Jones Edmunds & Associates, Inc.
CONSULTING ENGINEERS AND SCIENTISTS
JEA

October 10, 2000

Mr. Kim B. Ford, P.E.
Florida Department of Environmental Protection
Southwest District
Solid Waste Section
3804 Coconut Palm Drive
Tampa, FL 33619-8318

RE: Citrus County Central Landfill
Class I Landfill Geomembrane Remediation
Permit No. SO09-247381
JEA Project No.: 03860-003-01-1000

Dear Mr. Ford:

The purpose of this correspondence is to present a proposed plan which addresses the stress-cracked areas of geomembrane liner in the Citrus County Central Landfill. The proposed remediation plan is based on an investigation conducted by Dr. Ian D. Peggs, of I-CORP International, Inc. and engineering analysis performed by Jones, Edmunds & Associates, Inc. (JEA).

Dr. Peggs' investigation report, previously-submitted to your office, states that cracks appear in a portion of the apex-down folds and in areas adjacent to a few seams of the currently-exposed liner areas. To estimate the amount of potential leakage resulting from the cracked areas, JEA performed a hydrologic analysis using the HELP Model ("Hydrologic Evaluation of Landfill Performance, Version 3.01," Schroeder, 1994). As a conservative estimate, model conditions assume that a penetrating crack exists in every fold (apex-up and apex-down) and that each crack extends the entire length of the exposed liner slope that is currently exposed. These assumptions are conservative based on Peggs' investigations which revealed only 12 penetrating cracks which did not extend the entire length of slope. HELP model results show the leakage rate to be considerably greater than that expected with typical landfill operations. HELP model results are included as Attachment 1.

Due to potential high leakage rates, application of a soil cover over the exposed areas would not by itself provide an appropriate solution. Repair methods which include welding of the existing geomembrane material (as suggested by the liner manufacturer) were also rejected on Dr. Peggs recommendation that added thermal energy from seaming procedures may aggravate the stress cracking problem. Therefore, it appears that applying new material may be the most viable remediation alternative.

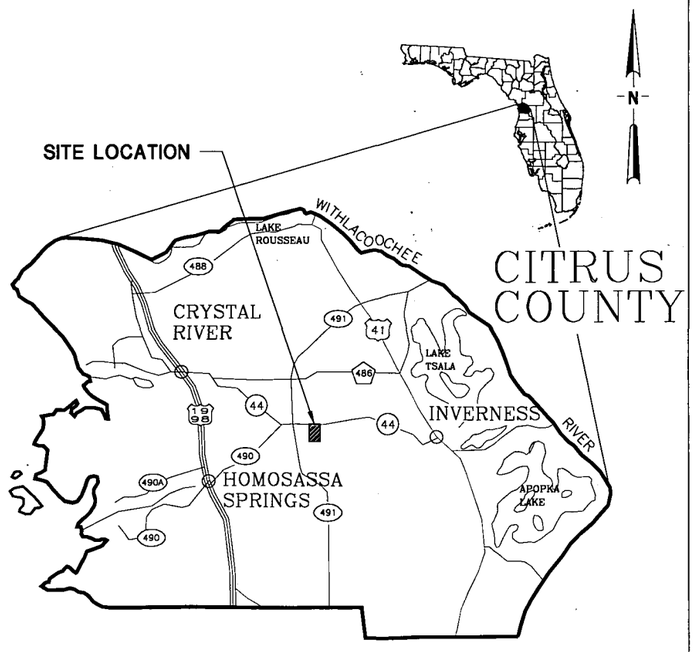
730 NE Waldo Road, Bldg. A • Gainesville, Florida 32641 • Telephone (352) 377-5821 • FAX (352) 377-3166

CITRUS COUNTY CENTRAL LANDFILL

LINER REMEDIATION

PREPARED FOR:

CITRUS COUNTY BOARD OF COUNTY COMMISSIONERS
CITRUS COUNTY, FLORIDA



SITE VICINITY MAP

PREPARED BY:

Jones Edmunds & Associates, Inc. JEA
730 Northeast Waldo Road/Gainesville, Florida 32641 / (352) 377-5821 CONSULTING ENGINEERS AND SCIENTISTS

DRAWING INDEX	
DWG No	DESCRIPTION
1 OF 4	COVER SHEET
2 OF 4	GENERAL NOTES AND ABBREVIATIONS
3 OF 4	LINER REMEDIATION
4 OF 4	LINER REMEDIATION SECTION

DAVID A. KEOUGH
CERTIFICATE
NO. 33
STATE OF
PROFESSIONAL ENGINEER

JEA PROJECT No: 03860-004-01

DECEMBER 2000

GENERAL NOTES

1. ALL ELEVATIONS ARE BASED ON USGS MEAN SEA LEVEL DATUM OF 1929, UNLESS OTHERWISE NOTED.

2. ANY NGVD '29 MONUMENT WITHIN THE LIMITS OF CONSTRUCTION IS TO BE PROTECTED. IF IN DANGER OF DAMAGE, THE CONTRACTOR SHALL NOTIFY:

   MR. RONNIE TAYLOR
   FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
   BUREAU OF SURVEYS AND MAPPING
   3900 COMMONWEALTH BLVD
   MS 105
   TALLAHASSEE, FLORIDA 32399-3000
   TELEPHONE #(904)488-2427

3. LOCATIONS, ELEVATIONS, AND DIMENSIONS OF EXISTING UTILITIES, STRUCTURES, AND OTHER FEATURES ARE SHOWN TO THE BEST INFORMATION AVAILABLE AT THE TIME OF PREPARATION OF THESE PLANS. THE CONTRACTOR SHALL VERIFY, PRIOR TO CONSTRUCTION, THE LOCATIONS, ELEVATIONS, AND DIMENSIONS OF ALL EXISTING UTILITIES, STRUCTURES, AND OTHER FEATURES (WHETHER OR NOT SHOWN ON THE PLANS) AFFECTING THEIR OWN WORK.

4. THE INFORMATION PROVIDED IN THESE PLANS IS SOLELY TO ASSIST THE CONTRACTOR IN ASSESSING THE NATURE AND EXTENT OF THE CONDITIONS WHICH MAY BE ENCOUNTERED DURING THE COURSE OF WORK. ALL CONTRACTORS ARE DIRECTED, PRIOR TO BIDDING, TO CONDUCT WHATEVER INVESTIGATIONS THEY MAY DEEM NECESSARY TO ARRIVE AT THEIR OWN CONCLUSIONS REGARDING THE ACTUAL CONDITIONS THAT WILL BE ENCOUNTERED, AND UPON WHICH THEIR BIDS SHALL BE BASED.

5. THE CONTRACTOR SHALL BE AWARE THAT THERE MAY BE SOME UTILITY CONFLICTS. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO LOCATE AND PROTECT ANY AND ALL EXISTING UTILITIES ON THIS *PROJECT WITHOUT INCREASE IN THE CONTRACT PRICE OR TIME.*

6. FIELD CONDITIONS MAY NECESSITATE SLIGHT ALIGNMENT AND GRADE DEVIATION OF THE PROPOSED CONSTRUCTION TO AVOID OBSTACLES, AS ORDERED BY THE ENGINEER. THE CONTRACTOR SHALL CONSTRUCT THE PROPOSED FACILITIES TO THE ORDERED DEVIATION WITHOUT INCREASE IN THE CONTRACT PRICE OR TIME.

7. THE CONTRACTOR SHALL PROVIDE AT LEAST 48 HOURS NOTICE TO THE VARIOUS UTILITY COMPANIES IN ORDER TO PERMIT THE LOCATION OF EXISTING UNDERGROUND UTILITIES IN ADVANCE OF CONSTRUCTION. CONTACT UTILITIES NOTIFICATION CENTER AT 1-800-432-4770

8. THE CONTRACTOR SHALL REPLACE ALL EXISTING PAVING, STABILIZED EARTH, CURBS, DRIVEWAYS, SIDEWALKS, FENCES, MAILBOXES, GRASSING, SIGNS, AND OTHER IMPROVEMENTS WITH SAME TYPE OF MATERIAL THAT WAS REMOVED DURING CONSTRUCTION OR AS DIRECTED BY THE ENGINEER WITHOUT INCREASE IN THE CONTRACT PRICE OR TIME.

9. THE CONTRACTOR SHALL MAINTAIN A CLEAR PATH FOR ALL SURFACE WATER DRAINAGE STRUCTURES AND DITCHES DURING ALL PHASES OF CONSTRUCTION AND SHALL USE WHATEVER MEANS NECESSARY TO MANAGE STORMWATER SUCH THAT THE IMPACT TO CONSTRUCTION IS MINIMIZED. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIR OF DAMAGE DUE TO STORMWATER.

10. THE CONTRACTOR SHALL PROVIDE WARNING SIGNALS, SIGNS, LIGHTS, BARRICADES, FLAGMEN, ETC. IN ACCORDANCE WITH OSHA, DOT, AND OTHER APPLICABLE REGULATORY REQUIREMENTS AND AS OTHERWISE NECESSARY TO PROVIDE FOR SITE SAFETY DURING CONSTRUCTION.

11. THE CONTRACTOR SHALL NOTIFY THE ENGINEER IMMEDIATELY WHEN CONFLICTS BETWEEN DRAWINGS AND ACTUAL CONDITIONS ARE DISCOVERED.

12. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH EXISTING COUNTY DESIGN AND CONSTRUCTION STANDARDS UNLESS THOSE STANDARDS CONFLICT WITH THESE CONTRACT DOCUMENTS IN WHICH CASE THESE CONTRACT DOCUMENTS SHALL GOVERN. SUCH CONFLICTS SHALL BE BROUGHT TO THE ENGINEER'S ATTENTION IMMEDIATELY.

13. THE CONTRACTOR SHALL PREVENT DISTURBANCE TO AND UNDERMINING OF ADJACENT STRUCTURES, SLABS, PIPING, AND OTHER UTILITIES OR FACILITIES DURING CONSTRUCTION.

14. *THE CONTRACTOR SHALL VERIFY ALL CLEARANCES PRIOR TO* CONSTRUCTION.

15. DEWATERING SHALL BE PROVIDED BY THE CONTRACTOR AS NECESSARY TO INSTALL/CONSTRUCT THE WORK PROPERLY. DEWATERING DISCHARGE SHALL BE IN ACCORDANCE WITH APPLICABLE REGULATIONS AND REQUIREMENTS OF AGENCIES HAVING JURISDICTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS, AS REQUIRED, WITHOUT INCREASE IN PRICE OR TIME.

16. ALL PIPING SHALL BE PROPERLY SUPPORTED. ALL PIPING WHICH WILL BE PRESSURIZED DURING OPERATION SHALL BE PROPERLY RESTRAINED.

17. FACILITIES PROVIDED UNDER THIS PROJECT SHALL BE CLEANED AT THE CLOSE OF CONSTRUCTION IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.

18. CONSTRUCTION MONUMENTS FOR VERTICAL AND HORIZONTAL CONTROL HAVE BEEN PROVIDED AT THE PROJECT SITE. THE CONTRACTOR SHALL VERIFY THE ACCURACY OF THESE MONUMENTS TO THEIR OWN SATISFACTION. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR PROPER VERTICAL AND HORIZONTAL ALIGNMENT OF CONSTRUCTED FACILITIES AND FINISHED GRADE.

19. THE CONTRACTOR SHALL PROVIDE A PROFESSIONAL LAND SURVEYOR REGISTERED IN THE STATE OF FLORIDA TO ESTABLISH THE CONSTRUCTION SITE LAYOUT, PERFORM TOPOGRAPHIC SURVEYS, AND PERFORM ALL OTHER REQUIRED SURVEYING SERVICES.

20. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO BECOME FAMILIAR *WITH THE OSHA EXCAVATION SAFETY STANDARDS AND TO ABIDE BY* THEM AS COVERED UNDER THE FLORIDA TRENCH SAFETY ACT (LAWS OF FLORIDA 90-96) EFFECTIVE OCTOBER 1, 1990.

21. THE CONTRACTOR SHALL COMPLY WITH ALL TERMS, CONDITIONS, AND REQUIREMENTS OF ALL APPLICABLE PERMITS, INCLUDING FDEP AND WATER MANAGEMENT DISTRICT PERMITS FOR THE SITE.

22. THE CONTRACTOR SHALL BE AWARE THAT THE CONSTRUCTION SITE IS ADJACENT AND CONNECTS TO ACTIVE LANDFILL CELLS, AND THAT LANDFILL GAS MAY MIGRATE ONTO THE CONSTRUCTION SITE. THE CONTRACTOR SHALL TAKE WHATEVER MEANS NECESSARY TO PROTECT PERSONNEL AND FACILITIES FROM RELATED HAZARDS, INCLUDING EXPLOSION, ASPHYXIATION, AND POISONING DUE TO THE PRESENCE OF LANDFILL GASES.

23. THE CONTRACTOR SHALL PREVENT DAMAGE TO THE EXISTING GEOMEMBRANE. CONTRACTOR SHALL NOTIFY THE ENGINEER IMMEDIATELY SHOULD DAMAGE OCCUR AND PERFORM REPAIRS AS DIRECTED BY THE ENGINEER WITHOUT INCREASE IN THE CONTRACT PRICE OR TIME.

24. THE CONTRACTOR SHALL NOT INTERFERE WITH FACILITY OPERATIONS. THE CONTRACTOR SHALL COORDINATE WITH AND NOTIFY THE OWNER A MINIMUM OF 48 HOURS IN ADVANCE OF ALL PLANNED UTILITY OUTAGES AND ROAD CROSSINGS.

25. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PREVENTING STORMWATER RUNOFF, SOLID WASTE, LANDFILL GAS, AND LEACHATE FROM ENTERING OR IMPACTING THE AREAS OF THE WORK. THE CONTRACTOR SHALL INSTALL AND MAINTAIN MANAGEMENT AND CONTROL DEVICES INCLUDING DIVERSION/COLLECTION BERMS, DITCHES, PUMPING STATIONS, WALLS, LINERS, ETC. TO COMPLY WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS WITHOUT INCREASE IN THE CONTRACT PRICE OR TIME.

26. THE CONTRACTOR SHALL PROVIDE AND MAINTAIN ENVIRONMENTAL PROTECTION DURING THE LIFE OF THE CONTRACT, INCLUDING THE WARRANTY PERIOD. THE CONTRACTORS' OPERATIONS SHALL COMPLY WITH FEDERAL, STATE, AND LOCAL REGULATIONS, INCLUDING THOSE PERTAINING TO WATER, AIR, SOLID WASTE, HAZARDOUS WASTE MATERIALS, OILY SUBSTANCES, AND NOISE POLLUTION. THE CONTRACTOR SHALL IMPLEMENT EROSION AND SEDIMENTATION CONTROL MEASURES AS NECESSARY TO COMPLY WITH THESE REGULATIONS FOR BOTH TEMPORARY AND PERMANENT CONSTRUCTION.

ABBREVIATIONS

GENERAL

APPROX	APPROXIMATE, APPROXIMATELY
BLDG	BUILDING
BTM	BOTTOM
CB	CATCH BASIN
CM	CONCRETE MONUMENT
CO	COMPANY
CONC	CONCRETE
CONT	CONTINUOUS
CORR	CORRUGATED
DET	DETAIL
DOT	DEPARTMENT OF TRANSPORTATION (FLORIDA)
DI	DUCTILE IRON
DIA	DIAMETER
DIM	DIMENSION
DIP	DUCTILE IRON PIPE
DWG	DRAWING
EA	EACH
ETC	ET CETERA
EI	ENGINEERING INTERN
ENCL	ENCLOSE, ENCLOSURE
EL	ELEVATION
EQUIP	EQUIPMENT
EXIST	EXISTING
F	FEMALE
FDEP	FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
FIN	FINISHED
GALV	GALVANIZED
GR	GRADE
GS	GALVANIZED STEEL
HDPE	HIGH DENSITY POLYETHYLENE
HP	HIGH POINT
ID	INSIDE DIAMETER
IE	INVERT ELEVATION
L	LENGTH
M	MALE
MAX	MAXIMUM
MFR	MANUFACTURER
MH	MANHOLE
MIN	MINIMUM
MISC	MISCELLANEOUS
MSL	(ABOVE) MEAN SEA LEVEL
MT	MOUNT
N/A	NOT APPLICABLE
N/AVAIL	NOT AVAILABLE
NGVD	NATIONAL GEODETIC VERTICAL DATUM
NIC	NOT IN CONTRACT
No	NUMBER
NP	NONPERFORATED
NTS	NOT TO SCALE
OAE	OR ENGINEER APPROVED EQUAL
OC	ON CENTER
OD	OUTSIDE DIAMETER
OSHA	OCCUPATIONAL SAFETY & HEALTH ADMINISTRATION
RLS	PROFESSIONAL LAND SURVEYOR RADIUS
RCP	REINFORCED CONCRETE PIPE
REF	REFERENCE
R/W	RIGHT OF WAY
REQD	REQUIRED
	SLOPE
SCH	SCHEDULE
SDR	STANDARD DIMENSION RATIO
SHT	SHEET
SIM	SIMILAR
SRWMD	SUWANNEE RIVER WATER MANAGEMENT DISTRICT
SS	STAINLESS STEEL
STD	STANDARD
STL	STEEL
	TANGENT
TBM	TURNING BENCH MARK
TYP	TYPICAL
USC&GS	UNITED STATES COASTAL AND GEODETIC SURVEY
USGS	UNITED STATES GEOLOGICAL SURVEY
WGT	WEIGHT
△	DELTA, ANGULAR CHANGE

MECHANICAL

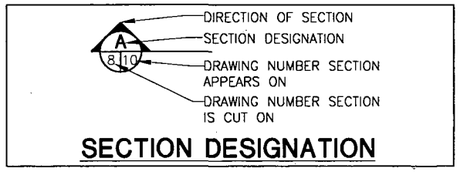
BCCMP	BITUMINOUS COATED CORRUGATED METAL PIPE
BLD	BLIND
BWJ	BUTT-WELDED JOINT
CMP	CORRUGATED METAL PIPE
ELL	ELBOW
FJ	FLANGED JOINT
FLG	FLANGE
LR	LONG RADIUS
NPT	AMER. STD. TAPER PIPE THREAD
PV	PLUG VALVE
PVC	POLYVINYL CHLORIDE
RED	REDUCER
SOF	SLIP-ON FLANGE
WJ	WELDED JOINT

