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Frost	10/15/07	RCO3223

CDM Transmittal

CDM

5400 Glenwood Avenue, Suite 300
Raleigh, North Carolina 27612
Phone: 919-787-5620
Fax: 919-781-5730

RECEIVED

OCT 12 2007

SOLID WASTE SECTION
ASHEVILLE REGIONAL OFFICE

To:	Mr. Ed Mussler, P.E.	**From:**	W. Michael Brinchek
Organization/ Address:	NCDENR	**Date:**	October 11, 2007

Re: Buncombe County Solid Waste Management Facility

Response to Conditions for Compliance

Job #: 6447-

Via: *Mail:* *Overnight:* X *Courier:*

Enclosed please find: Response to Conditions for Compliance

$3,000 Fee for Permit Modification

For your information		**Approved**	
For your review	X	**Approved as noted**	
For your signature		**Returned to you for correction**	

Message:

Ed,

I hope this finds you well. As stated above, we are including herewith a check made payable to NCDENR Division of Waste Management for $3,000 to cover the permit modification fee, along with CDM's responses to the Conditions for Compliance. Should you have any questions or need any additional information, please contact me at your earliest convenience.

Regards,

W. Michael Brinchek

Signed

cc: Mr. L. Frost, NCDENR

CDM
5400 Glenwood Avenue, Suite 300
Raleigh, North Carolina 27612
tel: 919 787-5620
fax: 919 781-5730

October 11, 2007

Mr. Ed Mussler
Permitting Branch Head
North Carolina Department of Environment and
Natural Resources – Division of Waste Management
Solid Waste Section
401 Oberlin Road, Suite 150
1646 Mall Service Center
Raleigh, North Carolina 27699-1646

Subject: Conditions for Compliance
Buncombe County Subtitle D Landfill
Alexander, North Carolina
Permit # 11-07

Dear Mr. Mussler:

On behalf of Buncombe County, CDM is providing the documentation for the Conditions for Compliance as required by the Compliance Order dated September 7, 2007, which was issued to Buncombe County by the North Carolina Department of Natural Resources (NCDENR) Division of Waste Managment for the leachate release outside of the waste cell at the Buncombe County Subtitle D Landfill. A copy of the Compliance Order is provided as Attachment 1.

Background

On July 22, 2007, the County staff discovered a leachate outbreak outside of the landfill liner near the Cell 3 leachate pump station. The leachate flowed to an adjacent stormwater ditch, into a culvert, and into a sediment pond. The leachate leak was estimated to have lasted for approximately 8 hours. On July 31, 2007, water samples were collected by Pace Analytical Services, Inc. from two of the down-gradient sediment ponds and analyzed for pH, conductivity, dissolved oxygen, and turbidity. Sample results were non-conclusive as to whether the ponds had been impacted by the release.

On September 7, 2007, a Compliance Order was issued by the Division of Waste Management (DWM) detailing violations of concern and the actions required by the County to come into compliance.

As indicated in a September 20, 2007 conference call between Buncombe County, CDM and the NCDENR Asheville Regional Office, the leachate release was the result of Cell 3 pump

CDM

malfunction and not a result of bioreactor activity, as the bioreactor was only operated in a testing capacity for one to two weeks in May, 2007. The malfunctioning pump within Cell 3 has since been replaced and has been operational since the release.

Future releases will be prevented through the implementation of an inspection and maintenance regimen, which is discussed in the attached revised operations plan.

Response to Conditions of Compliance
For ease of review, CDM has provided below the action required by the Conditions for Compliance followed by our response.

1. Monitor to assure leachate is contained on site or properly treated prior to discharge in accordance with 15 A NCAC 13B .1626 (8)(d).

   CDM has revised Section 16 – Leachate Management Plan of the Operations Plan to incorporate a more rigorous leachate sump pump control monitoring regiment; annual maintenance of all leachate sump pumps and identification of actions that will be taken by the County in the event of power loss at the site. The revised Section 16 is provided herein as Attachment 2.

2. To assess the impact of the leachate release outside the waste cell, the County shall acquire the services of a N.C. licensed professional geologist with experience in assessment and remediation of ground water contamination and submit a phased assessment plan to the Division. The professional geologist shall consult with the Solid Waste Section Hydrogeologist about the site prior to developing the plan. The Section will review the submitted plan, approve, or request more information of amendments before implementation. The plan shall then be implemented as approved. With 30 days, submit this plan to:

   Jaclynne Drummond, Compliance Hydrogeologist
   NC DENR – Division of Waste Management
   Solid Waste Section
   410 Oberlin Road, Ste. 150
   1646 Mail Service Center
   Raleigh, NC 27699-1646

   CDM provided an assessment plan to Ms. Jaclynne Drummond on September 19, 2007 and has provided a copy of the correspondence herein as Attachment 3. CDM performed sampling gon

October 1, 2007 and is awaiting sample results, which will be forwarded to NCDENR upon receipt.

3. Within 30 days, submit a report that assesses the leachate collection system, the leachate recirculation system, the hydraulic capacity of both systems, the ability of the systems to maintain less than one foot of head on the base liner of the landfill, and the cause of the release, and outlines steps to prevent future leachate releases. The report shall also include a contingency plan that addresses the county's preparation and response to future leachate releases. A Section engineer will review the submitted plan, and will either approve or request more information or amendments before implementation. An application for a permit modification and approval by the Solid Waste will be required prior to any operational changes or modifications of the leachate collection system.

   CDM has conducted an assessment of the existing leachate collection system, which is provided as Attachement 4. Based upon CDM's analysis, CDM does not anticipate the need for any changes to the leachate collection system.

4. With in 30 days, submit a revised operations plan for routine inspections of the leachate recirculation system. The revised operation plan will include provisions for yearly cleaning and periodic camera inspections of the leachate collection system. The leachate recirculation system cleaning, maintenance, and inspection will be addressed as appropriate. Any design changes or remediation of either system that is deemed appropriate shall be submitted for approval. Submit the report described above, the application for permit modification $3,000 fee and revised operation plan to:

   CDM has revised Section 16 – Leachate Management Plan of the Operations Plan to incorporate a more rigorous leachate sump pump control monitoring regiment; annual maintenance of all leachate sump pumps and identification of actions that will be taken by the County in the event of power loss at the site. The revised Section 16 is provided herein as Attachment 2.

CDM

If you have any questions or comments regarding the scope of work described in this assessment plan, please do not hesitate to contact me at (919) 787-5620.

Very truly yours,

W. Michael Brinchek, P.E.
Camp Dresser & McKee

NORTH CAROLINA PROFESSIONAL SEAL 028426 ENGINEER W. MICHAEL BRINCHEK

10/11/2007

cc: J. Mears, BCSWMF
C. Gabel, CDM
L. Frost, NCDENR DWM
D. Aja, NCDENR DWM
J. Wiseman, CDM
M. Colone, CDM
K. Yang, CDM

ATTACHMENT 1

COMPLIANCE ORDER

State of North Carolina Department of Environment and Natural Resources

Michael F. Easley, Governor
William G. Ross, Jr., Secretary
Dexter R. Matthews, Director

RECEIVED

SEP 13 2007

BUNCOMBE COUNTY
DEPT OF GENERAL SERVICES
Solid Waste Dept.

THE DIVISION OF WASTE MANAGEMENT

September 7, 2007

RECEIVED

SEP 12 2007

Buncombe County
Manager's Office

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Buncombe County
c/o Wanda Greene, County Manager
205 College Street
Asheville, NC 28801

Re: Compliance Order
Buncombe County Landfill, Permit #11-07

Dear Ms. Greene:

Enclosed is a Compliance Order issued to Buncombe County because of certain violations of the North Carolina Solid Waste Management Act (N.C. General Statute 130A, Article 9) and of the North Carolina Solid Waste Management Rules (15A N.C. Administrative Code 13B) which implements the Act. This Compliance Order describes the violations of concern and the actions required by Buncombe County to come into compliance with both the General Statutes and the Administrative Code.

I encourage Buncombe County to schedule an informal conference at once with my staff to discuss this Compliance Order. Please contact Ms. Deborah Aja, Western Regional Supervisor, at the Asheville Regional Office at 828-296-4702

Sincerely,

Paul S. Crissman

Paul S. Crissman, Chief
Solid Waste Section
Division of Waste Management

Enclosure

cc: Nancy Scott, Assistant Attorney General
Deborah Aja, Western District Supervisor
Mark Poindexter, Supervisor, Field Operations Branch
Jaclynne Drummond, Compliance Hydrogeologist
Ed Mussler, Supervisor, Permitting
Larry Frost, Permitting Engineer
Central Files, Solid Waste

4. On July 31, 2007, Mr. Tom Williams from Pace Lab Analytical Services, Inc., took water samples from sediment ponds #3 and #4 in order to help determine if leachate had flowed into stormwater detention pond #4. The county forwarded the results by email to Mr. Hetzell on August 9, 2007.

5. On August 16, 2007, Mr. Hetzell conducted a site visit to the Buncombe County Landfill to photograph and verify the area of the Leachate release.

STATEMENT OF VIOLATIONS

The above facts constitute a violation of Title 15A N.C. Admin. Code Subchapter 13B

1. Section .1626(8)(d) which states that:

> Leachate shall be contained on site or properly treated prior to discharge.

Buncombe County violated this rule in that leachate was released from the landfill and entered the storm water sediment system without being properly treated prior to discharge.

CONDITIONS FOR COMPLIANCE

Based on the foregoing, you are hereby ordered to take the following actions:

1. Monitor to assure leachate is contained on site or properly treated prior to discharge in accordance with 15 A NCAC 13B .1626 (8) (d).

2. To assess the impact of the leachate release outside the waste cell, the County shall acquire the services of a N.C. licensed professional geologist with experience in assessment and remediation of ground water contamination and submit a phased assessment plan to the Division. The professional geologist shall consult with the Solid Waste Section Hydrogeologist about the site prior to developing the plan. The Section will review the submitted plan, approve, or request more information or amendments before implementation. The plan shall then be implemented as approved. With 30 days, submit this plan to:

   Jaclynne Drummond, Compliance Hydrogeologist
   NC DENR – Division of Waste Management
   Solid Waste Section
   410 Oberlin Road, Suite 150
   1646 Mail Service Center
   Raleigh, North Carolina 27699-1646

3. Within 30 days, submit a report that assesses the leachate collection system, the leachate recirculation system, the hydraulic capacity of both systems, the ability of the systems to maintain less than one foot of head on the base liner of the landfill, and the cause of the release, and outlines steps to prevent future leachate releases. The report shall also include a contingency plan that addresses the county's preparation and response to future leachate releases. A Section engineer will review the submitted plan, and will either approve or request more information or amendments before implementation. An application for a permit modification and approval by the Solid Waste will be required prior to any operational changes or modifications of the leachate collection system.

4. Within 30 days, submit a revised operations plan for routine inspections of the leachate system and the leachate recirculation system. The revised operation plan will include provisions for yearly cleaning and periodic camera inspections of the leachate collection system. The leachate recirculation system cleaning, maintenance, and inspection will be addressed as appropriate. Any design changes or remediation of either system that is deemed appropriate shall be submitted for approval. Submit the report described above, the application for permit modification and revised operation plan to:

Ed Mussler, Permitting Branch Head
NC DENR – Division of Waste Management
Solid Waste Section
410 Oberlin Road, Suite 150
1646 Mail Service Center
Raleigh, North Carolina 27699-1646

Also submit a copy of the application for permit modification and revised operation plan to:

Larry Frost, Permitting Engineer
NC DENR – Division of Waste Management
Asheville Regional Office
2090 US Highway 70
Swannanoa, NC 28778

NOTE: The above submittals require a permit modification and therefore a permit application fee for a municipal solid waste landfill modification will apply.

POTENTIAL CONSEQUENCES OF FAILURE TO COMPLY

You are hereby advised that, pursuant to N.C.G.S. 130A-22, each day of continued violation of any requirement of the act, the rules, or any order issued under the act or rules constitutes a separate violation for which a penalty of up to $5,000.00 per day may be imposed. If the violation(s) continue, you may also be subject to further enforcement actions including injunction from operation of a solid waste management facility or a solid waste collection service and any such further relief as may be necessary to achieve compliance with the North Carolina Solid Waste Management Act and Rules.

INFORMAL CONFERENCE

The Division encourages you to schedule an informal conference to discuss this matter and to give you an opportunity to provide additional information, including any actions you have taken to correct the violation(s). If you desire an informal conference, please contact:

Ms. Deborah Aja
NC DENR – Division of Waste Management
Solid Waste Section
2090 US Highway 70
Swannanoa, North Carolina 28778
Telephone (828) 296-4702

By: Paul S. Crissman

Paul S. Crissman
Chief, Solid Waste Section
Division of Waste Management
Department of Environment and Natural Resources

CERTIFICATE OF SERVICE

I hereby certify that I have caused a copy of the foregoing Compliance Order to be served upon the person designated below, at the last known address, causing said copy to be deposited in the U.S. Mail, First Class (certified mail postage prepaid, and return receipt requested) in an envelope addressed to:

Buncombe County
c/o Wanda Greene, County Manager
205 College Street
Asheville, NC 28801

Dated this 7 day of September, 2007

Amy Kadrie
Compliance Officer
Division of Waste Management
Department of Environment and Natural Resources

ATTACHMENT 2

OPERATION PLAN

Section 16
Leachate Management Plan

16.1 Maintenance of the Leachate Collection and Storage System

16.1.1 System Design

The leachate collection pipes within the proposed municipal solid waste landfill (MSWLF) unit will convey collected leachate by gravity to a sump area, where a submersible pump will pump leachate to a pump station located outside the cell. Cleanouts are located at the upstream ends of the collection pipes, and at the sump area low point. From the pump stations, leachate will be pumped to the leachate storage pond adjacent to the southwest side of the MSWLF unit. Another pumping station at the pond will pump leachate through a flow metering vault, to a truck loading station, where tank trucks will be filled to haul leachate to the Metropolitan Sewerage District (MSD) wastewater treatment plant. The pond will serve as an equalization basin to absorb peak flows coming from the pump stations. Depending upon the leachate quality, and the surcharge rates for high nutrient concentrations, pretreatment facilities may be required at the leachate pond prior to discharge to the sewer system. A pretreatment plant will be added if the regulated nutrients exceed surcharge levels, as monitored by periodic sampling results. All leachate removed from the holding pond will be flow monitored and recorded using a flow meter.

16.1.2 Storage Pond Maintenance

Inspection of the storage pond will be made on an annual basis by County staff. Any stored leachate and sediment in the pond must be removed so that the pond bottom is visible. The inspector should verify that flows from the pump stations are not impeded, by inspecting flows at the junction manhole. Once flow is verified, the pump stations that transfer leachate to the pond should all be turned off. Then, the inspector should perform a thorough walkover of the pond bottom, surveying the protective layer for any signs of damage, such as cracks, tears, gouges, uplift, or soft spots. Observations should be recorded in the operating record and photographs should be taken of the areas of concern and also placed in the operating record.

If damage or potential problems are discovered, they should be reported to the facility supervisor so that repairs may be made as soon as possible. All repair activities should be recorded in the operating record as well. The pond should be put back on-line as soon as possible, to minimize leachate storage time within the pump stations and cells.

16.1.3 Maintenance of the Leachate Collection System

The perforated leachate collection piping will be pressure cleaned and flushed annually to remove any accumulation of debris, sediment, or organic growth. This can be achieved by inserting a self-propelled, high pressure jetting system into the collection pipes by way of the clean-out ports. The outside lines can be accessed

through the pump stations, the header line manholes, and the junction manhole at the leachate pond. The monitoring vault should be visually inspected during routine monitoring but have the following maintenance performed as well. At a minimum, the flow meter should be flushed clean of grease and debris build-ups on a quarterly basis. Each leachate pump (and mechanical aerator when installed) should be removed for visual inspection and oil replacement every 12 to 14 months or in accordance with the manufacturers' recommendations. Oil replacement not only ensures good quality lubricant within the units for smooth operation, but is also a good monitor for oil leaks and/or water intrusion. Each valve shall be manually operated to check for proper operation, and control and instrumentation performance monitored regularly. The control panels shall be fully inspected at the same time, to ensure proper alarm operations, reset functions, and normal operations performance.

16.2 Leachate Generation Records

The leachate effluent line from the storage pond is designed with a flow meter to measure the amount of leachate being discharged from the landfill. In addition, each sump pump station is designed with a flow meter to measure the leachate discharge from each sump. The operator shall read and register the leachate flows on a weekly basis at the leachate effluent line and at each of the sump pump stations.

The information to be collected shall include the date, time, leachate quantity (in gallons), and the name of the person taking measurements. In addition, the measurements at each sump pump shall include the pump run time (in hours) and leachate levels. Weekly measurements recorded at each sump pump station will be used to detect potential pump malfunction.

The records shall be maintained at the landfill by the operator and made available to Solid Waste Section personnel for inspection when requested. A sample form to be used for recording leachate flows at the effluent is attached as Table 16-1. A sample form to be used for recording leachate flows at each sump pump station is attached as Table 16-2.

After substantial rainfall events, the operator may want to record leachate flows on a daily basis, until flows resume to pre-storm averages. Any and all unusual leachate flow conditions shall be noted on the form, with an adjustment to recording frequency made at the operator's or the Section's discretion.

16.3 Leachate Quality Sampling

The County shall obtain a leachate sample as required by the receiving municipality in their pre-treatment permit. The sample shall be packaged in a watertight container, placed in an insulating storage box, and packed with ice. The package shall be express delivered to a certified laboratory to perform the required analytical tests. The results of the lab analyses shall be kept in the landfill operating records and made available to the receiving wastewater treatment plant staff as well as State regulatory

personnel for their inspection. The County landfill operating staff will sample on a quarterly basis, which may become the required sampling frequency for the County for all parameters, after a period of time during which the leachate quality stabilizes. The results of any additional lab analyses shall also be kept in the landfill operating records.

Composite or grab samples shall be obtained at the leachate storage pond, and at any pretreatment facilities, if applicable. In addition, the operator shall collect samples on a semi-annual basis, or more often if desired, of the raw leachate, just as it empties into the leachate pond, or from the pump station wet wells, in order to obtain

Table 16-1

Buncombe County Lined Landfill
Leachate Flow Records – Leachate Pond
(Sample)

Date	Totalizer Reading	ADF (gpd)	Rainfall Since Last Reading (In.)	Active Cells ID Nos.	Closed Cells ID Nos.	Recording Operator	Comments/ Observations

Table 16-2

Buncombe County Lined Landfill
Leachate Flow Records – Leachate Sump Pump Station
(Sample)

Date	Time	Cell No.	Inches of Head	Hour Meter	Flow Meter	Comments/ Observations

analyses of the actual leachate characteristics as it emerges from the bottom of the lined landfill.

16.4 Leachate Disposal Approval

Leachate from the new lined landfill will be pumped from the storage pond to the truck loading station, which will fill trucks used to haul the leachate to the MSD sanitary sewer system for final disposal. An approval letter from MSD stating that they will accept the landfill leachate will be included in the operating records. Any pretreatment requirements will be included in the Pretreatment Permit issued by MSD prior to landfill operations.

16.5 Leachate Management Contingency Plan

16.5.1 Leachate Sump Pump Station

Should a pump station not appear to be functioning properly, based upon weekly monitoring records, the pump will be removed and troubleshooted in accordance with manufacturer recommendations. If troubleshooting techniques do not provide a prompt resolution, one of the spare pumps located on-site will be installed in its place and necessary repairs will be made.

Should power be lost at the site the pumping station control panels are equipped with receptacles for a portable emergency generator, to operate the pumping stations until power is restored. A portable emergency generator will be available within twelve hours of a power outage.

16.5.2 Leachate Storage

During periods when components of the leachate pond pump station are inoperative or down for maintenance, or when storm flows are extremely high, excessive leachate will be dealt with using either of two contingency plans.

The storage capacity of the leachate holding pond is approximately 1,000,000 gallons, when completely full to within 12 inches of the top of the pond liner. This will provide up to 17 days of storage during peak leachate flow periods, and about 69 days storage for average annual daily flows. If surface evaporation rates are considered, even longer storage periods can be achieved. This volume is also adequate to capture the leachate from the peak rainfall event from the five years of rainfall data used in the HELP model leachate projections (assuming several acres of open cell area with only the first solid waste lift installed) and still have reserve capacity for additional daily flows. Therefore, considerable storage capability is provided by the leachate pond for periods of unusually high precipitation or unusual operating conditions.

Should a period of substantial rainfall persist, and the leachate pond approach full stage, the pumping stations can be turned off. The leachate would be temporarily stored in the pump station wet wells and the disposal cells until the level in the pond

is adequately reduced. The cells would be monitored daily to ensure that overflow does not occur. If the storage pond encroaches to within 6 inches of the ponds 12-inch freeboard (18 inches from the top of the pond liner), leachate hauling will be increased to a frequency adequate to deplete the leachate volume in the storage pond to an acceptable level.

Should power be lost at the site the pumping station control panel at the leachate pond is equiped with receptacles for a portable emergency generator, to operate the pumps long enough to control leachate flow volumes. A portable emergency generator will be available within twelve hours of a power outage.

ATTACHMENT 3

ASSESSMENT PLAN

CDM
5400 Glenwood Avenue, Suite 300
Raleigh, North Carolina 27612
tel: 919 787-5620
fax: 919 781-5730

September 19, 2007

Ms. Jaclynne Drummond
Compliance Hydrogeologist
North Carolina Department of Environment and
Natural Resources – Division of Waste Management
Solid Waste Section
401 Oberlin Road, Suite 150
Raleigh, North Carolina 27699-1646

Subject: Leachate Spill Assessment Plan
Buncombe County Subtitle D Landfill
Alexander, North Carolina
Permit # 11-07

Dear Jackie:

CDM, on behalf of Buncombe County, is providing this Assessment Plan for the leachate release outside of the waste cell at the Buncombe County Subtitle D Landfill. The Plan includes collection and analysis of soil, sediment, surface water and groundwater samples to assess the impacts of leachate outside of the cell. The scope of work provided is based on discussions from our meeting on September 18, 2007.

Background

On July ~~22~~ 27, 2007, County staff discovered a leachate outbreak outside of the landfill liner near the Cell 3 leachate pump station. The leachate flowed to an adjacent stormwater ditch, into a culvert, and into a sediment pond. The leachate leak was estimated to have lasted for approximately 8 hours. On July 31, 2007, water samples were collected by Pace Analytical Services, Inc. from two of the down-gradient sediment ponds and analyzed for pH, conductivity, dissolved oxygen, and turbidity. Sample results were non-conclusive as to whether the ponds had been impacted by the release.

On September 7, 2007, a Compliance Order was issued by the Division of Waste Management (DWM) detailing violations of concern and the actions required by the County to come into compliance. One of the conditions was to assess the impact of the leachate release outside of the cell. In order to meet this condition and assess the impact of the release, CDM proposes the following scope:

Soil and Sediment Sampling
CDM will collect up to 6 soil samples from 3 locations in the base of the stormwater ditch down-gradient of the Cell 3 pump, and 1 sediment sample in the sediment pond at the culvert outfall. Samples will be collected at locations provided on Figure 1.

The soil samples will be collected with a hand-auger and will be obtained at depths of 6-inches and 2-feet below land surface. Sample S-1 will be collected at the leachate pump station, S-2 will be collected approximate 100-feet down-gradient of the pump station, and S-3 will be collected at the drop-inlet to the culvert. A pre-cleaned hand-auger head will be used to collect each sample.

Each soil sample will be screened for volatile organics with a Flame Ionization Detector (FID) utilizing head-space techniques. A portion of each sample will be placed in a sealed plastic bag and allowed to sit for 10 minutes, after that time, the head-space will be analyzed. If the head-space analysis on the sample from 2-feet indicates the presence of volatile organic compounds, a deeper sample from 3-feet will be collected and screened.

Sediment samples will be collected directly from the base of the pond at the culvert outfall. Similar to the soil samples, the sediment sample will be screened using head-space techniques. The sediment sample collection device will depend on the nature of the sediment at the outfall. Sediment sample location (S-4) is provided on Figure 1.

The remaining portions of each sample will be placed in laboratory supplied sample containers and placed in an iced cooler for overnight shipment to the laboratory. Soil and sediment samples will be analyzed by SGS Laboratories, Inc. in Wilmington, North Carolina for North Carolina Appendix I Volatile Organic Compounds (VOC) by EPA Method 8260 with 3550 preparation and RCRA Metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver).

Groundwater and Surface Water Sampling
As discussed in the September 18, 2007 meeting, groundwater samples from the down-gradient monitoring wells MW-2/2d and MW-10/10d will be collected and analyzed for Appendix I VOC and RCRA Metals. Monitoring well locations are provided on Figure 1. In addition, surface water samples will be collected from the sediment pond (SW-1) and the stream, directly down-gradient of the sediment pond outfall (SW-2). The surface water samples will also be analyzed for Appendix I VOC and RCRA Metals. Proposed surface water sample locations are provided on Figure 1.

CDM

Following receipt of the laboratory data, CDM will prepare a letter report detailing sampling activities and results and any recommendations for further investigation or remediation if necessary.

Schedule

Assuming DWM approval of this assessment plan, CDM is tentatively scheduled to begin the assessment the week of October 1, 2007. It is anticipated that field work will be completed in 2 days. Laboratory data should be available 10 working days from date of sample receipt by the laboratory. A final letter report will be submitted to the DWM within 2 weeks of receiving the laboratory reports.

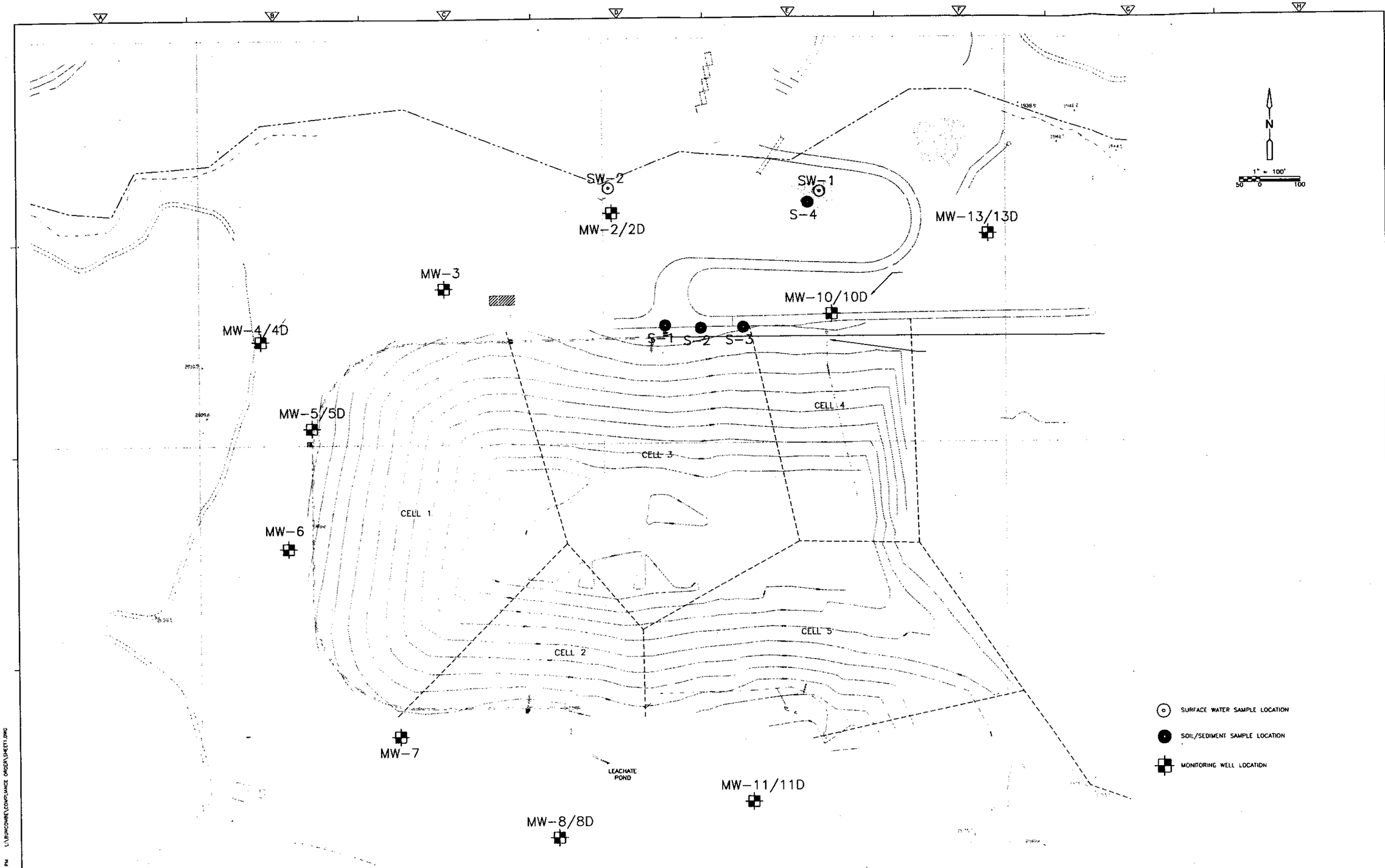
If you have any questions or comments regarding the scope of work described in this assessment plan, please do not hesitate to contact me at (919) 787-5620.