STRUCTURAL

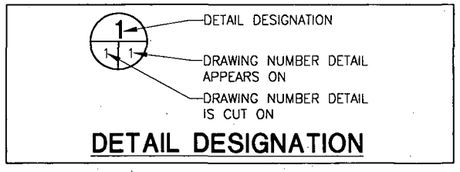
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
B/	BOTTOM OF
℄	CENTERLINE
CM/SEC	CENTIMETERS PER SECOND
CLR	CLEAR
EF	EACH FACE
EQ	EQUAL, EQUALLY
EW	EACH WAY
FT	FOOT, FEET
FTG	FOOTING
HORIZ	HORIZONTAL
LBR	LOAD BEARING RATIO
NOM	NOMINAL
P	PLATE
PSI	POUNDS PER SQUARE INCH
REINF	REINFORCEMENT, REINFORCING
SP	SPACING, SPACED
SQ	SQUARE
T/	TOP OF
VERT	VERTICAL
W	WIRE
W/	WITH
WWF	WELDED WIRE FABRIC
@	AT
ø	DIAMETER
#/IN	POUNDS PER INCH

ELECTRICAL

A	AMPS
C/B	CIRCUIT BREAKER
CAB	CABLE
COMB	COMBINATION
FVNR	FULL VOLTAGE NON-REVERSING
GFI	GROUND FAULT INTERRUPT
GND	GROUND
KVA	KILOVOLT AMP
LEV	LEVEL
NEMA	NATIONAL ELECTRICAL MANUFACTURING ASSOCIATION
P	POLE
PWR	POWER
SW	SWITCH
V	VOLT(S)
WP	WATER PROOF
XFMR	TRANSFORMER
Y	WYE
Z	IMPEDANCE



SECTION DESIGNATION



DETAIL DESIGNATION

01/18/01 14:19 TA je004-02.dwg

LTR.	DATE	REVISIONS	BY	APPRD.

DESIGNED JLD
DRAWN TA
CHECKED DAK
J.L DeVITA, EI
PROJECT ENGINEER

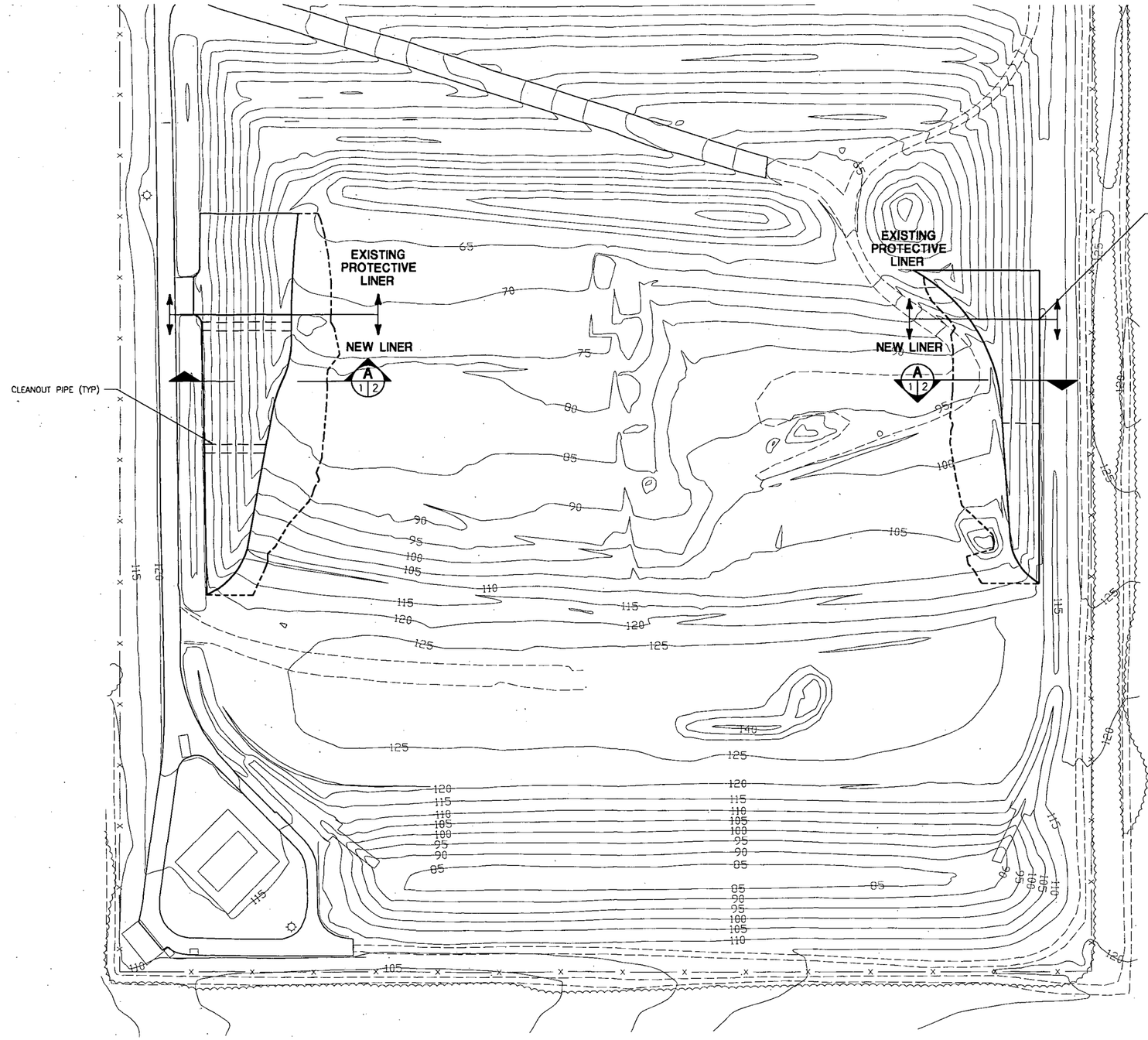
Jones Edmunds & Associates, Inc. JEA CONSULTING ENGINEERS AND SCIENTISTS
730 Northeast Waldo Road/Gainesville, Florida 32641 / (352) 377-5821

CITRUS COUNTY CENTRAL LANDFILL
CITRUS COUNTY, FLORIDA

GENERAL NOTES AND ABBREVIATIONS

APPROVED FOR JEA BY
D. A. KEOUGH
P.E. #33164

DATE: DEC 2000
SCALE: NONE
PROJECT NO.: 03860-004-
DWG. NO.: 2 OF 4



-N-

GRAPHIC SCALE

0 40 80 160

SCALE IN FEET

LEGEND

——— LIMITS OF EXISTING EXPOSED GEOMEMBRANE

- - - - - - - - LIMITS OF SOIL/SOLID WASTE 3H:1V SLOPE

NOTES

1. SURVEY DATA PROVIDED BY PTI, 6/20/00
2. NORTH AND SOUTH EDGES OF NEW LINER SHALL BE EXTRUSION WELDED ALONG ENTIRE SLOPE LENGTH. SEE DETAIL 1 3|4
3. NOTE THAT LOCATION OF EXISTING CLEANOUT PIPES ARE APPROXIMATE. CONTRACTOR SHALL SUBMIT A PLAN FOR ENGINEER APPROVAL DESCRIBING LINER INSTALLATION AND PROTECTION IN CLEANOUT VICINITY.

03/21/01 15:45 PEU je004-03.dwg

LTR.	DATE	REVISIONS	BY	APPRD.

DESIGNED JLD
DRAWN JAW
CHECKED DAK
J. L. DeVITA, EI
PROJECT ENGINEER

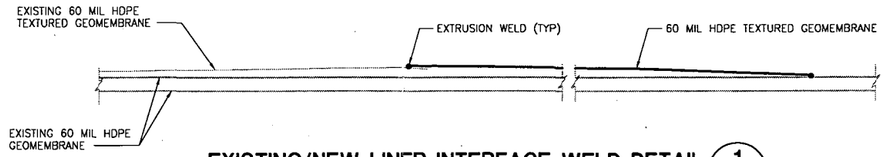
Jones Edmunds & Associates, Inc. JEA CONSULTING ENGINEERS AND SCIENTISTS
730 Northeast Waldo Road/Gainesville, Florida 32641 / (352) 377-5821

CITRUS COUNTY CENTRAL LANDFILL
CITRUS COUNTY, FLORIDA

LINER REMEDIATION

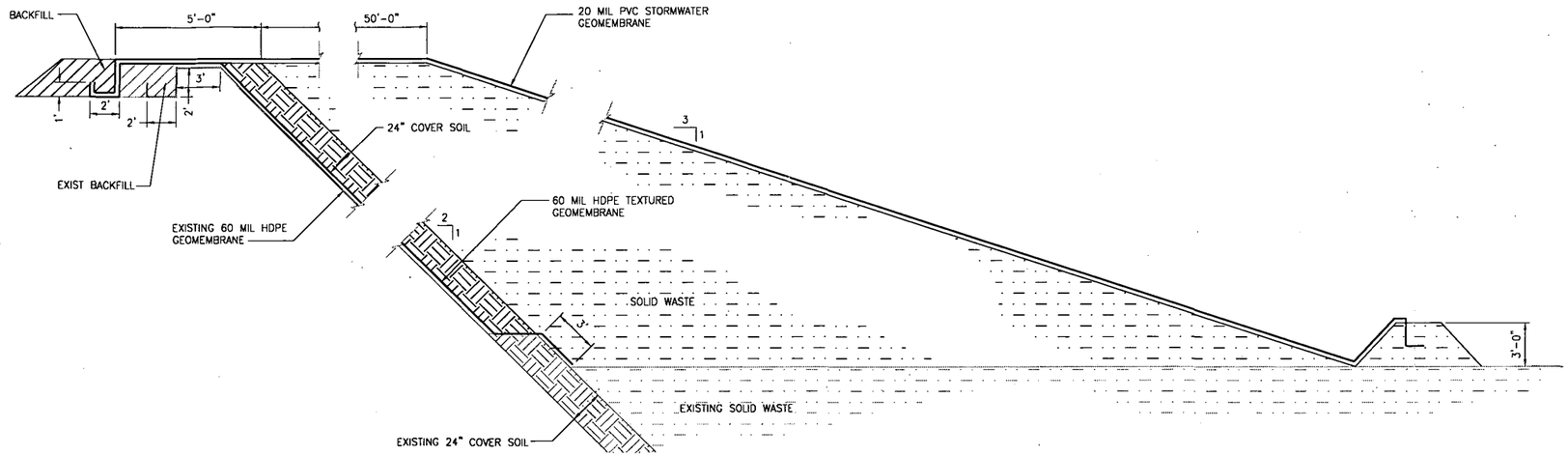
APPROVED FOR JEA BY
D. A. KEOUGH, PE
P.E.# 33164