Very truly yours,

Mathew F. Colone, P.G.
Camp Dresser & McKee

NORTH CAROLINA SEAL 1851 GEOLOGIST MATHEW F. COLONE
9/19/2007

cc: J. Mears, BCSWMF
C. Gabel, CDM
D. Aja, NCDENR DWM
J. Wiseman, CDM
W.M. Brinchek, CDM
K. Yang, CDM



REV. NO	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: M. COLONE
DRAWN BY: K. YANG
SHEET CHK'D BY: M. BRINCHER
CROSS CHK'D BY:
APPROVED BY:
DATE: SEPTEMBER 2007

CDM
Camp Dresser & McKee
Carolina Corporate Center
5400 Glenwood Avenue, Suite 300
Raleigh, North Carolina 27612
Tel. (919) 787-3820 Fax. (919) 781-0730
consulting • engineering • construction • operations

BUNCOMBE COUNTY, NORTH CAROLINA

LEACHATE OUTBREAK ASSESSMENT
BUNCOMBE COUNTY SOLID WASTE MANAGEMENT FACILITY

PROPOSED
SAMPLING LOCATIONS

PROJECT NO 6447-
FILE NAME: SHEET1.DWG
SHEET NO.
1

05/18/07 3:44:46 PM L:\BUNCOMBE\COMPLIANCE ORDER\SHEET1.DWG

ATTACHMENT 4

LCS ASSESSMENT

Leachate Collection System

Introduction

The hydraulic capacity of the Cell 3 leachate collection system (LCS) was calculated using of the Hydraulic Evaluation of Landfill Performance (HELP) Model Version 3.07 developed by Environmental Laboratory USAE Waterways Experiment Station for USEPA Risk Reduction Engineering Laboratory.

HELP Model Simulation

The HELP Model simulations include 100% leachate recirculation as this represents the peak condition for leachate generation.

The leachate collection system was modeled in 5 scenarios as following (*See Appendix A for HELP Model results*):

- Scenario 1 assumed 10 feet of waste
- Scenario 2 assumed 30 feet of waste
- Scenario 3 assumed 60 feet of waste and 100% recirculation of leachate
- Scenario 4 assumed 90 feet of waste and 100% recirculation of leachate
- Scenario 5 assumed 200 feet of waste and 100% recirculation of leachate

To perform the simulation, CDM assumed the following landfill layers, from top to bottom:

- A 12-inch interim cover layer: hydraulic conductivity of 1.2×10^{-4} cm/s
- MSW: hydraulic conductivity of 1×10^{-3} cm/s (thickness varies upon scenario)
- A 24-inch protective rock layer: hydraulic conductivity of 0.3 cm/s
- A 60-mil HDPE membrane liner
- A geosynthetic clay liner (GCL): hydraulic conductivity of 3×10^{-9} cm/s
- An 18-inch compacted soil layer: hydraulic conductivity of 1×10^{-5} cm/s

The assumed drainage length was 600 feet and the assumed minimum slope was 7%. The peak storm event, representing the rainfall volume for the 25-year, 24-hour storm event for the Buncombe County Solid Waste Management Facility, was used for the HELP Model simulations. The peak rainfall volume is 3.18 inches.

Modeling Results

The results of the Help Model analysis are provided in Table 1.1.

Table 1.1 Help Model Results Outline

Scenario	Peak daily impingement rate per acre (ft^3/day)	Peak daily impingement rate per acre (gpm)	Maximum daily head on the liner (inch)
1	1,550	8	1.4
2	800	4	2.2
3	2,886	15	7.6
4	768	4	2.1
5	771	4	2.1

Based on the HELP Model runs performed, the maximum head on the liner occurs during Scenario 3, which represents 60 feet of waste with 100% recirculation.

Leachate Pumps

The leachate sump pump in Cell 3 has a flowrate of 150 gpm. Taking the peak daily impingement rate from the above Table 1.1 - 15 gpm/acre and multiplying it by the Cell 3 area – 8.3 acres, the peak daily impingement rate for Cell 3 is approximately 125 gpm. Under normal operating conditions the Cell 3 pump has adequate capacity to remove leachate from the liner prior to developing unacceptable head conditions.

APPENDIX A

HELP MODEL RESULTS

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**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:      C:\HELP\HELP3~1\BUNC4.D4
TEMPERATURE DATA FILE:        C:\HELP\HELP3~1\BUNC7.D7
SOLAR RADIATION DATA FILE:    C:\HELP\HELP3~1\BUNC13.D13
EVAPOTRANSPIRATION DATA:      C:\HELP\HELP3~1\BUNC11.D11
SOIL AND DESIGN DATA FILE:    C:\HELP\HELP3~1\BUNC10.D10
OUTPUT DATA FILE:             C:\HELP\HELP3~1\BUNC10.OUT