DATE	PROJECT NO.
DEC 2000	03860-004-01
SCALE	DWG. NO.
1"=80'	3 OF 4



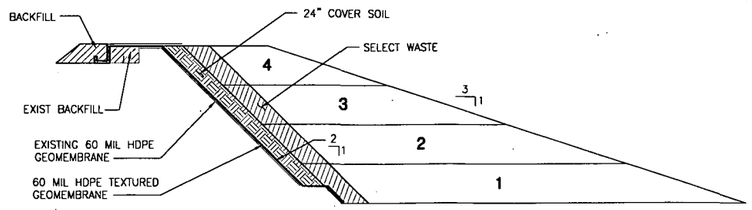
EXISTING/NEW LINER INTERFACE WELD DETAIL 1 | 3 | 4

NTS



TYPICAL SECTION A | 1 | 2

1"=5'



NOTES:

1. UPON COMPLETION OF NEW LINER INSTALLATION, WASTE FILLING OPERATIONS WILL COMMENCE AT TOE OF NEW LINER SLOPE, ALONG ENTIRE NEW LINER EXISTING SOLID WASTE INTERFACE.
2. WASTE FILLING WILL CONTINUE IN 10'-15' LIFTS AS SHOWN IN NEW LINER AREA WASTE FILLING PLAN.
3. ONCE WASTE FILL HAS ACHIEVED A 3:1 SLOPE, THE PROPOSED STORMWATER LINER WILL BE INSTALLED.

NEW LINER AREA WASTE FILLING PLAN

NTS

03/09/01 11:18 PEU je004-04.dwg

LTR.	DATE	REVISIONS	BY	APPRD.

DESIGNED JLD
DRAWN JAW
CHECKED DAK
J. L. DeVITA, EI
PROJECT ENGINEER

Jones Edmunds & Associates, Inc. JEA CONSULTING ENGINEERS AND SCIENTISTS
730 Northeast Waldo Road/Gainesville, Florida 32641 / (352) 377-5821

CITRUS COUNTY CENTRAL LANDFILL
CITRUS COUNTY, FLORIDA

LINER REMEDIATION SECTION

APPROVED FOR JEA BY
D. W. McKEOUGH, PE
P.E.# 33164

DATE: DEC 2000
SCALE: 1"=5'
PROJECT NO.: 03860-004-01
DWG. NO.: 4 OF 4

This alternative consists of using a geomembrane installer to place a new 60-mil HDPE geomembrane in the presently exposed liner areas, as shown in Drawing 1 (attached). Slope stability analyses to compare the factor of safety resulting from different geomembrane materials on the existing 2H:1V slope of smooth geomembrane have been performed. Results, provided as Attachment 2, show that a textured geomembrane liner would reduce the potential for material sloughing and slope failures when compared with a similar smooth geomembrane. Therefore, it is our recommendation that the proposed geomembrane consists of a 60-mil, HDPE, textured geomembrane. Please note that the proposed new material is composed of a different resin than that which was used for the original geomembrane material. As Dr. Peggs concluded in his investigative report, stress cracks were initiated due to the inadequacy of the antioxidant package incorporated into the geomembrane material. The proposed new geomembrane materials will contain a resin with improved oxidation resistance.

In addition, once a layer of solid waste is placed along the side slope, installation of a stormwater geomembrane is proposed. The stormwater geomembrane will provide erosion control and better leachate management.

We will advise the Department once arrangements for installation of the new liner are confirmed. It is anticipated that the time frame to fill the newly lined areas with solid waste to the level that will allow placement of the new stormwater liner and rain gutter will be between four and five months.

If you have any questions, please call me at 352/377-5821.

Sincerely,

David A. Keough, P.E.
Project Manager

H:\JMcGregor\DKeough\03860\012.wpd

Attachments

XC: Susan Metcalfe, Citrus County

ATTACHMENT 1

HELP MODEL RESULTS AND SUPPORTING INFORMATION

Citrus County Central Landfill
Geomembrane Liner Investigation

Comparison of HELP Model Results

Model Condtion	# holes/acre	Peak Leakage Rate (in/day)	Peak Leakage Rate (ft^3/day)
Conservative	953	0.157	5,697
Moderate	275	0.120	4,349
Standard	2	0.001	46

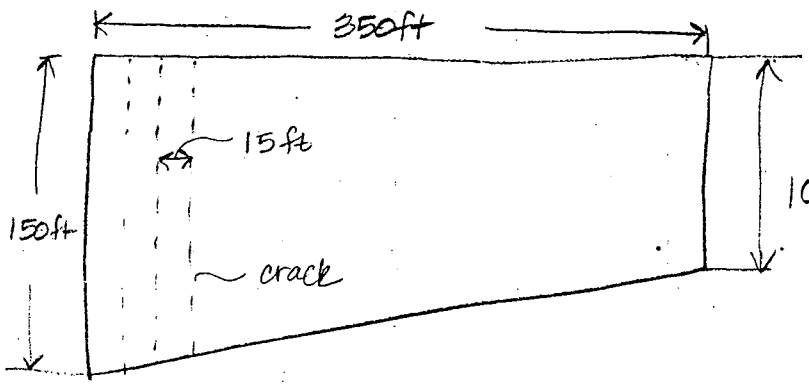
Notes:
1 - Area of each hole = 1 cm^2
2 - See attached calculations for number of holes for conservative & moderate cases.
3 - Number of holes for standard case based on industry standard for installed liner.

Jones Edmunds & Associates, Inc. JEA
CONSULTING ENGINEERS AND SCIENTISTS
Destin • Gainesville • Jacksonville • Tampa

PROJECT NUMBER: _____ SHEET 1 OF 1
PROJECT NAME: CITRUS CO - LINER REMED
BY: JLD DATE: 9/13/00
SUBJECT: LINER "CRACKS"
CHECKED BY: _____ DATE: _____

PROBLEM: RELATE OPEN AREAS OF LINER CRACKS TO STANDARD HOLE AREA

ASSUMPTIONS: STANDARD LINER HOLE AREA = 1 cm^2
HORIZONTAL DISTANCE B/T CRACKS = 15 ft
AVG VERTICAL LENGTH OF CRACK = 125 ft
WIDTH OF CRACK = 0.01 cm



TOTAL NUMBER OF CRACKS = $\frac{350\text{ ft}}{15\text{ ft}} = 23.3 \Rightarrow \underline{25}$

OPEN AREA OF 1 CRACK = $(125\text{ ft})/0.01\text{ cm})\left(\frac{30.48\text{ cm}}{1\text{ ft}}\right)$

$= 38.1\ cm^2$

TOTAL OPEN AREA = $25(38.1\ cm^2) = 952.5\ cm^2$

21 cm²/ac

0.09 acre

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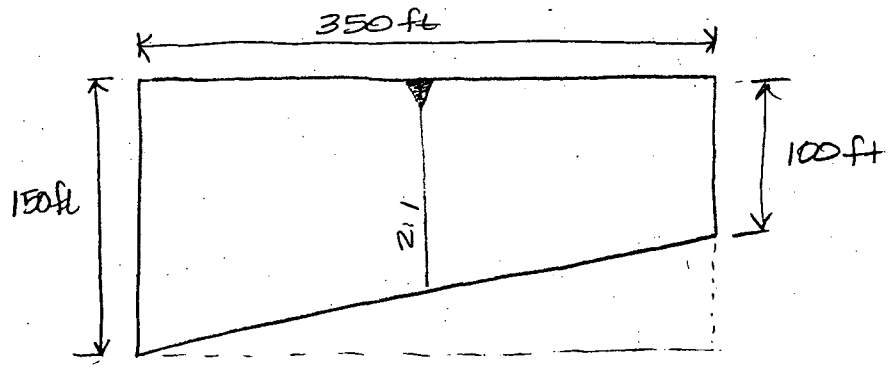
PROJECT NUMBER: _____ SHEET 1 OF 1
PROJECT NAME: CITRUS CO. LINER INVEST
BY: JLD DATE: 9-13-00
SUBJECT: LINER REMEDIATION AREA
CHECKED BY: _____ DATE: _____

PROBLEM: ESTIMATE LINER REMEDIATION AREA



AREA = (150 ft)(350 ft) - (0.5)(50 ft)(150 ft)

AREA = 43,750 ft^2 ≅ 1 ac.