TIME:   9:56     DATE:  11/11/2004


******************************************************************************

     TITLE:  Buncombe County-Cell 6-10' Waste

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                  LAYER  1
                                  --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER  18
          THICKNESS                    =    120.00   INCHES
          POROSITY                     =      0.6710 VOL/VOL
          FIELD CAPACITY               =      0.2920 VOL/VOL
          WILTING POINT                =      0.0770 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2994 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC
```

LAYER 2

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 21

THICKNESS	=	24.00	INCHES
POROSITY	=	0.3970	VOL/VOL
FIELD CAPACITY	=	0.0320	VOL/VOL
WILTING POINT	=	0.0130	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0457	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000012000	CM/SEC
SLOPE	=	7.00	PERCENT
DRAINAGE LENGTH	=	200.0	FEET

LAYER 3

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	1.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

LAYER 4

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.25	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	18.00	INCHES
POROSITY	=	0.4750	VOL/VOL
FIELD CAPACITY	=	0.3780	VOL/VOL
WILTING POINT	=	0.2650	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3531	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #18 WITH BARE GROUND CONDITIONS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 250. FEET.

SCS RUNOFF CURVE NUMBER	=	80.50	
FRACTION OF AREA ALLOWING RUNOFF	=	0.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	4.395	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	8.052	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.924	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	43.572	INCHES
TOTAL INITIAL WATER	=	43.572	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM ASHEVILLE NORTH CAROLINA

STATION LATITUDE	=	35.26	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	96	
END OF GROWING SEASON (JULIAN DATE)	=	298	
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	7.60	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	75.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	84.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	77.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR ASHEVILLE NORTH CAROLINA

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.48	3.60	5.13	3.84	4.19	4.20
4.43	4.79	3.96	3.29	3.29	3.51

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ASHEVILLE NORTH CAROLINA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
36.80	39.10	46.40	55.70	63.30	69.80
73.20	72.60	66.90	56.00	46.40	39.30

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ASHEVILLE NORTH CAROLINA
AND STATION LATITUDE = 35.26 DEGREES

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.75	169702.562	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	34.968	126933.422	74.80
DRAINAGE COLLECTED FROM LAYER 2	11.7802	42762.004	25.20
PERC./LEAKAGE THROUGH LAYER 4	0.000004	0.013	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0545		
PERC./LEAKAGE THROUGH LAYER 5	0.162880	591.255	0.35
CHANGE IN WATER STORAGE	-0.161	-584.123	-0.34
SOIL WATER AT START OF YEAR	43.572	158165.672	
SOIL WATER AT END OF YEAR	43.411	157581.547	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	0.000	0.00

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	52.69	191264.703	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	27.108	98403.102	51.45
DRAINAGE COLLECTED FROM LAYER 2	23.2672	84459.773	44.16
PERC./LEAKAGE THROUGH LAYER 4	0.000006	0.021	0.00
AVG. HEAD ON TOP OF LAYER 3	0.1080		
PERC./LEAKAGE THROUGH LAYER 5	0.098010	355.776	0.19
CHANGE IN WATER STORAGE	2.217	8046.156	4.21
SOIL WATER AT START OF YEAR	43.411	157581.547	
SOIL WATER AT END OF YEAR	45.627	165627.703	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

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ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	48.62	176490.672	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	33.037	119925.578	67.95
DRAINAGE COLLECTED FROM LAYER 2	16.9499	61528.020	34.86

PERC./LEAKAGE THROUGH LAYER 4	0.000004	0.016	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0786		
PERC./LEAKAGE THROUGH LAYER 5	0.069873	253.640	0.14
CHANGE IN WATER STORAGE	-1.437	-5216.629	-2.96
SOIL WATER AT START OF YEAR	45.627	165627.703	
SOIL WATER AT END OF YEAR	44.190	160411.078	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.058	0.00

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	41.42	150354.609	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	29.686	107761.852	71.67
DRAINAGE COLLECTED FROM LAYER 2	10.5050	38133.180	25.36
PERC./LEAKAGE THROUGH LAYER 4	0.000004	0.013	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0485		
PERC./LEAKAGE THROUGH LAYER 5	0.054279	197.031	0.13
CHANGE IN WATER STORAGE	1.174	4262.520	2.83
SOIL WATER AT START OF YEAR	44.190	160411.078	
SOIL WATER AT END OF YEAR	45.365	164673.594	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.023	0.00

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	45.64	165673.219	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	32.782	118997.242	71.83
DRAINAGE COLLECTED FROM LAYER 2	14.6442	53158.496	32.09
PERC./LEAKAGE THROUGH LAYER 4	0.000004	0.015	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0678		
PERC./LEAKAGE THROUGH LAYER 5	0.044090	160.048	0.10
CHANGE IN WATER STORAGE	-1.830	-6642.616	-4.01
SOIL WATER AT START OF YEAR	45.365	164673.594	
SOIL WATER AT END OF YEAR	43.535	158030.984	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.045	0.00

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.72	180483.578	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	31.451	114166.594	63.26
DRAINAGE COLLECTED FROM LAYER 2	18.6146	67571.102	37.44
PERC./LEAKAGE THROUGH LAYER 4	0.000005	0.017	0.00

AVG. HEAD ON TOP OF LAYER 3	0.0864		
PERC./LEAKAGE THROUGH LAYER 5	0.037148	134.847	0.07
CHANGE IN WATER STORAGE	-0.383	-1388.945	-0.77
SOIL WATER AT START OF YEAR	43.535	158030.984	
SOIL WATER AT END OF YEAR	43.152	156642.031	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.023	0.00

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ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	52.38	190139.437	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	35.553	129056.180	67.87
DRAINAGE COLLECTED FROM LAYER 2	18.0071	65365.699	34.38
PERC./LEAKAGE THROUGH LAYER 4	0.000005	0.016	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0833		
PERC./LEAKAGE THROUGH LAYER 5	0.032061	116.381	0.06
CHANGE IN WATER STORAGE	-1.212	-4398.833	-2.31
SOIL WATER AT START OF YEAR	43.152	156642.031	
SOIL WATER AT END OF YEAR	41.940	152243.203	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.006	0.00

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ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.99	163313.672	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	34.270	124399.547	76.17
DRAINAGE COLLECTED FROM LAYER 2	11.0383	40069.199	24.54
PERC./LEAKAGE THROUGH LAYER 4	0.000004	0.013	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0513		
PERC./LEAKAGE THROUGH LAYER 5	0.028249	102.545	0.06
CHANGE IN WATER STORAGE	-0.346	-1257.561	-0.77
SOIL WATER AT START OF YEAR	41.940	152243.203	
SOIL WATER AT END OF YEAR	41.594	150985.641	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.054	0.00

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ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.55	179866.531	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	28.549	103632.227	57.62
DRAINAGE COLLECTED FROM LAYER 2	16.7743	60890.812	33.85
PERC./LEAKAGE THROUGH LAYER 4	0.000004	0.016	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0781		
PERC./LEAKAGE THROUGH LAYER 5	0.025106	91.135	0.05

CHANGE IN WATER STORAGE	4.202	15252.302	8.48
SOIL WATER AT START OF YEAR	41.594	150985.641	
SOIL WATER AT END OF YEAR	45.195	164057.828	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.601	2180.112	1.21
ANNUAL WATER BUDGET BALANCE	0.0000	0.051	0.00

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	52.04	188905.234	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	32.898	119419.695	63.22
DRAINAGE COLLECTED FROM LAYER 2	22.5764	81952.383	43.38
PERC./LEAKAGE THROUGH LAYER 4	0.000005	0.020	0.00
AVG. HEAD ON TOP OF LAYER 3	0.1061		
PERC./LEAKAGE THROUGH LAYER 5	0.022632	82.155	0.04
CHANGE IN WATER STORAGE	-3.457	-12549.047	-6.64
SOIL WATER AT START OF YEAR	45.195	164057.828	
SOIL WATER AT END OF YEAR	42.194	153163.828	
SNOW WATER AT START OF YEAR	0.601	2180.112	1.15
SNOW WATER AT END OF YEAR	0.145	525.067	0.28
ANNUAL WATER BUDGET BALANCE	0.0000	0.045	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	3.54	3.70	5.00	4.27	4.72	4.58
	4.33	4.93	3.33	3.08	3.58	3.34
STD. DEVIATIONS	1.51	2.26	2.55	1.73	1.51	2.11
	1.73	2.35	1.97	1.55	2.09	1.21
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.390	1.792	2.677	3.541	3.863	4.358
	3.661	3.752	2.485	1.955	1.577	0.979
STD. DEVIATIONS	0.290	0.282	0.303	0.592	0.891	1.207
	1.605	0.922	0.808	0.677	0.383	0.213
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	1.9790	2.2330	2.2878	2.0973	1.5377	0.5514
	0.5625	0.3660	0.9856	1.0028	1.2567	1.5558
STD. DEVIATIONS	1.0411	1.3067	1.4817	1.6771	1.4939	0.6885
	0.5478	0.4694	1.3514	1.3290	0.9065	1.3566
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 5						
TOTALS	0.0058	0.0050	0.0054	0.0050	0.0050	0.0047
	0.0048	0.0046	0.0044	0.0044	0.0041	0.0042
STD. DEVIATIONS	0.0052	0.0043	0.0045	0.0041	0.0039	0.0036
	0.0035	0.0033	0.0030	0.0030	0.0028	0.0027

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	0.1078	0.1340	0.1246	0.1180	0.0837	0.0310
	0.0306	0.0199	0.0555	0.0546	0.0707	0.0847
STD. DEVIATIONS	0.0567	0.0791	0.0807	0.0944	0.0814	0.0387
	0.0298	0.0256	0.0760	0.0724	0.0510	0.0739

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 10

	INCHES		CU. FEET	PERCENT
PRECIPITATION	48.38	(3.671)	175619.4	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	32.030	(2.8000)	116269.53	66.205
LATERAL DRAINAGE COLLECTED FROM LAYER 2	16.41572	(4.48650)	59589.062	33.93079
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00000	(0.00000)	0.016	0.00001
AVERAGE HEAD ON TOP OF LAYER 3	0.076	(0.021)		
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.05743	(0.04381)	208.481	0.11871
CHANGE IN WATER STORAGE	-0.123	(2.1838)	-447.68	-0.255

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 10

	(INCHES)	(CU. FT.)
PRECIPITATION	3.18	11543.400
RUNOFF	0.000	0.0000

DRAINAGE COLLECTED FROM LAYER 2	0.42762	1552.26990
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000000	0.00030
AVERAGE HEAD ON TOP OF LAYER 3	0.722	
MAXIMUM HEAD ON TOP OF LAYER 3	1.397	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	5.6 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000623	2.26136
SNOW WATER	2.49	9036.6895

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4953
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0985

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 10

LAYER	(INCHES)	(VOL/VOL)
1	35.1975	0.2933
2	1.0269	0.0428
3	0.0000	0.0000
4	0.1875	0.7500
5	5.7820	0.3212
SNOW WATER	0.145	

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**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:      C:\HELP\HELP3-1\BUNC4.D4
TEMPERATURE DATA FILE:        C:\HELP\HELP3-1\BUNC7.D7
SOLAR RADIATION DATA FILE:    C:\HELP\HELP3-1\BUNC13.D13
EVAPOTRANSPIRATION DATA:      C:\HELP\HELP3-1\BUNC11.D11
SOIL AND DESIGN DATA FILE:    C:\HELP\HELP3-1\BUNC30.D10
OUTPUT DATA FILE:             C:\HELP\HELP3-1\BUNC30.OUT


TIME:   9:56     DATE:  11/11/2004


******************************************************************************

     TITLE:  Buncombe County-Cell 6-30' Waste

******************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                  LAYER  1
                                  --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER  10
          THICKNESS                  =      12.00   INCHES
          POROSITY                   =       0.3980 VOL/VOL
          FIELD CAPACITY             =       0.2440 VOL/VOL
          WILTING POINT              =       0.1360 VOL/VOL
          INITIAL SOIL WATER CONTENT =       0.3280 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =  0.119999997000E-03 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	360.00	INCHES
POROSITY	=	0.6710	VOL/VOL
FIELD CAPACITY	=	0.2920	VOL/VOL
WILTING POINT	=	0.0770	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2943	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 21

THICKNESS	=	24.00	INCHES
POROSITY	=	0.3970	VOL/VOL
FIELD CAPACITY	=	0.0320	VOL/VOL
WILTING POINT	=	0.0130	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0656	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000012000	CM/SEC
SLOPE	=	7.00	PERCENT
DRAINAGE LENGTH	=	600.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	1.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 5

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.25	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	18.00	INCHES
POROSITY	=	0.4750	VOL/VOL
FIELD CAPACITY	=	0.3780	VOL/VOL
WILTING POINT	=	0.2650	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3531	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #10 WITH BARE GROUND CONDITIONS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 250. FEET.

SCS RUNOFF CURVE NUMBER	=	94.10	
FRACTION OF AREA ALLOWING RUNOFF	=	0.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.936	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.776	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.632	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	118.007	INCHES
TOTAL INITIAL WATER	=	118.007	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
ASHEVILLE NORTH CAROLINA

STATION LATITUDE	=	35.26	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	

START OF GROWING SEASON (JULIAN DATE)	=	96
END OF GROWING SEASON (JULIAN DATE)	=	298
EVAPORATIVE ZONE DEPTH	=	12.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	7.60 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	71.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	75.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	84.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	77.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ASHEVILLE NORTH CAROLINA

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.48	3.60	5.13	3.84	4.19	4.20
4.43	4.79	3.96	3.29	3.29	3.51

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ASHEVILLE NORTH CAROLINA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
36.80	39.10	46.40	55.70	63.30	69.80
73.20	72.60	66.90	56.00	46.40	39.30

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ASHEVILLE NORTH CAROLINA
AND STATION LATITUDE = 35.26 DEGREES

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.75	169702.562	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	33.495	121587.016	71.65
DRAINAGE COLLECTED FROM LAYER 3	13.2588	48129.316	28.36
PERC./LEAKAGE THROUGH LAYER 5	0.000014	0.052	0.00

AVG. HEAD ON TOP OF LAYER 4	0.1836		
PERC./LEAKAGE THROUGH LAYER 6	0.162586	590.186	0.35
CHANGE IN WATER STORAGE	-0.166	-604.021	-0.36
SOIL WATER AT START OF YEAR	118.007	428363.812	
SOIL WATER AT END OF YEAR	117.840	427759.781	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.061	0.00

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	52.69	191264.703	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	25.367	92083.211	48.14
DRAINAGE COLLECTED FROM LAYER 3	23.2612	84438.266	44.15
PERC./LEAKAGE THROUGH LAYER 5	0.000024	0.089	0.00
AVG. HEAD ON TOP OF LAYER 4	0.3219		
PERC./LEAKAGE THROUGH LAYER 6	0.097898	355.371	0.19
CHANGE IN WATER STORAGE	3.964	14387.841	7.52
SOIL WATER AT START OF YEAR	117.840	427759.781	
SOIL WATER AT END OF YEAR	121.804	442147.625	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.021	0.00

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ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	48.62	176490.672	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	32.033	116280.609	65.88
DRAINAGE COLLECTED FROM LAYER 3	20.6733	75044.062	42.52
PERC./LEAKAGE THROUGH LAYER 5	0.000022	0.079	0.00
AVG. HEAD ON TOP OF LAYER 4	0.2884		
PERC./LEAKAGE THROUGH LAYER 6	0.069817	253.437	0.14
CHANGE IN WATER STORAGE	-4.156	-15087.465	-8.55
SOIL WATER AT START OF YEAR	121.804	442147.625	
SOIL WATER AT END OF YEAR	117.647	427060.187	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.018	0.00

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	41.42	150354.609	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	27.997	101627.977	67.59
DRAINAGE COLLECTED FROM LAYER 3	11.4507	41565.918	27.65
PERC./LEAKAGE THROUGH LAYER 5	0.000013	0.046	0.00
AVG. HEAD ON TOP OF LAYER 4	0.1583		

PERC./LEAKAGE THROUGH LAYER 6	0.054251	196.932	0.13
CHANGE IN WATER STORAGE	1.918	6963.888	4.63
SOIL WATER AT START OF YEAR	117.647	427060.187	
SOIL WATER AT END OF YEAR	119.566	434024.062	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.106	0.00

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	45.64	165673.219	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	31.299	113614.867	68.58
DRAINAGE COLLECTED FROM LAYER 3	16.8918	61317.109	37.01
PERC./LEAKAGE THROUGH LAYER 5	0.000018	0.065	0.00
AVG. HEAD ON TOP OF LAYER 4	0.2344		
PERC./LEAKAGE THROUGH LAYER 6	0.044068	159.967	0.10
CHANGE IN WATER STORAGE	-2.595	-9418.774	-5.69
SOIL WATER AT START OF YEAR	119.566	434024.062	
SOIL WATER AT END OF YEAR	116.971	424605.281	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.039	0.00

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.72	180483.578	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	30.130	109371.305	60.60
DRAINAGE COLLECTED FROM LAYER 3	18.1313	65816.523	36.47
PERC./LEAKAGE THROUGH LAYER 5	0.000019	0.069	0.00
AVG. HEAD ON TOP OF LAYER 4	0.2529		
PERC./LEAKAGE THROUGH LAYER 6	0.037131	134.787	0.07
CHANGE IN WATER STORAGE	1.422	5161.019	2.86
SOIL WATER AT START OF YEAR	116.971	424605.281	
SOIL WATER AT END OF YEAR	118.393	429766.312	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.053	0.00

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ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	52.38	190139.437	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	34.663	125825.578	66.18
DRAINAGE COLLECTED FROM LAYER 3	20.7880	75460.602	39.69
PERC./LEAKAGE THROUGH LAYER 5	0.000022	0.078	0.00
AVG. HEAD ON TOP OF LAYER 4	0.2895		
PERC./LEAKAGE THROUGH LAYER 6	0.032046	116.328	0.06
CHANGE IN WATER STORAGE	-3.103	-11263.104	-5.92

SOIL WATER AT START OF YEAR	118.393	429766.312	
SOIL WATER AT END OF YEAR	115.290	418503.187	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.032	0.00

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ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.99	163313.672	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	32.775	118971.859	72.85
DRAINAGE COLLECTED FROM LAYER 3	12.6030	45748.770	28.01
PERC./LEAKAGE THROUGH LAYER 5	0.000014	0.049	0.00
AVG. HEAD ON TOP OF LAYER 4	0.1752		
PERC./LEAKAGE THROUGH LAYER 6	0.028244	102.526	0.06
CHANGE IN WATER STORAGE	-0.416	-1509.417	-0.92
SOIL WATER AT START OF YEAR	115.290	418503.187	
SOIL WATER AT END OF YEAR	114.874	416993.781	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.059	0.00

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ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.55	179866.531	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	27.238	98875.352	54.97
DRAINAGE COLLECTED FROM LAYER 3	17.4695	63414.160	35.26
PERC./LEAKAGE THROUGH LAYER 5	0.000018	0.067	0.00
AVG. HEAD ON TOP OF LAYER 4	0.2428		
PERC./LEAKAGE THROUGH LAYER 6	0.025098	91.107	0.05
CHANGE IN WATER STORAGE	4.817	17485.865	9.72
SOIL WATER AT START OF YEAR	114.874	416993.781	
SOIL WATER AT END OF YEAR	119.091	432299.531	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.601	2180.112	1.21
ANNUAL WATER BUDGET BALANCE	0.0000	0.044	0.00

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	52.04	188905.234	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	31.880	115724.070	61.26
DRAINAGE COLLECTED FROM LAYER 3	23.8792	86681.461	45.89
PERC./LEAKAGE THROUGH LAYER 5	0.000025	0.090	0.00
AVG. HEAD ON TOP OF LAYER 4	0.3323		
PERC./LEAKAGE THROUGH LAYER 6	0.022621	82.115	0.04
CHANGE IN WATER STORAGE	-3.742	-13582.433	-7.19
SOIL WATER AT START OF YEAR	119.091	432299.531	

SOIL WATER AT END OF YEAR	115.805	420372.156	
SNOW WATER AT START OF YEAR	0.601	2180.112	1.15
SNOW WATER AT END OF YEAR	0.145	525.067	0.28
ANNUAL WATER BUDGET BALANCE	0.0000	0.016	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	3.54	3.70	5.00	4.27	4.72	4.58
	4.33	4.93	3.33	3.08	3.58	3.34
STD. DEVIATIONS	1.51	2.26	2.55	1.73	1.51	2.11
	1.73	2.35	1.97	1.55	2.09	1.21
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.389	1.789	2.608	3.403	3.642	4.116
	3.510	3.571	2.302	1.829	1.551	0.978
STD. DEVIATIONS	0.289	0.280	0.399	0.637	0.960	1.223
	1.655	0.932	0.887	0.743	0.412	0.213
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	1.8498	1.7935	2.1470	2.1766	2.0484	1.3528