→ SAME REMEDIATION AREA ON OPPOSITE SIDE OF LANDFILL

⇒ AREA = 2 (43,750 ft^2)

AREA = 87,500 ft^2 ≅ 90,000 ft^2

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PROJECT NUMBER: _____ SHEET ____ OF ____
PROJECT NAME: CITRUS CO LINER INVEST.
BY: JLD DATE: 10-4-00
SUBJECT: LINER "CRACKS"
CHECKED BY: _____ DATE: _____

PROBLEM: ESTIMATE LINER OPENINGS BASED ON IAN PEGGS' INVESTIGATION REPORT & RELATE TO STANDARD HOLES IN LINER

REPORT INFO: (PEGGS, 7/00) NUMBER OF FULLY PENETRATING CRACKS = 12

ASSUMPTIONS: AVG VERTICAL LENGTH OF CRACK = 75 ft
WIDTH OF CRACK = 0.01 cm
STANDARD LINER HOLE AREA = 1 cm^2

1.) CALCULATE TOTAL AREA OF LINER OPENINGS (CRACKS)

$$A_T = N W L$$

A_T = TOTAL AREA OF LINER OPENINGS
N = NUMBER OF CRACKS
W = WIDTH OF EACH CRACK
L = LENGTH OF EACH CRACK

$$A_T = (12)(0.01 cm)(75 ft)\left(\frac{30.5 cm}{ft}\right)$$

$$A_T = 274.5 cm^2$$

2) RELATE A_T TO NUMBER OF STANDARD HOLES. (N_H)

$$N_H = \frac{274.5 cm^2}{1 cm^2} \simeq \underline{\underline{275}}$$

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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:\HELP3\CITRUS4.D4
TEMPERATURE DATA FILE:       C:\HELP3\CITRUS7.D7
SOLAR RADIATION DATA FILE:   C:\HELP3\CITRUS13.D13
EVAPOTRANSPIRATION DATA:     C:\HELP3\CITRUS11.D11
SOIL AND DESIGN DATA FILE:   C:\HELP3\950DEF.D10
OUTPUT DATA FILE:            C:\HELP3\950def.OUT

TIME:  16:58     DATE:   9/29/2000

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     TITLE:  Citrus County Liner - Solid Waste Fill -Average Slope Length
                    CONSERVATIVE CASE
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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   5
          THICKNESS                     =      6.00   INCHES
          POROSITY                      =    0.4570 VOL/VOL
          FIELD CAPACITY                =    0.1310 VOL/VOL
          WILTING POINT                 =    0.0580 VOL/VOL
          INITIAL SOIL WATER CONTENT    =    0.1084 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.100000005000E-02 CM/SEC
        NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
               FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	840.00	INCHES
POROSITY	=	0.6710	VOL/VOL
FIELD CAPACITY	=	0.2920	VOL/VOL
WILTING POINT	=	0.0770	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2896	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 2

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4370	VOL/VOL
FIELD CAPACITY	=	0.0620	VOL/VOL
WILTING POINT	=	0.0240	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0786	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.579999993000E-02	CM/SEC
SLOPE	=	50.00	PERCENT
DRAINAGE LENGTH	=	134.0	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	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	950.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	4 - POOR	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	50.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	10.000	ACRES
EVAPORATIVE ZONE DEPTH	=	22.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.335	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	13.478	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.580	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	245.829	INCHES
TOTAL INITIAL WATER	=	245.829	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
TAMPA FLORIDA

STATION LATITUDE	=	27.58	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	0	
END OF GROWING SEASON (JULIAN DATE)	=	367	
EVAPORATIVE ZONE DEPTH	=	22.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	8.60	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	72.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	78.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00	%

NOTE: PRECIPITATION DATA FOR TAMPA FLORIDA
WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR TAMPA FLORIDA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
59.80	60.80	66.20	71.60	77.10	80.90
82.20	82.20	80.90	74.50	66.70	61.30

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR TAMPA FLORIDA
AND STATION LATITUDE = 27.58 DEGREES

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ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT
PRECIPITATION	33.90	1230569.870	100.00
RUNOFF	0.207	7499.246	0.61
EVAPOTRANSPIRATION	29.074	1055369.870	85.76
DRAINAGE COLLECTED FROM LAYER 3	0.1855	6735.255	0.55
PERC./LEAKAGE THROUGH LAYER 4	4.290434	155742.766	12.66
AVG. HEAD ON TOP OF LAYER 4	0.0052		
CHANGE IN WATER STORAGE	0.144	5223.775	0.42
SOIL WATER AT START OF YEAR	246.573	8950607.000	
SOIL WATER AT END OF YEAR	246.717	8955831.000	
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	-0.969	0.00

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ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT
PRECIPITATION	43.44	1576871.500	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	40.143	1457192.870	92.41
DRAINAGE COLLECTED FROM LAYER 3	0.1334	4843.349	0.31
PERC./LEAKAGE THROUGH LAYER 4	3.165879	114921.414	7.29
AVG. HEAD ON TOP OF LAYER 4	0.0039		

CHANGE IN WATER STORAGE	-0.002	-85.854	-0.01
SOIL WATER AT START OF YEAR	246.717	8955831.000	
SOIL WATER AT END OF YEAR	246.715	8955745.000	
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	-0.268	0.00

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ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	41.73	1514799.120	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	42.911	1557683.620	102.83
DRAINAGE COLLECTED FROM LAYER 3	0.0096	348.717	0.02
PERC./LEAKAGE THROUGH LAYER 4	0.501326	18198.117	1.20
AVG. HEAD ON TOP OF LAYER 4	0.0005		
CHANGE IN WATER STORAGE	-1.692	-61431.836	-4.06
SOIL WATER AT START OF YEAR	246.715	8955745.000	
SOIL WATER AT END OF YEAR	245.022	8894313.000	
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	0.446	0.00

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ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT

PRECIPITATION	32.03	1162689.250	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	29.255	1061961.750	91.34
DRAINAGE COLLECTED FROM LAYER 3	0.0020	74.084	0.01
PERC./LEAKAGE THROUGH LAYER 4	0.146270	5309.605	0.46
AVG. HEAD ON TOP OF LAYER 4	0.0001		
CHANGE IN WATER STORAGE	2.627	95344.000	8.20
SOIL WATER AT START OF YEAR	245.022	8894313.000	
SOIL WATER AT END OF YEAR	247.649	8989657.000	
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	-0.186	0.00

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ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.85	1446554.750	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	37.746	1370187.870	94.72
DRAINAGE COLLECTED FROM LAYER 3	0.1117	4053.679	0.28
PERC./LEAKAGE THROUGH LAYER 4	2.862452	103906.992	7.18
AVG. HEAD ON TOP OF LAYER 4	0.0033		
CHANGE IN WATER STORAGE	-0.870	-31593.562	-2.18
SOIL WATER AT START OF YEAR	247.649	8989657.000	
SOIL WATER AT END OF YEAR	246.779	8958064.000	
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	-0.216	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1974 THROUGH 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.46	2.16	1.65	0.98	3.41	6.80
	5.24	5.54	5.78	2.07	0.76	2.34
STD. DEVIATIONS	1.35	1.88	0.75	0.53	3.13	4.89
	1.27	1.10	3.22	2.05	0.89	1.10
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.041
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.092
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.279	2.558	2.197	1.336	2.598	4.652
	6.340	5.326	4.822	2.295	1.313	1.111
STD. DEVIATIONS	0.702	0.680	1.372	0.516	2.090	2.362
	0.986	0.746	0.820	1.963	0.848	0.318
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	0.0006	0.0052	0.0153	0.0017	0.0006	0.0004
	0.0133	0.0222	0.0016	0.0064	0.0199	0.0013
STD. DEVIATIONS	0.0007	0.0105	0.0333	0.0031	0.0009	0.0004
	0.0290	0.0489	0.0022	0.0125	0.0435	0.0020
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0340	0.1411	0.3555	0.0726	0.0327	0.0222
	0.2969	0.4946	0.0667	0.1641	0.4538	0.0589
STD. DEVIATIONS	0.0289	0.2548	0.7403	0.1194	0.0357	0.0183
	0.6172	1.0618	0.0855	0.2761	0.9534	0.0835

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.0004	0.0020	0.0052	0.0007	0.0004	0.0003
	0.0045	0.0074	0.0007	0.0023	0.0069	0.0006
STD. DEVIATIONS	0.0003	0.0038	0.0109	0.0011	0.0004	0.0002
	0.0095	0.0160	0.0009	0.0041	0.0147	0.0007

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1974 THROUGH 1978

	INCHES		CU. FEET	PERCENT
PRECIPITATION	38.19	(4.980)	1386296.7	100.00
RUNOFF	0.041	(0.0924)	1499.85	0.108
EVAPOTRANSPIRATION	35.826	(6.3502)	1300479.25	93.810
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.08846	(0.08011)	3211.017	0.23163
PERCOLATION/LEAKAGE THROUGH LAYER 4	2.19327	(1.79198)	79615.781	5.74305
AVERAGE HEAD ON TOP OF LAYER 4	0.003	(0.002)		
CHANGE IN WATER STORAGE	0.041	(1.6227)	1491.30	0.108

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PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)
PRECIPITATION	5.47	198561.000
RUNOFF	0.207	7499.2456
DRAINAGE COLLECTED FROM LAYER 3	0.00858	311.27985
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.156935	5696.75439
AVERAGE HEAD ON TOP OF LAYER 4	0.087	
MAXIMUM HEAD ON TOP OF LAYER 4	0.182	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4762
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0718

*** 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 1978

LAYER	(INCHES)	(VOL/VOL)
1	1.2132	0.2022
2	243.0350	0.2893
3	1.7864	0.0744
4	0.0000	0.0000
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:\HELP3\CITRUS4.D4
TEMPERATURE DATA FILE:       C:\HELP3\CITRUS7.D7
SOLAR RADIATION DATA FILE:   C:\HELP3\CITRUS13.D13
EVAPOTRANSPIRATION DATA:     C:\HELP3\CITRUS11.D11
SOIL AND DESIGN DATA FILE:   C:\HELP3\275DEF.D10
OUTPUT DATA FILE:            C:\HELP3\275def.OUT

TIME:  13:14     DATE:  10/ 4/2000

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     TITLE:  Citrus County Liner - Solid Waste Fill -Average Slope Length
                    MODERATE CASE
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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   5
          THICKNESS                    =      6.00   INCHES
          POROSITY                     =      0.4570 VOL/VOL
          FIELD CAPACITY               =      0.1310 VOL/VOL
          WILTING POINT                =      0.0580 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.1084 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC
        NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
                 FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	840.00	INCHES
POROSITY	=	0.6710	VOL/VOL
FIELD CAPACITY	=	0.2920	VOL/VOL
WILTING POINT	=	0.0770	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2896	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 2

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4370	VOL/VOL
FIELD CAPACITY	=	0.0620	VOL/VOL
WILTING POINT	=	0.0240	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0786	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.579999993000E-02	CM/SEC
SLOPE	=	50.00	PERCENT
DRAINAGE LENGTH	=	134.0	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	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	275.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	4 - POOR	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	50.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	10.000	ACRES
EVAPORATIVE ZONE DEPTH	=	22.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.335	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	13.478	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.580	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	245.829	INCHES
TOTAL INITIAL WATER	=	245.829	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
TAMPA FLORIDA

STATION LATITUDE	=	27.58	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	0	
END OF GROWING SEASON (JULIAN DATE)	=	367	
EVAPORATIVE ZONE DEPTH	=	22.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	8.60	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	72.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	78.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00	%

NOTE: PRECIPITATION DATA FOR TAMPA FLORIDA
WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR TAMPA FLORIDA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
59.80	60.80	66.20	71.60	77.10	80.90
82.20	82.20	80.90	74.50	66.70	61.30

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR TAMPA FLORIDA
AND STATION LATITUDE = 27.58 DEGREES

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ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT
PRECIPITATION	33.90	1230569.870	100.00
RUNOFF	0.207	7499.246	0.61
EVAPOTRANSPIRATION	29.074	1055369.870	85.76
DRAINAGE COLLECTED FROM LAYER 3	0.7595	27571.320	2.24
PERC./LEAKAGE THROUGH LAYER 4	3.716438	134906.703	10.96
AVG. HEAD ON TOP OF LAYER 4	0.0208		
CHANGE IN WATER STORAGE	0.144	5223.775	0.42
SOIL WATER AT START OF YEAR	246.573	8950615.000	
SOIL WATER AT END OF YEAR	246.717	8955839.000	
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	-0.969	0.00

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ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT
PRECIPITATION	43.44	1576871.500	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	40.143	1457192.870	92.41
DRAINAGE COLLECTED FROM LAYER 3	0.5483	19904.799	1.26
PERC./LEAKAGE THROUGH LAYER 4	2.751010	99861.664	6.33
AVG. HEAD ON TOP OF LAYER 4	0.0154		

CHANGE IN WATER STORAGE	-0.002	-87.515	-0.01
SOIL WATER AT START OF YEAR	246.717	8955839.000	
SOIL WATER AT END OF YEAR	246.715	8955751.000	
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	-0.303	0.00

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ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	41.73	1514799.120	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	42.911	1557683.620	102.83
DRAINAGE COLLECTED FROM LAYER 3	0.0313	1137.900	0.08
PERC./LEAKAGE THROUGH LAYER 4	0.479595	17409.293	1.15
AVG. HEAD ON TOP OF LAYER 4	0.0009		
CHANGE IN WATER STORAGE	-1.692	-61432.387	-4.06
SOIL WATER AT START OF YEAR	246.715	8955751.000	
SOIL WATER AT END OF YEAR	245.023	8894319.000	
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	0.642	0.00

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ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT

PRECIPITATION	32.03	1162689.250	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	29.255	1061961.750	91.34
DRAINAGE COLLECTED FROM LAYER 3	0.0062	223.414	0.02
PERC./LEAKAGE THROUGH LAYER 4	0.142343	5167.036	0.44
AVG. HEAD ON TOP OF LAYER 4	0.0002		
CHANGE IN WATER STORAGE	2.626	95337.906	8.20
SOIL WATER AT START OF YEAR	245.023	8894319.000	
SOIL WATER AT END OF YEAR	247.649	8989657.000	
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	-0.853	0.00

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ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.85	1446554.750	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	37.746	1370187.870	94.72
DRAINAGE COLLECTED FROM LAYER 3	0.4559	16549.777	1.14
PERC./LEAKAGE THROUGH LAYER 4	2.518106	91407.266	6.32
AVG. HEAD ON TOP OF LAYER 4	0.0128		
CHANGE IN WATER STORAGE	-0.870	-31590.238	-2.18
SOIL WATER AT START OF YEAR	247.649	8989657.000	
SOIL WATER AT END OF YEAR	246.779	8958066.000	
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	0.095	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1974 THROUGH 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.46	2.16	1.65	0.98	3.41	6.80
	5.24	5.54	5.78	2.07	0.76	2.34
STD. DEVIATIONS	1.35	1.88	0.75	0.53	3.13	4.89
	1.27	1.10	3.22	2.05	0.89	1.10
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.041
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.092
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.279	2.558	2.197	1.336	2.598	4.652
	6.340	5.326	4.822	2.295	1.313	1.111
STD. DEVIATIONS	0.702	0.680	1.372	0.516	2.090	2.362
	0.986	0.746	0.820	1.963	0.848	0.318
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	0.0021	0.0209	0.0624	0.0072	0.0021	0.0012
	0.0525	0.0935	0.0058	0.0237	0.0840	0.0050
STD. DEVIATIONS	0.0023	0.0433	0.1367	0.0141	0.0029	0.0013
	0.1150	0.2068	0.0088	0.0470	0.1842	0.0087
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0326	0.1243	0.3074	0.0693	0.0313	0.0214
	0.2465	0.4332	0.0634	0.1359	0.4001	0.0562
STD. DEVIATIONS	0.0274	0.2195	0.6345	0.1133	0.0337	0.0174
	0.5062	0.9268	0.0807	0.2170	0.8354	0.0790

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.0007	0.0076	0.0205	0.0025	0.0007	0.0004
	0.0173	0.0307	0.0020	0.0078	0.0285	0.0016
STD. DEVIATIONS	0.0007	0.0157	0.0449	0.0048	0.0010	0.0004
	0.0378	0.0680	0.0030	0.0155	0.0626	0.0028

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1974 THROUGH 1978

	INCHES		CU. FEET	PERCENT
PRECIPITATION	38.19	(4.980)	1386296.7	100.00
RUNOFF	0.041	(0.0924)	1499.85	0.108
EVAPOTRANSPIRATION	35.826	(6.3502)	1300479.25	93.810
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.36026	(0.33073)	13077.442	0.94334
PERCOLATION/LEAKAGE THROUGH LAYER 4	1.92150	(1.54194)	69750.398	5.03142
AVERAGE HEAD ON TOP OF LAYER 4	0.010	(0.009)		
CHANGE IN WATER STORAGE	0.041	(1.6226)	1490.31	0.108

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PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)
PRECIPITATION	5.47	198561.000
RUNOFF	0.207	7499.2456
DRAINAGE COLLECTED FROM LAYER 3	0.03046	1105.72412
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.119820	4349.44824
AVERAGE HEAD ON TOP OF LAYER 4	0.310	
MAXIMUM HEAD ON TOP OF LAYER 4	0.625	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4762
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0718

*** 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 1978

LAYER	(INCHES)	(VOL/VOL)
1	1.2132	0.2022
2	243.0350	0.2893
3	1.7865	0.0744
4	0.0000	0.0000
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       **
**                                                                  **
**                                                                  **
**********************************************************************
**********************************************************************

PRECIPITATION DATA FILE:     C:\HELP3\CITRUS4.D4
TEMPERATURE DATA FILE:       C:\HELP3\CITRUS7.D7
SOLAR RADIATION DATA FILE:   C:\HELP3\CITRUS13.D13
EVAPOTRANSPIRATION DATA:     C:\HELP3\CITRUS11.D11
SOIL AND DESIGN DATA FILE:   C:\HELP3\2DEF.D10
OUTPUT DATA FILE:            C:\HELP3\2def.OUT

TIME:  14:16     DATE:  10/ 4/2000

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

     TITLE:  Citrus County Liner - Solid Waste Fill -Average Slope Length
                          STANDARD CASE
**********************************************************************

     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   5
          THICKNESS                    =      6.00   INCHES
          POROSITY                     =      0.4570 VOL/VOL
          FIELD CAPACITY               =      0.1310 VOL/VOL
          WILTING POINT                =      0.0580 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.1084 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC
       NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
              FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	840.00	INCHES
POROSITY	=	0.6710	VOL/VOL
FIELD CAPACITY	=	0.2920	VOL/VOL
WILTING POINT	=	0.0770	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2896	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 2