	1.1814	0.6444	0.8420	1.1226	1.3134	1.3687
STD. DEVIATIONS	0.7951	0.7228	1.2105	0.8601	1.4051	1.1823
	1.2542	0.4063	0.9854	1.0805	1.0073	0.8848
PERCOLATION/LEAKAGE THROUGH LAYER 5						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 6

TOTALS	0.0058	0.0050	0.0054	0.0050	0.0050	0.0047
	0.0047	0.0046	0.0044	0.0044	0.0041	0.0042
STD. DEVIATIONS	0.0051	0.0043	0.0045	0.0041	0.0039	0.0036
	0.0035	0.0033	0.0030	0.0030	0.0027	0.0027

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.3022	0.3227	0.3508	0.3674	0.3347	0.2284
	0.1930	0.1053	0.1421	0.1834	0.2217	0.2236
STD. DEVIATIONS	0.1299	0.1320	0.1978	0.1452	0.2295	0.1996
	0.2049	0.0664	0.1664	0.1765	0.1701	0.1446

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 10

	INCHES		CU. FEET	PERCENT
PRECIPITATION	48.38	(3.671)	175619.4	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	30.688	(2.9702)	111396.20	63.430
LATERAL DRAINAGE COLLECTED FROM LAYER 3	17.84067	(4.38355)	64761.617	36.87611
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.00002	(0.00000)	0.068	0.00004
AVERAGE HEAD ON TOP OF LAYER 4	0.248	(0.061)		
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.05738	(0.04372)	208.276	0.11859
CHANGE IN WATER STORAGE	-0.206	(3.1977)	-746.66	-0.425

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 10

	(INCHES)	(CU. FT.)
PRECIPITATION	3.18	11543.400
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 3	0.22037	799.95111
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000000	0.00085
AVERAGE HEAD ON TOP OF LAYER 4	1.116	
MAXIMUM HEAD ON TOP OF LAYER 4	2.188	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	8.9 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000621	2.25568
SNOW WATER	2.49	9036.6895

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3980
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1360

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 10

LAYER	(INCHES)	(VOL/VOL)

1	3.5427	0.2952
2	105.3186	0.2926
3	0.9741	0.0406
4	0.0000	0.0000
5	0.1875	0.7500
6	5.7821	0.3212
SNOW WATER	0.145	

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**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:      C:\HELP\HELP3~1\BUNCREC.D4
TEMPERATURE DATA FILE:        C:\HELP\HELP3~1\BUNCREC.D7
SOLAR RADIATION DATA FILE:    C:\HELP\HELP3~1\BUNCREC.D13
EVAPOTRANSPIRATION DATA:      C:\HELP\HELP3~1\BUNCREC.D11
SOIL AND DESIGN DATA FILE:    C:\HELP\HELP3~1\BUN60REC.D10
OUTPUT DATA FILE:             C:\HELP\HELP3~1\BUN60R12.OUT


TIME:   7:20     DATE:  11/24/2004


******************************************************************************

     TITLE:  Buncombe County Landfill Bioreactor (60-ft MSW)

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                  LAYER  1
                                  --------

                 TYPE 1 - VERTICAL PERCOLATION LAYER
                     MATERIAL TEXTURE NUMBER  10
          THICKNESS                  =     12.00   INCHES
          POROSITY                   =      0.3980 VOL/VOL
          FIELD CAPACITY             =      0.2440 VOL/VOL
          WILTING POINT              =      0.1360 VOL/VOL
          INITIAL SOIL WATER CONTENT =      0.2440 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =  0.119999997000E-03 CM/SEC
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                          LAYER  2
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            TYPE 1 - VERTICAL PERCOLATION LAYER
                MATERIAL TEXTURE NUMBER   0
  THICKNESS                    =    720.00   INCHES
  POROSITY                     =      0.6710 VOL/VOL
  FIELD CAPACITY               =      0.4500 VOL/VOL
  WILTING POINT                =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT   =      0.2500 VOL/VOL
  EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC
NOTE:  100.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 3
         IS RECIRCULATED INTO THIS LAYER.


                          LAYER  3
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              TYPE 2 - LATERAL DRAINAGE LAYER
                MATERIAL TEXTURE NUMBER  21
  THICKNESS                    =     24.00   INCHES
  POROSITY                     =      0.3970 VOL/VOL
  FIELD CAPACITY               =      0.0320 VOL/VOL
  WILTING POINT                =      0.0130 VOL/VOL
  INITIAL SOIL WATER CONTENT   =      0.0320 VOL/VOL
  EFFECTIVE SAT. HYD. COND.    =  0.300000012000      CM/SEC
  SLOPE                        =      7.00   PERCENT
  DRAINAGE LENGTH              =    600.0    FEET
NOTE:  100.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
         LAYER IS RECIRCULATED INTO LAYER #  2.


                          LAYER  4
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              TYPE 4 - FLEXIBLE MEMBRANE LINER
                MATERIAL TEXTURE NUMBER  35
  THICKNESS                    =      0.06   INCHES
  POROSITY                     =      0.0000 VOL/VOL
  FIELD CAPACITY               =      0.0000 VOL/VOL
  WILTING POINT                =      0.0000 VOL/VOL
  INITIAL SOIL WATER CONTENT   =      0.0000 VOL/VOL
  EFFECTIVE SAT. HYD. COND.    =  0.199999996000E-12 CM/SEC
  FML PINHOLE DENSITY          =      1.00   HOLES/ACRE
  FML INSTALLATION DEFECTS     =      1.00   HOLES/ACRE
  FML PLACEMENT QUALITY        =  3 - GOOD


                          LAYER  5
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TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.25	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	18.00	INCHES
POROSITY	=	0.4750	VOL/VOL
FIELD CAPACITY	=	0.3780	VOL/VOL
WILTING POINT	=	0.2650	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4180	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #10 WITH BARE GROUND CONDITIONS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 250. FEET.

SCS RUNOFF CURVE NUMBER	=	94.10	
FRACTION OF AREA ALLOWING RUNOFF	=	50.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.928	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.776	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.632	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	191.408	INCHES
TOTAL INITIAL WATER	=	191.408	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM

ASHEVILLE NORTH CAROLINA

STATION LATITUDE	=	35.26 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	96
END OF GROWING SEASON (JULIAN DATE)	=	298
EVAPORATIVE ZONE DEPTH	=	12.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	7.60 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	71.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	75.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	84.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	77.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR ASHEVILLE NORTH CAROLINA

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.48	3.60	5.13	3.84	4.19	4.20
4.43	4.79	3.96	3.29	3.29	3.51

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR ASHEVILLE NORTH CAROLINA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
36.80	39.10	46.40	55.70	63.30	69.80
73.20	72.60	66.90	56.00	46.40	39.30

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR ASHEVILLE NORTH CAROLINA AND STATION LATITUDE = 35.26 DEGREES

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.75	169702.562	100.00
RUNOFF	4.263	15475.074	9.12
EVAPOTRANSPIRATION	32.327	117348.062	69.15

RECIRCULATION INTO LAYER 2	0.000000	0.000	0.00
DRAINAGE COLLECTED FROM LAYER 3	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 3	0.000000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 5	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0000		
PERC./LEAKAGE THROUGH LAYER 6	0.720001	2613.602	1.54
CHANGE IN WATER STORAGE	9.440	34265.824	20.19
SOIL WATER AT START OF YEAR	191.407	694809.062	
SOIL WATER AT END OF YEAR	200.847	729074.875	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.006	0.00

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	52.69	191264.703	100.00
RUNOFF	7.122	25851.742	13.52
EVAPOTRANSPIRATION	24.877	90304.000	47.21
RECIRCULATION INTO LAYER 2	0.000000	0.000	0.00
DRAINAGE COLLECTED FROM LAYER 3	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 3	0.000000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 5	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0000		
PERC./LEAKAGE THROUGH LAYER 6	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	20.691	75109.031	39.27
SOIL WATER AT START OF YEAR	200.847	729074.875	

SOIL WATER AT END OF YEAR	221.538	804183.937	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.061	0.00

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ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	48.62	176490.672	100.00
RUNOFF	5.651	20512.391	11.62
EVAPOTRANSPIRATION	31.171	113149.070	64.11
RECIRCULATION INTO LAYER 2	0.000000	0.000	0.00
DRAINAGE COLLECTED FROM LAYER 3	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 3	0.000000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 5	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0000		
PERC./LEAKAGE THROUGH LAYER 6	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	11.799	42829.191	24.27
SOIL WATER AT START OF YEAR	221.538	804183.937	
SOIL WATER AT END OF YEAR	233.337	847013.125	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.016	0.00

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	41.42	150354.609	100.00
RUNOFF	4.126	14976.146	9.96
EVAPOTRANSPIRATION	27.561	100047.148	66.54
RECIRCULATION INTO LAYER 2	0.000000	0.000	0.00
DRAINAGE COLLECTED FROM LAYER 3	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 3	0.000000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 5	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0000		
PERC./LEAKAGE THROUGH LAYER 6	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	9.733	35331.293	23.50
SOIL WATER AT START OF YEAR	233.337	847013.125	
SOIL WATER AT END OF YEAR	243.070	882344.375	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.021	0.00

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	45.64	165673.219	100.00
RUNOFF	4.332	15725.381	9.49
EVAPOTRANSPIRATION	30.922	112247.703	67.75
RECIRCULATION INTO LAYER 2	0.000000	0.000	0.00
DRAINAGE COLLECTED FROM LAYER 3	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 3	0.000000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 5	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0000		
PERC./LEAKAGE THROUGH LAYER 6	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	10.386	37700.133	22.76
SOIL WATER AT START OF YEAR	243.070	882344.375	
SOIL WATER AT END OF YEAR	253.456	920044.562	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.003	0.00

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.72	180483.578	100.00
RUNOFF	5.539	20108.008	11.14
EVAPOTRANSPIRATION	29.361	106579.383	59.05
RECIRCULATION INTO LAYER 2	0.027144	98.532	0.05
DRAINAGE COLLECTED FROM LAYER 3	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 3	0.027144	98.532	0.05
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.007	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0004		
PERC./LEAKAGE THROUGH LAYER 6	0.414498	1504.628	0.83
CHANGE IN WATER STORAGE	14.405	52291.199	28.97
SOIL WATER AT START OF YEAR	253.456	920044.562	
SOIL WATER AT END OF YEAR	267.861	972335.750	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0001	0.358	0.00

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ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	52.38	190139.437	100.00
RUNOFF	6.139	22284.070	11.72
EVAPOTRANSPIRATION	34.041	123569.250	64.99
RECIRCULATION INTO LAYER 2	0.044821	162.702	0.09
DRAINAGE COLLECTED FROM LAYER 3	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 3	0.044821	162.702	0.09
PERC./LEAKAGE THROUGH LAYER 5	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0006		
PERC./LEAKAGE THROUGH LAYER 6	0.179082	650.069	0.34
CHANGE IN WATER STORAGE	12.021	43635.996	22.95
SOIL WATER AT START OF YEAR	267.861	972335.750	
SOIL WATER AT END OF YEAR	279.882	1015971.750	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.051	0.00

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ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.99	163313.672	100.00
RUNOFF	4.324	15695.401	9.61

EVAPOTRANSPIRATION	32.321	117324.672	71.84
RECIRCULATION INTO LAYER 2	0.103969	377.408	0.23
DRAINAGE COLLECTED FROM LAYER 3	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 3	0.103969	377.408	0.23
PERC./LEAKAGE THROUGH LAYER 5	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
PERC./LEAKAGE THROUGH LAYER 6	0.103923	377.242	0.23
CHANGE IN WATER STORAGE	8.241	29916.150	18.32
SOIL WATER AT START OF YEAR	279.882	1015971.750	
SOIL WATER AT END OF YEAR	288.123	1045887.870	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0001	0.213	0.00

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ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.55	179866.531	100.00
RUNOFF	5.509	19997.096	11.12
EVAPOTRANSPIRATION	26.809	97316.242	54.10
RECIRCULATION INTO LAYER 2	0.124320	451.282	0.25
DRAINAGE COLLECTED FROM LAYER 3	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 3	0.124320	451.282	0.25
PERC./LEAKAGE THROUGH LAYER 5	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
PERC./LEAKAGE THROUGH LAYER 6	0.072689	263.862	0.15
CHANGE IN WATER STORAGE	17.159	62287.145	34.63

SOIL WATER AT START OF YEAR	288.123	1045887.870	
SOIL WATER AT END OF YEAR	304.682	1105994.870	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.601	2180.112	1.21
ANNUAL WATER BUDGET BALANCE	0.0006	2.184	0.00

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	52.04	188905.234	100.00
RUNOFF	6.445	23394.980	12.38
EVAPOTRANSPIRATION	31.640	114852.203	60.80
RECIRCULATION INTO LAYER 2	0.133618	485.035	0.26
DRAINAGE COLLECTED FROM LAYER 3	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 3	0.133618	485.035	0.26
PERC./LEAKAGE THROUGH LAYER 5	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0019		
PERC./LEAKAGE THROUGH LAYER 6	0.055840	202.700	0.11
CHANGE IN WATER STORAGE	13.900	50456.414	26.71
SOIL WATER AT START OF YEAR	304.682	1105994.870	
SOIL WATER AT END OF YEAR	319.038	1158106.370	
SNOW WATER AT START OF YEAR	0.601	2180.112	1.15
SNOW WATER AT END OF YEAR	0.145	525.067	0.28
ANNUAL WATER BUDGET BALANCE	-0.0003	-1.064	0.00

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ANNUAL TOTALS FOR YEAR 11

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.48	139682.391	100.00
RUNOFF	3.537	12840.018	9.19
EVAPOTRANSPIRATION	27.507	99850.375	71.48
RECIRCULATION INTO LAYER 2	0.090306	327.812	0.23
DRAINAGE COLLECTED FROM LAYER 3	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 3	0.090306	327.812	0.23
PERC./LEAKAGE THROUGH LAYER 5	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0013		
PERC./LEAKAGE THROUGH LAYER 6	0.045242	164.230	0.12
CHANGE IN WATER STORAGE	7.391	26828.658	19.21
SOIL WATER AT START OF YEAR	319.038	1158106.370	
SOIL WATER AT END OF YEAR	326.573	1185460.120	
SNOW WATER AT START OF YEAR	0.145	525.067	0.38
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	-0.0002	-0.882	0.00

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ANNUAL TOTALS FOR YEAR 12

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.14	142078.203	100.00
RUNOFF	6.315	22925.199	16.14
EVAPOTRANSPIRATION	22.594	82014.930	57.73
RECIRCULATION INTO LAYER 2	26.617634	96622.008	68.01
DRAINAGE COLLECTED FROM LAYER 3	0.0000	0.000	0.00

RECIRCULATION FROM LAYER 3	26.617634	96622.008	68.01
PERC./LEAKAGE THROUGH LAYER 5	0.000034	0.124	0.00
AVG. HEAD ON TOP OF LAYER 4	0.3655		
PERC./LEAKAGE THROUGH LAYER 6	0.038035	138.068	0.10
CHANGE IN WATER STORAGE	9.398	34114.555	24.01
SOIL WATER AT START OF YEAR	326.573	1185460.120	
SOIL WATER AT END OF YEAR	335.971	1219574.620	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.7949	2885.444	2.03

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 12

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	3.43	3.61	5.13	4.06	4.68	4.40
	4.08	4.63	3.02	2.89	3.77	3.08
STD. DEVIATIONS	1.40	2.10	2.81	1.65	1.49	2.01
	1.68	2.24	2.00	1.50	2.32	1.27
RUNOFF						
TOTALS	0.428	0.504	0.661	0.381	0.489	0.366
	0.326	0.579	0.367	0.292	0.599	0.282
STD. DEVIATIONS	0.369	0.585	0.606	0.206	0.356	0.352
	0.235	0.540	0.441	0.284	0.661	0.224
EVAPOTRANSPIRATION						
TOTALS	1.357	1.685	2.697	3.215	3.663	3.785
	3.368	3.254	2.023	1.730	1.471	1.013
STD. DEVIATIONS	0.296	0.384	0.432	0.730	1.055	1.190
	1.464	0.930	1.010	0.772	0.513	0.210

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0040	0.0038	0.0058	0.0060	0.0053	0.0043
	0.0039	0.0137	0.0089	0.0060	0.5594	1.6406
STD. DEVIATIONS	0.0062	0.0050	0.0078	0.0074	0.0057	0.0044
	0.0038	0.0370	0.0215	0.0103	1.9211	5.6634

LATERAL DRAINAGE COLLECTED FROM LAYER 3

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LATERAL DRAINAGE RECIRCULATED FROM LAYER 3

TOTALS	0.0040	0.0038	0.0058	0.0060	0.0053	0.0043
	0.0039	0.0137	0.0089	0.0060	0.5594	1.6406
STD. DEVIATIONS	0.0062	0.0050	0.0078	0.0074	0.0057	0.0044
	0.0038	0.0370	0.0215	0.0103	1.9211	5.6634

PERCOLATION/LEAKAGE THROUGH LAYER 5

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 6

TOTALS	0.0436	0.0172	0.0165	0.0094	0.0084	0.0072
	0.0067	0.0062	0.0055	0.0054	0.0049	0.0048
STD. DEVIATIONS	0.1349	0.0458	0.0284	0.0193	0.0159	0.0129
	0.0114	0.0100	0.0086	0.0080	0.0071	0.0067

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.0007	0.0007	0.0009	0.0010	0.0009	0.0007
	0.0006	0.0022	0.0015	0.0010	0.0944	0.2680
STD. DEVIATIONS	0.0010	0.0009	0.0013	0.0013	0.0009	0.0007
	0.0006	0.0060	0.0036	0.0017	0.3243	0.9252

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 12

	INCHES		CU. FEET	PERCENT
PRECIPITATION	46.79	(4.992)	169829.6	100.00
RUNOFF	5.275	(1.1295)	19148.79	11.275
EVAPOTRANSPIRATION	29.261	(3.4290)	106216.91	62.543
DRAINAGE RECIRCULATED INTO LAYER 2	2.26182	(7.67027)	8210.398	4.83449
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.00000	(0.00000)	0.000	0.00000
DRAINAGE RECIRCULATED FROM LAYER 3	2.26182	(7.67027)	8210.398	4.83449
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.00000	(0.00001)	0.015	0.00001
AVERAGE HEAD ON TOP OF LAYER 4	0.031	(0.105)		
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.13578	(0.21821)	492.867	0.29021
CHANGE IN WATER STORAGE	12.047	(3.9081)	43730.46	25.750

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 12

	(INCHES)	(CU. FT.)
PRECIPITATION	3.66	13285.801
RUNOFF	1.243	4512.8271
DRAINAGE RECIRCULATED INTO LAYER 2	0.79512	2886.29053
DRAINAGE COLLECTED FROM LAYER 3	0.00000	0.00000
DRAINAGE RECIRCULATED FROM LAYER 3	0.79512	2886.29053
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000001	0.00368

AVERAGE HEAD ON TOP OF LAYER 4	4.027	
MAXIMUM HEAD ON TOP OF LAYER 4	7.642	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	27.9 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.033864	122.92488
SNOW WATER	2.49	9036.6895

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.3980

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1360

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 12

LAYER	(INCHES)	(VOL/VOL)
1	2.8085	0.2340
2	323.9999	0.4500
3	3.0804	0.1283
4	0.0000	0.0000
5	0.1875	0.7500
6	5.8947	0.3275
SNOW WATER	0.000	

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**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:     C:\HELP\HELP3~1\BUNCREC.D4
TEMPERATURE DATA FILE:       C:\HELP\HELP3~1\BUNCREC.D7
SOLAR RADIATION DATA FILE:   C:\HELP\HELP3~1\BUNCREC.D13
EVAPOTRANSPIRATION DATA:     C:\HELP\HELP3~1\BUNCREC.D11
SOIL AND DESIGN DATA FILE:   C:\HELP\HELP3~1\BUN90REC.D10
OUTPUT DATA FILE:            C:\HELP\HELP3~1\BUN90R05.OUT


TIME:   7:24     DATE:  11/24/2004


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     TITLE:  Buncombe County Landfill Bioreactor (90-ft MSW)

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                  LAYER  1
                                  --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER  10
          THICKNESS                    =      12.00   INCHES
          POROSITY                     =       0.3980 VOL/VOL
          FIELD CAPACITY               =       0.2440 VOL/VOL
          WILTING POINT                =       0.1360 VOL/VOL
          INITIAL SOIL WATER CONTENT   =       0.2440 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.119999997000E-03 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	360.00	INCHES
POROSITY	=	0.6710	VOL/VOL
FIELD CAPACITY	=	0.4500	VOL/VOL
WILTING POINT	=	0.0770	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

NOTE: 100.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 4
IS RECIRCULATED INTO THIS LAYER.

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	720.00	INCHES
POROSITY	=	0.6710	VOL/VOL
FIELD CAPACITY	=	0.4500	VOL/VOL
WILTING POINT	=	0.0770	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 4

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 21

THICKNESS	=	24.00	INCHES
POROSITY	=	0.3970	VOL/VOL
FIELD CAPACITY	=	0.0320	VOL/VOL
WILTING POINT	=	0.0130	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0320	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000012000	CM/SEC
SLOPE	=	7.00	PERCENT
DRAINAGE LENGTH	=	600.0	FEET

NOTE: 100.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
LAYER IS RECIRCULATED INTO LAYER # 2.

LAYER 5

TYPE 4 - FLEXIBLE MEMBRANE LINER