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4370	VOL/VOL
FIELD CAPACITY	=	0.0620	VOL/VOL
WILTING POINT	=	0.0240	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0788	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.579999993000E-02	CM/SEC
SLOPE	=	50.00	PERCENT
DRAINAGE LENGTH	=	134.0	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	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	50.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	10.000	ACRES
EVAPORATIVE ZONE DEPTH	=	22.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.335	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	13.478	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.580	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	245.833	INCHES
TOTAL INITIAL WATER	=	245.833	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
TAMPA FLORIDA

STATION LATITUDE	=	27.58	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	0	
END OF GROWING SEASON (JULIAN DATE)	=	367	
EVAPORATIVE ZONE DEPTH	=	22.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	8.60	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	72.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	78.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00	%

NOTE: PRECIPITATION DATA FOR TAMPA FLORIDA
WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR TAMPA FLORIDA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
59.80	60.80	66.20	71.60	77.10	80.90
82.20	82.20	80.90	74.50	66.70	61.30

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR TAMPA FLORIDA
AND STATION LATITUDE = 27.58 DEGREES

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ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT
PRECIPITATION	33.90	1230569.870	100.00
RUNOFF	0.207	7499.246	0.61
EVAPOTRANSPIRATION	29.074	1055369.870	85.76
DRAINAGE COLLECTED FROM LAYER 3	4.4173	160347.875	13.03
PERC./LEAKAGE THROUGH LAYER 4	0.058687	2130.330	0.17
AVG. HEAD ON TOP OF LAYER 4	0.1214		
CHANGE IN WATER STORAGE	0.144	5223.221	0.42
SOIL WATER AT START OF YEAR	246.577	8950754.000	
SOIL WATER AT END OF YEAR	246.721	8955977.000	
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	-0.595	0.00

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ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT
PRECIPITATION	43.44	1576871.500	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	40.143	1457192.870	92.41
DRAINAGE COLLECTED FROM LAYER 3	3.2443	117769.867	7.47
PERC./LEAKAGE THROUGH LAYER 4	0.044475	1614.427	0.10
AVG. HEAD ON TOP OF LAYER 4	0.0912		

CHANGE IN WATER STORAGE	0.008	294.672	0.02
SOIL WATER AT START OF YEAR	246.721	8955977.000	
SOIL WATER AT END OF YEAR	246.729	8956272.000	
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	-0.328	0.00

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ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	41.73	1514799.120	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	42.911	1557683.620	102.83
DRAINAGE COLLECTED FROM LAYER 3	0.5071	18408.816	1.22
PERC./LEAKAGE THROUGH LAYER 4	0.015154	550.074	0.04
AVG. HEAD ON TOP OF LAYER 4	0.0141		
CHANGE IN WATER STORAGE	-1.704	-61843.930	-4.08
SOIL WATER AT START OF YEAR	246.729	8956272.000	
SOIL WATER AT END OF YEAR	245.026	8894428.000	
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	0.488	0.00

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ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT

PRECIPITATION	32.03	1162689.250	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	29.255	1061961.750	91.34
DRAINAGE COLLECTED FROM LAYER 3	0.1448	5256.613	0.45
PERC./LEAKAGE THROUGH LAYER 4	0.005907	214.414	0.02
AVG. HEAD ON TOP OF LAYER 4	0.0041		
CHANGE IN WATER STORAGE	2.624	95257.039	8.19
SOIL WATER AT START OF YEAR	245.026	8894428.000	
SOIL WATER AT END OF YEAR	247.650	8989685.000	
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	-0.562	0.00

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ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.85	1446554.750	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	37.746	1370187.870	94.72
DRAINAGE COLLECTED FROM LAYER 3	2.9288	106314.523	7.35
PERC./LEAKAGE THROUGH LAYER 4	0.044412	1612.156	0.11
AVG. HEAD ON TOP OF LAYER 4	0.0823		
CHANGE IN WATER STORAGE	-0.869	-31559.775	-2.18
SOIL WATER AT START OF YEAR	247.650	8989685.000	
SOIL WATER AT END OF YEAR	246.780	8958125.000	
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	-0.013	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1974 THROUGH 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.46	2.16	1.65	0.98	3.41	6.80
	5.24	5.54	5.78	2.07	0.76	2.34
STD. DEVIATIONS	1.35	1.88	0.75	0.53	3.13	4.89
	1.27	1.10	3.22	2.05	0.89	1.10
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.041
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.092
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.279	2.558	2.197	1.336	2.598	4.652
	6.340	5.326	4.822	2.295	1.313	1.111
STD. DEVIATIONS	0.702	0.680	1.372	0.516	2.090	2.362
	0.986	0.746	0.820	1.963	0.848	0.318
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	0.0354	0.1263	0.3451	0.1091	0.0344	0.0227
	0.2338	0.5627	0.0833	0.1110	0.5099	0.0747
STD. DEVIATIONS	0.0316	0.2210	0.7165	0.2009	0.0398	0.0195
	0.4767	1.2174	0.1217	0.1539	1.0770	0.1181
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0011	0.0022	0.0047	0.0021	0.0010	0.0008
	0.0032	0.0068	0.0018	0.0021	0.0064	0.0017
STD. DEVIATIONS	0.0007	0.0028	0.0086	0.0031	0.0009	0.0005
	0.0054	0.0136	0.0022	0.0020	0.0122	0.0021

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.0116	0.0458	0.1134	0.0371	0.0113	0.0077
	0.0768	0.1849	0.0283	0.0365	0.1731	0.0245
STD. DEVIATIONS	0.0104	0.0805	0.2355	0.0682	0.0131	0.0066
	0.1567	0.4001	0.0413	0.0506	0.3658	0.0388

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1974 THROUGH 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.19 (4.980)	1386296.7	100.00
RUNOFF	0.041 (0.0924)	1499.85	0.108
EVAPOTRANSPIRATION	35.826 (6.3502)	1300479.25	93.810
LATERAL DRAINAGE COLLECTED FROM LAYER 3	2.24847 (1.84500)	81619.539	5.88760
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.03373 (0.02220)	1224.280	0.08831
AVERAGE HEAD ON TOP OF LAYER 4	0.063 (0.051)		
CHANGE IN WATER STORAGE	0.041 (1.6246)	1474.24	0.106

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PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)
PRECIPITATION	5.47	198561.000
RUNOFF	0.207	7499.2456
DRAINAGE COLLECTED FROM LAYER 3	0.11877	4311.25439
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.001272	46.18091
AVERAGE HEAD ON TOP OF LAYER 4	1.210	
MAXIMUM HEAD ON TOP OF LAYER 4	2.388	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4762
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0718

*** 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 1978

LAYER	(INCHES)	(VOL/VOL)
1	1.2132	0.2022
2	243.0350	0.2893
3	1.7881	0.0745
4	0.0000	0.0000
SNOW WATER	0.000	

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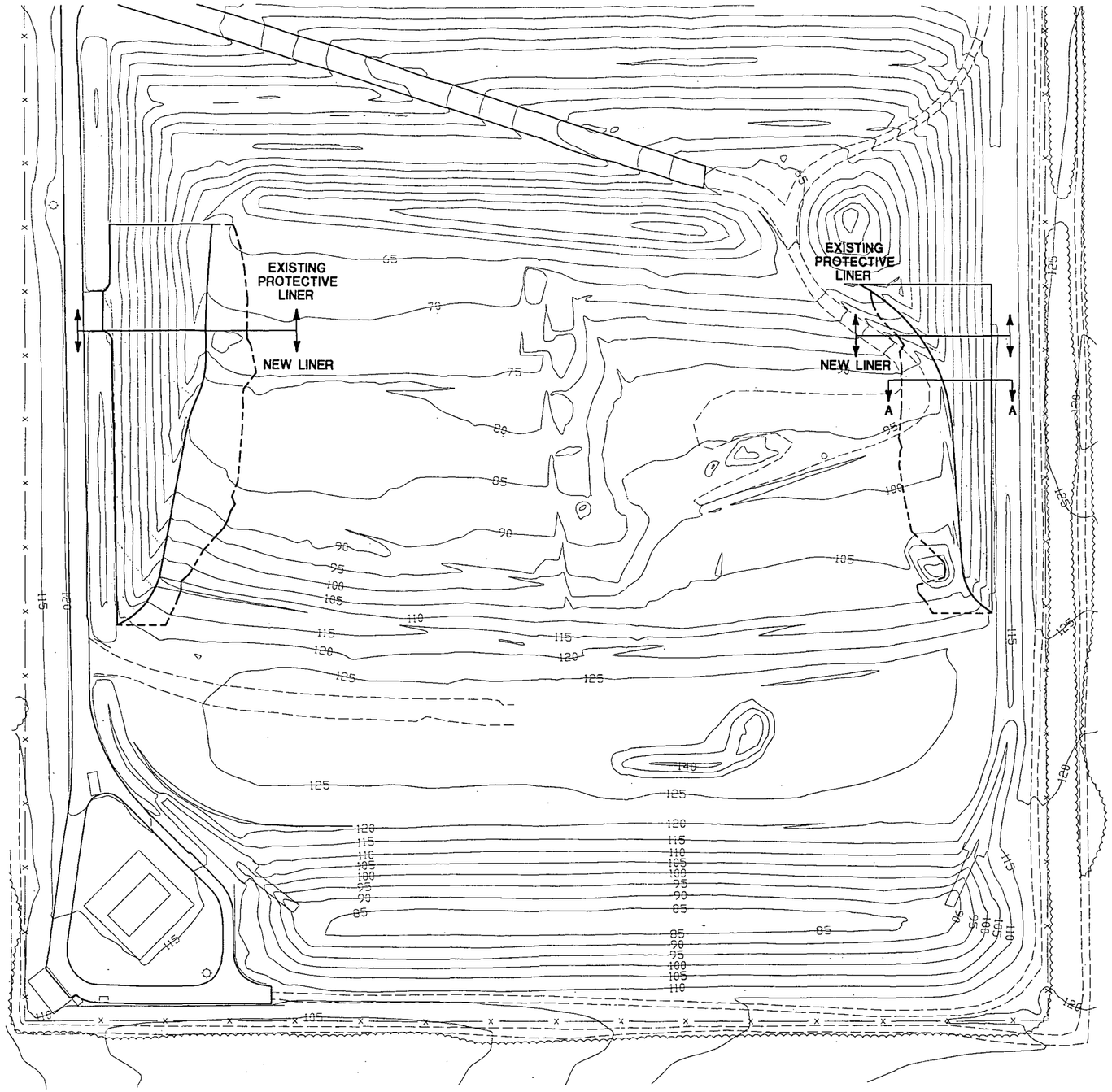
ATTACHMENT 2