```
                MATERIAL TEXTURE NUMBER  35
THICKNESS                    =      0.06    INCHES
POROSITY                     =      0.0000 VOL/VOL
FIELD CAPACITY               =      0.0000 VOL/VOL
WILTING POINT                =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY          =      1.00    HOLES/ACRE
FML INSTALLATION DEFECTS     =      1.00    HOLES/ACRE
FML PLACEMENT QUALITY        =  3 - GOOD


                         LAYER  6
                         --------

                TYPE 3 - BARRIER SOIL LINER
                MATERIAL TEXTURE NUMBER  17
THICKNESS                    =      0.25    INCHES
POROSITY                     =      0.7500 VOL/VOL
FIELD CAPACITY               =      0.7470 VOL/VOL
WILTING POINT                =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.300000003000E-08 CM/SEC


                         LAYER  7
                         --------

            TYPE 1 - VERTICAL PERCOLATION LAYER
                MATERIAL TEXTURE NUMBER   0
THICKNESS                    =     18.00    INCHES
POROSITY                     =      0.4750 VOL/VOL
FIELD CAPACITY               =      0.3780 VOL/VOL
WILTING POINT                =      0.2650 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.4180 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.999999975000E-05 CM/SEC


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

 NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
          SOIL DATA BASE USING SOIL TEXTURE #10 WITH BARE
          GROUND CONDITIONS, A SURFACE SLOPE OF  5.% AND
          A SLOPE LENGTH OF  250. FEET.

SCS RUNOFF CURVE NUMBER              =     94.10
FRACTION OF AREA ALLOWING RUNOFF     =     50.0     PERCENT
AREA PROJECTED ON HORIZONTAL PLANE   =      1.000   ACRES
EVAPORATIVE ZONE DEPTH               =     12.0     INCHES
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INITIAL WATER IN EVAPORATIVE ZONE	=	2.928	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.776	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.632	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	425.407	INCHES
TOTAL INITIAL WATER	=	425.407	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
ASHEVILLE NORTH CAROLINA

STATION LATITUDE	=	35.26	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	96	
END OF GROWING SEASON (JULIAN DATE)	=	298	
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	7.60	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	75.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	84.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	77.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ASHEVILLE NORTH CAROLINA

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.48	3.60	5.13	3.84	4.19	4.20
4.43	4.79	3.96	3.29	3.29	3.51

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ASHEVILLE NORTH CAROLINA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
36.80	39.10	46.40	55.70	63.30	69.80
73.20	72.60	66.90	56.00	46.40	39.30

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ASHEVILLE NORTH CAROLINA
AND STATION LATITUDE = 35.26 DEGREES

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.75	169702.562	100.00
RUNOFF	4.263	15475.607	9.12
EVAPOTRANSPIRATION	32.358	117458.219	69.21
RECIRCULATION INTO LAYER 2	1.089729	3955.718	2.33
DRAINAGE COLLECTED FROM LAYER 4	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 4	1.089729	3955.718	2.33
PERC./LEAKAGE THROUGH LAYER 6	0.000003	0.012	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0149		
PERC./LEAKAGE THROUGH LAYER 7	1.124397	4081.561	2.41
CHANGE IN WATER STORAGE	9.005	32687.170	19.26
SOIL WATER AT START OF YEAR	425.407	1544228.870	
SOIL WATER AT END OF YEAR	434.412	1576916.120	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.001	0.00

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	52.69	191264.703	100.00
RUNOFF	7.122	25853.537	13.52
EVAPOTRANSPIRATION	24.952	90577.234	47.36

RECIRCULATION INTO LAYER 2	0.091463	332.012	0.17
DRAINAGE COLLECTED FROM LAYER 4	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 4	0.091463	332.012	0.17
PERC./LEAKAGE THROUGH LAYER 6	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0013		
PERC./LEAKAGE THROUGH LAYER 7	0.184211	668.687	0.35
CHANGE IN WATER STORAGE	20.431	74165.523	38.78
SOIL WATER AT START OF YEAR	434.412	1576916.120	
SOIL WATER AT END OF YEAR	454.843	1651081.620	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	-0.0001	-0.275	0.00

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ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	48.62	176490.672	100.00
RUNOFF	5.653	20519.383	11.63
EVAPOTRANSPIRATION	31.351	113805.227	64.48
RECIRCULATION INTO LAYER 2	0.099663	361.776	0.20
DRAINAGE COLLECTED FROM LAYER 4	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 4	0.099663	361.776	0.20
PERC./LEAKAGE THROUGH LAYER 6	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0014		
PERC./LEAKAGE THROUGH LAYER 7	0.105398	382.595	0.22
CHANGE IN WATER STORAGE	11.510	41782.887	23.67
SOIL WATER AT START OF YEAR	454.843	1651081.620	

SOIL WATER AT END OF YEAR	466.354	1692864.500	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0002	0.572	0.00

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	41.42	150354.609	100.00
RUNOFF	4.126	14977.200	9.96
EVAPOTRANSPIRATION	27.596	100173.742	66.62
RECIRCULATION INTO LAYER 2	0.099578	361.467	0.24
DRAINAGE COLLECTED FROM LAYER 4	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 4	0.099578	361.467	0.24
PERC./LEAKAGE THROUGH LAYER 6	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0014		
PERC./LEAKAGE THROUGH LAYER 7	0.073769	267.782	0.18
CHANGE IN WATER STORAGE	9.624	34936.203	23.24
SOIL WATER AT START OF YEAR	466.354	1692864.500	
SOIL WATER AT END OF YEAR	475.978	1727800.620	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	-0.0001	-0.315	0.00

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	45.64	165673.219	100.00
RUNOFF	4.332	15726.066	9.49
EVAPOTRANSPIRATION	30.887	112118.945	67.67
RECIRCULATION INTO LAYER 2	0.097192	352.806	0.21
DRAINAGE COLLECTED FROM LAYER 4	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 4	0.097192	352.806	0.21
PERC./LEAKAGE THROUGH LAYER 6	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0013		
PERC./LEAKAGE THROUGH LAYER 7	0.056343	204.526	0.12
CHANGE IN WATER STORAGE	10.365	37623.918	22.71
SOIL WATER AT START OF YEAR	475.978	1727800.620	
SOIL WATER AT END OF YEAR	486.343	1765424.620	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	-0.0001	-0.246	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.80	3.62	4.97	5.08	4.87	4.55
	4.55	3.58	2.32	2.92	3.98	3.77
STD. DEVIATIONS	0.84	1.45	3.49	1.51	1.42	1.91
	1.45	0.72	0.99	1.81	2.74	0.65

RUNOFF

TOTALS	0.295	0.421	0.664	0.524	0.569	0.522
	0.358	0.214	0.222	0.248	0.602	0.460
STD. DEVIATIONS	0.295	0.389	0.795	0.157	0.443	0.460
	0.182	0.120	0.212	0.226	0.644	0.195

EVAPOTRANSPIRATION

TOTALS	1.367	1.711	2.482	3.554	3.264	4.222
	3.653	3.255	1.949	1.534	1.457	0.981
STD. DEVIATIONS	0.312	0.315	0.317	0.436	0.462	1.047
	1.836	0.592	0.934	0.664	0.604	0.222

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.1891	0.0159	0.0123	0.0104	0.0097	0.0084
	0.0082	0.0081	0.0080	0.0077	0.0085	0.0093
STD. DEVIATIONS	0.4038	0.0197	0.0099	0.0050	0.0029	0.0015
	0.0011	0.0010	0.0012	0.0005	0.0020	0.0026

LATERAL DRAINAGE COLLECTED FROM LAYER 4

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LATERAL DRAINAGE RECIRCULATED FROM LAYER 4

TOTALS	0.1891	0.0159	0.0123	0.0104	0.0097	0.0084
	0.0082	0.0081	0.0080	0.0077	0.0085	0.0093
STD. DEVIATIONS	0.4038	0.0197	0.0099	0.0050	0.0029	0.0015
	0.0011	0.0010	0.0012	0.0005	0.0020	0.0026