DRAWINGS



-N-

GRAPHIC SCALE

0 40 80 160

SCALE IN FEET

LEGEND

——— LIMITS OF EXISTING EXPOSED GEOMEMBRANE

— — — LIMITS OF SOIL/SOLID WASTE 3H:1V SLOPE

NOTE:
SURVEY DATA PROVIDED BY PTI, 6/20/00

09/29/00 15:00 TA JE003001.dwg

LTR.	DATE	REVISIONS	BY	APPRO.

DESIGNED JLD
DRAWN JAW
CHECKED DAK
PROJECT ENGINEER

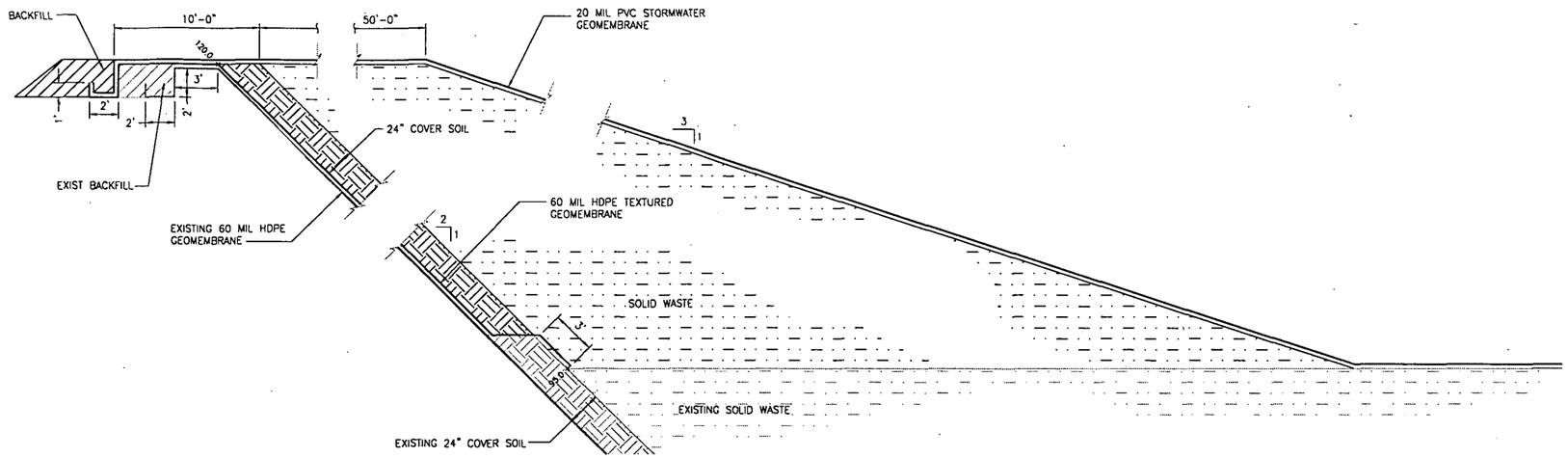
Jones Edmunds & Associates, Inc. JEA CONSULTING ENGINEERS AND SCIENTISTS
730 Northeast Waldo Road/Gainesville, Florida 32641 / (352) 377-5822

CITRUS COUNTY
CENTRAL LANDFILL

LINER REMEDIATION

APPROVED FOR JEA BY
REG. PROF. ENGINEER

DATE: SEP 2000
SCALE: 1"= 60'
PROJECT NO.: 03860-003-01
DWG. NO.: 1



SECTION A-A
SCALE: 1"=5'

09/29/00 16:06 TA JE003002.dwg

LTR.	DATE	REVISIONS	BY	APPRD.

DESIGNED JLD
DRAWN JAW
CHECKED DAK
PROJECT ENGINEER

Jones Edmunds & Associates, Inc. JEA CONSULTING ENGINEERS AND SCIENTISTS
730 Northwest Waldo Road/Gainesville, Florida 32641 / (352) 377-5821

CITRUS COUNTY
CENTRAL LANDFILL

LINER REMEDIATION

APPROVED FOR JEA BY
REC. PROF. ENGINEER

DATE: SEP 2000
SCALE: 1"= 60'
PROJECT NO.: 03860-003-01
DWG. NO.: 2

ATTACHMENT 3

SLOPE STABILITY ANALYSIS

Reference: Analysis and Design of Veneer Cover Soils
Robert M. Koerner, T-Yang Soong
1998 Sixth International Conference on Geosynthetics

Slope stability

Given: 2(H) : 1(V) exisitng slope

h	=	2 feet		
L	=	22.5 feet		
β	=	26.5 degrees	0.46251186 radians	
γ	=	110 lbs/ft^3		
ϕ	=	32 degrees	0.55850489 radians	
δ	=	18 degrees	0.314159 radians	(non-textured geomembrane)
δ	=	26 degrees	0.45378522 radians	(textured geomembrane)
Ca	=	0		

Calculate "a"

$$a = (Wa - Na*\cos\beta) * \cos\beta$$

$$Wa = \gamma h^2*[L/h - 1/\sin\beta - \tan\beta/2]$$

$$Na = Wa*\cos\beta$$

Wa	=	3854
Na	=	3449
a	=	**687**

Calculate "b"

$$b = -\ [\ (Wa - Na*\cos\beta) * \sin\beta * \tan\phi + (Na*\tan\delta + Ca) * \sin\beta * \cos\beta + \sin\beta\ (C + Wp*\tan\phi)$$

$$Wp = (\gamma*h^2) / (\sin 2\beta)$$

Wp	=	550.940014					
b	=	214	+				
				672	+		
						154	=
b	=	**-1039**		815			

Calculate "c"

$$c = (Na*\tan\delta + Ca) * \sin^2\beta * \tan\phi$$

c	=	**209**

Calculate FS

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

FS = 1.27 (2 feet of soil, 10 feet high on textured geomembrane)

Reference: Analysis and Design of Veneer Cover Soils
Robert M. Koerner, T-Yang Soong
1998 Sixth International Conference on Geosynthetics

Slope stability

Given: 2(H) : 1(V) exisitng slope

h	=	2 feet		
L	=	22.5 feet		
β	=	26.5 degrees	0.46251186 radians	
γ	=	110 lbs/ft^3		
ϕ	=	32 degrees	0.55850489 radians	
δ	=	18 degrees	0.314159 radians	(non-textured geomembrane)
δ	=	26 degrees	0.45378522 radians	(textured geomembrane)
Ca	=	0		

Calculate "a"

$$a = (Wa - Na*\cos\beta) * \cos\beta$$

$$Wa = \gamma h^2*[L/h - 1/\sin\beta - \tan\beta/2]$$

$$Na = Wa*\cos\beta$$

Wa	=	3854
Na	=	3449
a	=	**687**

Calculate "b"

$$b = -\ [(Wa - Na*\cos\beta) * \sin\beta * \tan\phi + (Na*\tan\delta + Ca) * \sin\beta * \cos\beta + \sin\beta\ (C + Wp*\tan\phi)$$

$$Wp = (\gamma*h^2) / (\sin 2\beta)$$

Wp	=	550.940014
b	=	214 + 448 + 154 =
b	=	**-815**

Calculate "c"

$$c = (Na*\tan\delta + Ca) * \sin^2\beta * \tan\phi$$

c	=	**139**

Calculate FS

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

FS = 1 (2 feet of soil, 10 feet high on ~~textured~~ smooth geomembrane)

Reference: Analysis and Design of Veneer Cover Soils
Robert M. Koerner, T-Yang Soong
1998 Sixth International Conference on Geosynthetics

Symbols

Wa	total weight of the active wedge
Wp	total weight of the passive wedge
Na	effective force normal to the failure plane of the active wedge
Np	effective force normal to the failure plane of the passive wedge
g	soil unit weight
h	thickness of soil cover
L	length of slope measured along the geomembrane
b	soil slope angle beneath the geomembrane
f	soil friction angle
g	interface friction angle
Ca	adhesive forces between soil and geomembrane
ca	adhesion between soil and geomembrane
C	cohesive force
Ea	interwedge force acting on the active wedge
Ep	interwedge force acting on the passive wedge
FS	factor of safety