PERCOLATION/LEAKAGE THROUGH LAYER 6

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.1034	0.0401	0.0306	0.0231	0.0199	0.0168
	0.0154	0.0140	0.0124	0.0119	0.0108	0.0105
STD. DEVIATIONS	0.2059	0.0681	0.0458	0.0309	0.0242	0.0186
	0.0159	0.0134	0.0112	0.0101	0.0086	0.0080

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0309	0.0029	0.0020	0.0017	0.0016	0.0014
	0.0013	0.0013	0.0014	0.0013	0.0014	0.0015
STD. DEVIATIONS	0.0660	0.0036	0.0016	0.0008	0.0005	0.0003
	0.0002	0.0002	0.0002	0.0001	0.0003	0.0004

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 5

	INCHES		CU. FEET	PERCENT
PRECIPITATION	47.02	(4.125)	170697.1	100.00
RUNOFF	5.099	(1.2877)	18510.36	10.844
EVAPOTRANSPIRATION	29.429	(3.0739)	106826.68	62.583
DRAINAGE RECIRCULATED INTO LAYER 2	0.29553	(0.44399)	1072.756	0.62846
LATERAL DRAINAGE COLLECTED FROM LAYER 4	0.00000	(0.00000)	0.000	0.00000
DRAINAGE RECIRCULATED FROM LAYER 4	0.29553	(0.44399)	1072.756	0.62846
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000	(0.00000)	0.010	0.00001
AVERAGE HEAD ON TOP OF LAYER 5	0.004	(0.006)		
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.30882	(0.45855)	1121.030	0.65674
CHANGE IN WATER STORAGE	12.187	(4.7021)	44239.14	25.917

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 5

	(INCHES)	(CU. FT.)
PRECIPITATION	2.91	10563.301
RUNOFF	0.911	3308.6289
DRAINAGE RECIRCULATED INTO LAYER 2	0.21175	768.64478
DRAINAGE COLLECTED FROM LAYER 4	0.00000	0.00000
DRAINAGE RECIRCULATED FROM LAYER 4	0.21175	768.64478
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00081
AVERAGE HEAD ON TOP OF LAYER 5	1.072	
MAXIMUM HEAD ON TOP OF LAYER 5	2.104	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	8.6 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.033864	122.92455
SNOW WATER	2.33	8458.7197

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.3459

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1360

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 5

LAYER	(INCHES)	(VOL/VOL)
1	3.3104	0.2759
2	153.5747	0.4266
3	322.4487	0.4478
4	0.8417	0.0351
5	0.0000	0.0000
6	0.1875	0.7500
7	5.9799	0.3322
SNOW WATER	0.000	

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**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:      C:\HELP\HELP3~1\BUNCREC.D4
TEMPERATURE DATA FILE:        C:\HELP\HELP3~1\BUNCREC.D7
SOLAR RADIATION DATA FILE:    C:\HELP\HELP3~1\BUNCREC.D13
EVAPOTRANSPIRATION DATA:      C:\HELP\HELP3~1\BUNCREC.D11
SOIL AND DESIGN DATA FILE:    C:\HELP\HELP3~1\BUN200RC.D10
OUTPUT DATA FILE:             C:\HELP\HELP3~1\BN200R21.OUT


TIME:   7:30     DATE:  11/24/2004


******************************************************************************

     TITLE:  Buncombe County Landfill Bioreactor (200-ft MSW)

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                  LAYER  1
                                  --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER  10
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.3980 VOL/VOL
          FIELD CAPACITY               =      0.2440 VOL/VOL
          WILTING POINT                =      0.1360 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2440 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.119999997000E-03 CM/SEC
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                    LAYER  2
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
  THICKNESS                    =   1320.00   INCHES
  POROSITY                     =      0.6710 VOL/VOL
  FIELD CAPACITY               =      0.4500 VOL/VOL
  WILTING POINT                =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT   =      0.2500 VOL/VOL
  EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC
NOTE:  100.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 4
         IS RECIRCULATED INTO THIS LAYER.


                    LAYER  3
                    --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
  THICKNESS                    =   1080.00   INCHES
  POROSITY                     =      0.6710 VOL/VOL
  FIELD CAPACITY               =      0.4500 VOL/VOL
  WILTING POINT                =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT   =      0.4500 VOL/VOL
  EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                    LAYER  4
                    --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER  21
  THICKNESS                    =     24.00   INCHES
  POROSITY                     =      0.3970 VOL/VOL
  FIELD CAPACITY               =      0.0320 VOL/VOL
  WILTING POINT                =      0.0130 VOL/VOL
  INITIAL SOIL WATER CONTENT   =      0.0320 VOL/VOL
  EFFECTIVE SAT. HYD. COND.    =  0.300000012000      CM/SEC
  SLOPE                        =      7.00   PERCENT
  DRAINAGE LENGTH              =    600.0    FEET
NOTE:  100.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
         LAYER IS RECIRCULATED INTO LAYER #  2.


                    LAYER  5
                    --------

          TYPE 4 - FLEXIBLE MEMBRANE LINER
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                MATERIAL TEXTURE NUMBER  35
THICKNESS                    =      0.06    INCHES
POROSITY                     =      0.0000 VOL/VOL
FIELD CAPACITY               =      0.0000 VOL/VOL
WILTING POINT                =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY          =      1.00    HOLES/ACRE
FML INSTALLATION DEFECTS     =      1.00    HOLES/ACRE
FML PLACEMENT QUALITY        =  3 - GOOD


                         LAYER  6
                         --------

                TYPE 3 - BARRIER SOIL LINER
                MATERIAL TEXTURE NUMBER  17
THICKNESS                    =      0.25    INCHES
POROSITY                     =      0.7500 VOL/VOL
FIELD CAPACITY               =      0.7470 VOL/VOL
WILTING POINT                =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.300000003000E-08 CM/SEC


                         LAYER  7
                         --------

            TYPE 1 - VERTICAL PERCOLATION LAYER
                MATERIAL TEXTURE NUMBER   0
THICKNESS                    =     18.00    INCHES
POROSITY                     =      0.4750 VOL/VOL
FIELD CAPACITY               =      0.3780 VOL/VOL
WILTING POINT                =      0.2650 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.4180 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.999999975000E-05 CM/SEC


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------

 NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
          SOIL DATA BASE USING SOIL TEXTURE #10 WITH BARE
          GROUND CONDITIONS, A SURFACE SLOPE OF  5.% AND
          A SLOPE LENGTH OF  500. FEET.

SCS RUNOFF CURVE NUMBER              =     93.90
FRACTION OF AREA ALLOWING RUNOFF     =     50.0     PERCENT
AREA PROJECTED ON HORIZONTAL PLANE   =      1.000   ACRES
EVAPORATIVE ZONE DEPTH               =     12.0     INCHES
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INITIAL WATER IN EVAPORATIVE ZONE	=	2.928	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.776	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.632	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	827.407	INCHES
TOTAL INITIAL WATER	=	827.407	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
ASHEVILLE NORTH CAROLINA

STATION LATITUDE	=	35.26	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	96	
END OF GROWING SEASON (JULIAN DATE)	=	298	
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	7.60	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	75.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	84.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	77.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ASHEVILLE NORTH CAROLINA

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.48	3.60	5.13	3.84	4.19	4.20
4.43	4.79	3.96	3.29	3.29	3.51

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ASHEVILLE NORTH CAROLINA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
36.80	39.10	46.40	55.70	63.30	69.80
73.20	72.60	66.90	56.00	46.40	39.30

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ASHEVILLE NORTH CAROLINA
AND STATION LATITUDE = 35.26 DEGREES

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.75	169702.562	100.00
RUNOFF	4.099	14878.525	8.77
EVAPOTRANSPIRATION	32.517	118035.156	69.55
RECIRCULATION INTO LAYER 2	1.097686	3984.601	2.35
DRAINAGE COLLECTED FROM LAYER 4	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 4	1.097686	3984.601	2.35
PERC./LEAKAGE THROUGH LAYER 6	0.000003	0.012	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0150		
PERC./LEAKAGE THROUGH LAYER 7	1.124397	4081.561	2.41
CHANGE IN WATER STORAGE	9.010	32707.443	19.27
SOIL WATER AT START OF YEAR	827.407	3003489.000	
SOIL WATER AT END OF YEAR	836.418	3036196.250	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.127	0.00

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	52.69	191264.703	100.00
RUNOFF	6.913	25095.516	13.12
EVAPOTRANSPIRATION	24.942	90538.898	47.34

RECIRCULATION INTO LAYER 2	0.102362	371.576	0.19
DRAINAGE COLLECTED FROM LAYER 4	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 4	0.102362	371.576	0.19
PERC./LEAKAGE THROUGH LAYER 6	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0014		
PERC./LEAKAGE THROUGH LAYER 7	0.184211	668.687	0.35
CHANGE IN WATER STORAGE	20.651	74961.586	39.19
SOIL WATER AT START OF YEAR	836.418	3036196.250	
SOIL WATER AT END OF YEAR	857.068	3111158.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.026	0.00

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ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	48.62	176490.672	100.00
RUNOFF	5.451	19787.494	11.21
EVAPOTRANSPIRATION	31.203	113268.406	64.18
RECIRCULATION INTO LAYER 2	0.102613	372.487	0.21
DRAINAGE COLLECTED FROM LAYER 4	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 4	0.102613	372.487	0.21
PERC./LEAKAGE THROUGH LAYER 6	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0014		
PERC./LEAKAGE THROUGH LAYER 7	0.105398	382.595	0.22
CHANGE IN WATER STORAGE	11.860	43051.523	24.39
SOIL WATER AT START OF YEAR	857.068	3111158.000	

SOIL WATER AT END OF YEAR	868.928	3154209.500	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0002	0.641	0.00

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	41.42	150354.609	100.00
RUNOFF	3.989	14480.186	9.63
EVAPOTRANSPIRATION	27.499	99821.195	66.39
RECIRCULATION INTO LAYER 2	0.110466	400.992	0.27
DRAINAGE COLLECTED FROM LAYER 4	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 4	0.110466	400.992	0.27
PERC./LEAKAGE THROUGH LAYER 6	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0015		
PERC./LEAKAGE THROUGH LAYER 7	0.073769	267.782	0.18
CHANGE IN WATER STORAGE	9.858	35785.984	23.80
SOIL WATER AT START OF YEAR	868.928	3154209.500	
SOIL WATER AT END OF YEAR	878.787	3189995.500	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	-0.0002	-0.546	0.00

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	45.64	165673.219	100.00
RUNOFF	4.143	15040.584	9.08
EVAPOTRANSPIRATION	30.777	111721.445	67.43
RECIRCULATION INTO LAYER 2	0.103151	374.440	0.23
DRAINAGE COLLECTED FROM LAYER 4	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 4	0.103151	374.440	0.23
PERC./LEAKAGE THROUGH LAYER 6	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0014		
PERC./LEAKAGE THROUGH LAYER 7	0.056343	204.526	0.12
CHANGE IN WATER STORAGE	10.663	38706.781	23.36
SOIL WATER AT START OF YEAR	878.787	3189995.500	
SOIL WATER AT END OF YEAR	889.450	3228702.250	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.125	0.00

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.72	180483.578	100.00
RUNOFF	5.336	19369.111	10.73
EVAPOTRANSPIRATION	29.244	106157.086	58.82
RECIRCULATION INTO LAYER 2	0.113676	412.645	0.23
DRAINAGE COLLECTED FROM LAYER 4	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 4	0.113676	412.645	0.23
PERC./LEAKAGE THROUGH LAYER 6	0.000003	0.009	0.00

AVG. HEAD ON TOP OF LAYER 5	0.0016		
PERC./LEAKAGE THROUGH LAYER 7	0.045575	165.438	0.09
CHANGE IN WATER STORAGE	15.094	54791.422	30.36
SOIL WATER AT START OF YEAR	889.450	3228702.250	
SOIL WATER AT END OF YEAR	904.544	3283493.750	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0001	0.526	0.00

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ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	52.38	190139.437	100.00
RUNOFF	5.952	21606.109	11.36
EVAPOTRANSPIRATION	33.957	123262.734	64.83
RECIRCULATION INTO LAYER 2	0.113149	410.731	0.22
DRAINAGE COLLECTED FROM LAYER 4	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 4	0.113149	410.731	0.22
PERC./LEAKAGE THROUGH LAYER 6	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0016		
PERC./LEAKAGE THROUGH LAYER 7	0.038206	138.689	0.07
CHANGE IN WATER STORAGE	12.433	45132.617	23.74
SOIL WATER AT START OF YEAR	904.544	3283493.750	
SOIL WATER AT END OF YEAR	916.977	3328626.250	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	-0.0002	-0.718	0.00

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ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.99	163313.672	100.00
RUNOFF	4.193	15219.179	9.32
EVAPOTRANSPIRATION	32.176	116798.891	71.52
RECIRCULATION INTO LAYER 2	0.114053	414.013	0.25
DRAINAGE COLLECTED FROM LAYER 4	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 4	0.114053	414.013	0.25
PERC./LEAKAGE THROUGH LAYER 6	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0016		
PERC./LEAKAGE THROUGH LAYER 7	0.032936	119.558	0.07
CHANGE IN WATER STORAGE	8.588	31176.037	19.09
SOIL WATER AT START OF YEAR	916.977	3328626.250	
SOIL WATER AT END OF YEAR	925.565	3359802.250	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.016	0.00

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ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.55	179866.531	100.00
RUNOFF	5.329	19343.012	10.75

EVAPOTRANSPIRATION	26.803	97294.070	54.09
RECIRCULATION INTO LAYER 2	0.110602	401.484	0.22
DRAINAGE COLLECTED FROM LAYER 4	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 4	0.110602	401.484	0.22
PERC./LEAKAGE THROUGH LAYER 6	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0015		
PERC./LEAKAGE THROUGH LAYER 7	0.028779	104.469	0.06
CHANGE IN WATER STORAGE	17.390	63124.633	35.10
SOIL WATER AT START OF YEAR	925.565	3359802.250	
SOIL WATER AT END OF YEAR	942.354	3420746.750	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.601	2180.112	1.21
ANNUAL WATER BUDGET BALANCE	0.0001	0.343	0.00

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	52.04	188905.234	100.00
RUNOFF	6.227	22605.811	11.97
EVAPOTRANSPIRATION	31.634	114830.242	60.79
RECIRCULATION INTO LAYER 2	0.122715	445.457	0.24
DRAINAGE COLLECTED FROM LAYER 4	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 4	0.122715	445.457	0.24
PERC./LEAKAGE THROUGH LAYER 6	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0017		
PERC./LEAKAGE THROUGH LAYER 7	0.025595	92.909	0.05
CHANGE IN WATER STORAGE	14.153	51376.320	27.20

SOIL WATER AT START OF YEAR	942.354	3420746.750	
SOIL WATER AT END OF YEAR	956.964	3473778.250	
SNOW WATER AT START OF YEAR	0.601	2180.112	1.15
SNOW WATER AT END OF YEAR	0.145	525.067	0.28
ANNUAL WATER BUDGET BALANCE	0.0000	-0.057	0.00

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ANNUAL TOTALS FOR YEAR 11

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.48	139682.391	100.00
RUNOFF	3.367	12221.239	8.75
EVAPOTRANSPIRATION	27.690	100513.930	71.96
RECIRCULATION INTO LAYER 2	0.123503	448.317	0.32
DRAINAGE COLLECTED FROM LAYER 4	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 4	0.123503	448.317	0.32
PERC./LEAKAGE THROUGH LAYER 6	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0017		
PERC./LEAKAGE THROUGH LAYER 7	0.023032	83.605	0.06
CHANGE IN WATER STORAGE	7.400	26863.664	19.23
SOIL WATER AT START OF YEAR	956.964	3473778.250	
SOIL WATER AT END OF YEAR	964.509	3501167.000	
SNOW WATER AT START OF YEAR	0.145	525.067	0.38
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.037	0.00

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ANNUAL TOTALS FOR YEAR 12

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.14	142078.203	100.00
RUNOFF	6.185	22450.449	15.80
EVAPOTRANSPIRATION	22.584	81980.867	57.70
RECIRCULATION INTO LAYER 2	0.110080	399.590	0.28
DRAINAGE COLLECTED FROM LAYER 4	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 4	0.110080	399.590	0.28
PERC./LEAKAGE THROUGH LAYER 6	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0015		
PERC./LEAKAGE THROUGH LAYER 7	0.020980	76.158	0.05
CHANGE IN WATER STORAGE	10.350	37571.074	26.44
SOIL WATER AT START OF YEAR	964.509	3501167.000	
SOIL WATER AT END OF YEAR	974.859	3538738.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	-0.0001	-0.353	0.00

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ANNUAL TOTALS FOR YEAR 13

	INCHES	CU. FEET	PERCENT
PRECIPITATION	48.94	177652.187	100.00
RUNOFF	3.860	14010.814	7.89
EVAPOTRANSPIRATION	30.771	111700.320	62.88
RECIRCULATION INTO LAYER 2	0.101799	369.531	0.21
DRAINAGE COLLECTED FROM LAYER 4	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 4	0.101799	369.531	0.21

PERC./LEAKAGE THROUGH LAYER 6	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0014		
PERC./LEAKAGE THROUGH LAYER 7	0.019160	69.551	0.04
CHANGE IN WATER STORAGE	14.289	51870.754	29.20
SOIL WATER AT START OF YEAR	974.859	3538738.000	
SOIL WATER AT END OF YEAR	985.585	3577673.500	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	3.563	12935.326	7.28
ANNUAL WATER BUDGET BALANCE	0.0002	0.739	0.00

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ANNUAL TOTALS FOR YEAR 14

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.64	147523.219	100.00
RUNOFF	5.322	19319.664	13.10
EVAPOTRANSPIRATION	25.326	91933.492	62.32
RECIRCULATION INTO LAYER 2	0.117519	426.595	0.29
DRAINAGE COLLECTED FROM LAYER 4	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 4	0.117519	426.595	0.29
PERC./LEAKAGE THROUGH LAYER 6	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0016		
PERC./LEAKAGE THROUGH LAYER 7	0.017667	64.132	0.04
CHANGE IN WATER STORAGE	9.974	36206.375	24.54
SOIL WATER AT START OF YEAR	985.585	3577673.500	
SOIL WATER AT END OF YEAR	999.123	3626815.000	
SNOW WATER AT START OF YEAR	3.563	12935.326	8.77
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	-0.0001	-0.437	0.00

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ANNUAL TOTALS FOR YEAR 15

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.42	135834.609	100.00
RUNOFF	2.692	9770.371	7.19
EVAPOTRANSPIRATION	27.150	98554.992	72.56
RECIRCULATION INTO LAYER 2	0.108906	395.328	0.29
DRAINAGE COLLECTED FROM LAYER 4	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 4	0.108906	395.328	0.29
PERC./LEAKAGE THROUGH LAYER 6	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0015		
PERC./LEAKAGE THROUGH LAYER 7	0.016385	59.478	0.04
CHANGE IN WATER STORAGE	7.562	27449.437	20.21
SOIL WATER AT START OF YEAR	999.123	3626815.000	
SOIL WATER AT END OF YEAR	1006.684	3654264.500	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0001	0.329	0.00

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ANNUAL TOTALS FOR YEAR 16

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.36	186436.812	100.00

RUNOFF	5.907	21442.779	11.50
EVAPOTRANSPIRATION	31.878	115718.781	62.07
RECIRCULATION INTO LAYER 2	0.120824	438.590	0.24
DRAINAGE COLLECTED FROM LAYER 4	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 4	0.120824	438.590	0.24
PERC./LEAKAGE THROUGH LAYER 6	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0017		
PERC./LEAKAGE THROUGH LAYER 7	0.015313	55.587	0.03
CHANGE IN WATER STORAGE	13.559	49218.582	26.40
SOIL WATER AT START OF YEAR	1006.684	3654264.500	
SOIL WATER AT END OF YEAR	1020.243	3703483.250	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0003	1.087	0.00

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ANNUAL TOTALS FOR YEAR 17

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.72	169593.562	100.00
RUNOFF	5.023	18232.986	10.75
EVAPOTRANSPIRATION	27.933	101396.664	59.79
RECIRCULATION INTO LAYER 2	0.126766	460.161	0.27
DRAINAGE COLLECTED FROM LAYER 4	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 4	0.126766	460.161	0.27
PERC./LEAKAGE THROUGH LAYER 6	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0018		
PERC./LEAKAGE THROUGH LAYER 7	0.014296	51.895	0.03

CHANGE IN WATER STORAGE	13.750	49913.828	29.43
SOIL WATER AT START OF YEAR	1020.243	3703483.250	
SOIL WATER AT END OF YEAR	1033.994	3753397.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	-0.0005	-1.816	0.00

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ANNUAL TOTALS FOR YEAR 18

	INCHES	CU. FEET	PERCENT
PRECIPITATION	55.53	201573.859	100.00
RUNOFF	6.116	22201.187	11.01
EVAPOTRANSPIRATION	31.578	114629.547	56.87
RECIRCULATION INTO LAYER 2	0.108520	393.928	0.20
DRAINAGE COLLECTED FROM LAYER 4	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 4	0.108520	393.928	0.20
PERC./LEAKAGE THROUGH LAYER 6	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0015		
PERC./LEAKAGE THROUGH LAYER 7	0.013436	48.774	0.02
CHANGE IN WATER STORAGE	17.822	64694.383	32.09
SOIL WATER AT START OF YEAR	1033.994	3753397.000	
SOIL WATER AT END OF YEAR	1051.816	3818091.250	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.038	0.00

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ANNUAL TOTALS FOR YEAR 19

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.12	178305.625	100.00
RUNOFF	4.984	18093.486	10.15
EVAPOTRANSPIRATION	31.699	115067.703	64.53
RECIRCULATION INTO LAYER 2	0.097926	355.470	0.20
DRAINAGE COLLECTED FROM LAYER 4	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 4	0.097926	355.470	0.20
PERC./LEAKAGE THROUGH LAYER 6	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0014		
PERC./LEAKAGE THROUGH LAYER 7	0.012672	45.999	0.03
CHANGE IN WATER STORAGE	12.424	45098.055	25.29
SOIL WATER AT START OF YEAR	1051.816	3818091.250	
SOIL WATER AT END OF YEAR	1064.240	3863189.500	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0001	0.385	0.00

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ANNUAL TOTALS FOR YEAR 20

	INCHES	CU. FEET	PERCENT
PRECIPITATION	45.76	166108.766	100.00
RUNOFF	4.049	14696.144	8.85
EVAPOTRANSPIRATION	33.852	122883.820	73.98
RECIRCULATION INTO LAYER 2	0.117415	426.216	0.26
DRAINAGE COLLECTED FROM LAYER 4	0.0000	0.000	0.00

RECIRCULATION FROM LAYER 4	0.117415	426.216	0.26
PERC./LEAKAGE THROUGH LAYER 6	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0016		
PERC./LEAKAGE THROUGH LAYER 7	0.012020	43.631	0.03
CHANGE IN WATER STORAGE	7.847	28485.219	17.15
SOIL WATER AT START OF YEAR	1064.240	3863189.500	
SOIL WATER AT END OF YEAR	1072.087	3891674.500	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.045	0.00

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ANNUAL TOTALS FOR YEAR 21

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.48	186872.375	100.00
RUNOFF	6.170	22398.781	11.99
EVAPOTRANSPIRATION	29.866	108413.008	58.01
RECIRCULATION INTO LAYER 2	0.326752	1186.109	0.63
DRAINAGE COLLECTED FROM LAYER 4	0.0000	0.000	0.00
RECIRCULATION FROM LAYER 4	0.326752	1186.109	0.63
PERC./LEAKAGE THROUGH LAYER 6	0.000003	0.010	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0045		
PERC./LEAKAGE THROUGH LAYER 7	0.011370	41.274	0.02
CHANGE IN WATER STORAGE	15.431	56015.082	29.98
SOIL WATER AT START OF YEAR	1072.087	3891674.500	
SOIL WATER AT END OF YEAR	1087.518	3947689.750	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00

SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0012	4.223	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 21

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	3.35	3.73	4.48	3.91	4.72	4.86
	4.03	4.77	3.31	2.80	3.41	3.71
STD. DEVIATIONS	1.52	1.73	2.40	2.02	1.47	1.91
	1.53	2.50	1.95	1.46	2.12	1.90
RUNOFF						
TOTALS	0.424	0.466	0.537	0.329	0.498	0.454
	0.294	0.570	0.346	0.263	0.479	0.354
STD. DEVIATIONS	0.372	0.471	0.500	0.233	0.366	0.364
	0.210	0.535	0.379	0.246	0.544	0.270
EVAPOTRANSPIRATION						
TOTALS	1.348	1.571	2.832	3.039	3.683	3.926
	3.433	3.231	2.210	1.880	1.401	1.020
STD. DEVIATIONS	0.308	0.372	0.474	0.994	1.062	1.270
	1.302	1.070	0.914	0.665	0.456	0.199
LATERAL DRAINAGE RECIRCULATED INTO LAYER 2						
TOTALS	0.0525	0.0099	0.0100	0.0090	0.0104	0.0105
	0.0102	0.0096	0.0088	0.0092	0.0160	0.0131
STD. DEVIATIONS	0.1974	0.0096	0.0056	0.0031	0.0030	0.0037
	0.0025	0.0023	0.0024	0.0023	0.0334	0.0145
LATERAL DRAINAGE COLLECTED FROM LAYER 4						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LATERAL DRAINAGE RECIRCULATED FROM LAYER 4

TOTALS	0.0525	0.0099	0.0100	0.0090	0.0104	0.0105
	0.0102	0.0096	0.0088	0.0092	0.0160	0.0131
STD. DEVIATIONS	0.1974	0.0096	0.0056	0.0031	0.0030	0.0037
	0.0025	0.0023	0.0024	0.0023	0.0334	0.0145

PERCOLATION/LEAKAGE THROUGH LAYER 6

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0261	0.0109	0.0087	0.0069	0.0062	0.0054
	0.0051	0.0047	0.0043	0.0042	0.0039	0.0038
STD. DEVIATIONS	0.1022	0.0348	0.0240	0.0166	0.0134	0.0106
	0.0093	0.0080	0.0069	0.0064	0.0056	0.0053

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0086	0.0018	0.0016	0.0015	0.0017	0.0018
	0.0017	0.0016	0.0015	0.0015	0.0027	0.0021
STD. DEVIATIONS	0.0322	0.0017	0.0009	0.0005	0.0005	0.0006
	0.0004	0.0004	0.0004	0.0004	0.0056	0.0024

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 21

	INCHES		CU. FEET	PERCENT
PRECIPITATION	47.07	(5.141)	170850.3	100.00
RUNOFF	5.015	(1.1150)	18203.02	10.654
EVAPOTRANSPIRATION	29.575	(3.0759)	107358.15	62.838
DRAINAGE RECIRCULATED	0.16907	(0.21800)	613.727	0.35922

INTO LAYER 2				
LATERAL DRAINAGE COLLECTED FROM LAYER 4	0.00000	(0.00000)	0.000	0.00000
DRAINAGE RECIRCULATED FROM LAYER 4	0.16907	(0.21800)	613.727	0.35922
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 5	0.002	(0.003)		
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.09007	(0.24048)	326.967	0.19138
CHANGE IN WATER STORAGE	12.386	(3.6306)	44961.95	26.317

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 21

	(INCHES)	(CU. FT.)
PRECIPITATION	3.66	13285.801
RUNOFF	1.224	4441.3711
DRAINAGE RECIRCULATED INTO LAYER 2	0.21249	771.32959
DRAINAGE COLLECTED FROM LAYER 4	0.00000	0.00000
DRAINAGE RECIRCULATED FROM LAYER 4	0.21249	771.32959
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00081
AVERAGE HEAD ON TOP OF LAYER 5	1.076	
MAXIMUM HEAD ON TOP OF LAYER 5	2.111	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	8.6 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.033864	122.92455
SNOW WATER	6.34	23023.9687

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.3980

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1360

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 21

LAYER	(INCHES)	(VOL/VOL)
1	3.3120	0.2760
2	592.2139	0.4486
3	485.2354	0.4493
4	0.9365	0.0390
5	0.0000	0.0000
6	0.1875	0.7500
7	5.6325	0.3129
SNOW WATER	0.000	

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