4738 North 40th Street, Sheboygan, Wisconsin 53083-1883 • P.O. Box 1067, Sheboygan, Wisconsin 53082-1067

RECEIVED
JAN 31 2000
By____

January 28, 2000

Mr. John Feeney
Southeast Region Annex
4041 North Richards Street
P.O. Box 12436
Milwaukee, WI 53212-0436

Subject: **Village of Grafton, Lime Kiln Park**
Response to Comments and Year 2000 Scope
Earth Tech Project No. 30250

Telephone
920.458.8711
Facsimile
920.458.0537

Dear Mr. Feeney:

This letter provides responses to your comments contained in a June 8, 1999, letter from WDNR to the Village of Grafton on the Lime Kiln Park Landfill Investigation and Preliminary Remedial Action Identification (Investigation Report) submitted to the Department by Earth Tech in January 1999. These responses address completion of additional fieldwork to further define the extent of the groundwater plume's downgradient edge, and monitoring to confirm the occurrence of natural attenuation.

The comments are answered in the order of the bullets contained in your June 8 letter. Included is a description of the methodology for additional fieldwork. These responses also consider discussions between the Department, Village of Grafton, and Earth Tech at the August 31, 1999, meeting.

Bullet Item No. 1 – Landfill Cap

Comment: Determine if the current landfill cap is adequate and if it complies with the closure requirements of s. NR 500, Wis. Adm. Code.

Response: Enclosed with this letter are data and calculations that demonstrate the adequacy of the current landfill cap to meet the intent of NR 500 requirements. Included are boring logs and calculations that show the thickness and infiltration rate of the landfill cap. It is Earth Tech's opinion that the cap is adequate and meets closure requirements of NR 500.

The landfill cap effectively minimizes rainfall infiltration through the landfill and prevents direct contact with the waste by park-users. These conclusions are supported by boring logs which document the thickness of the existing cover, the well-maintained condition of the cover, and infiltration calculations indicating infiltration accounts for less than 15 percent of the water moving through the landfill. The volume of infiltration is small compared to the volume of groundwater that flows through the waste because approximately 7 feet of waste are below the water table. Boring logs also show that the cap thickness is adequate to prevent direct contact with waste to park-users. Therefore, no changes to the landfill cap are recommended.

Eighteen boreholes were advanced within and adjacent to the landfill to evaluate the extent of waste and the landfill cover characteristics. Six of the 18 borings did not encounter waste. Boring logs are included in Attachment A. The boring logs show that the clay cover ranges from 3 to 6.5 feet in thickness, and that an average of 1/2-foot of topsoil overlies the clay. The topsoil and clay thicknesses meet current NR 500 standards.

A cover inspection completed in February 1998 observed no visible cracks or breaks, and there was no relevant evidence that there had been stressed vegetation. Vegetation atop the cover is in excellent condition. The cover is sloped to the south to allow the majority of precipitation to run off rather than infiltrate. The infiltration through the cover is low because of the high cover slope and low permeability materials used in cover construction. If damage occurs to the cover, it is repaired and maintained by the Village of Grafton.

Cover infiltration was estimated using the HELP Model and assuming the minimum and average thickness of cover material at the landfill. Approximately 17,200 ft^3 per year of precipitation infiltrates the landfill, assuming a minimum cover thickness of 3.5 feet, and approximately 16,300 ft^3 per year infiltrates the landfill at the average thickness of 5 feet per year. Assumptions about climate and the hydraulic conductivity of the cover were made for HELP model purposes. An average climate year for Milwaukee was used for both simulations. The cover hydraulic conductivity was assumed to be $1x10^{-6}$ cm/sec, a conservative (high) estimate. HELP model simulations are provided in Attachment B.

The bottom 7 feet of waste are below the water table. Based on groundwater flow velocity calculated using Darcy's Law, approximately 88,900 ft^3 per year of groundwater flows through the waste. Infiltration through the cover comprises approximately 15 percent of the water (groundwater and infiltration) that flows through waste. Infiltration through the landfill cover is thus small compared to the amount of groundwater that flows through the waste material. Calculation sheets are included in Attachment C.

Bullet Item No. 2 – Additional Site Wells

Comment: Install a minimum of two additional bedrock wells on the downgradient side of the east plume to fully determine the extent of contamination. An adequate monitoring well network is needed before the department will approve natural attenuation as a final remedial option. These wells should be deep enough to account for possible downward migration of the contaminant plume, and to show that contaminant concentrations are decreasing with depth or clean at depth. The wells should be nested, or set up for discreet sampling, at various depths to determine if downward contaminant migration is occurring.

Response: At the August 31, 1999, meeting, it was decided that one new well would be installed downgradient of the landfill. Monitoring well MW-7B will be placed south of the Milwaukee River on the Watts property. A map showing the proposed well location is enclosed. The well is downgradient of Lime Kiln Park in the anticipated direction of groundwater flow, and will investigate the downgradient extent of contaminant migration.

The MW-7B borehole will be drilled to the base of the Racine Dolomite, the dolomite formation that transmits the majority of groundwater in the shallow rock. The Racine Dolomite overlies the Waukesha Dolomite, which is a confining layer that separates the Racine Dolomite from deeper aquifers. The Waukesha Dolomite will not be penetrated. Groundwater samples will be collected from two intervals in the borehole to evaluate the vertical distribution of compounds in groundwater. A packer apparatus will be used to sample discrete layers of the stratigraphy. A well will be set at the level of the highest contaminant concentrations found in laboratory results, if volatile organic compounds (VOCs) are detected. Should no compounds associated with the landfill be detected, the well will be constructed at an elevation consistent with wells constructed on-site and will be used for future monitoring and protection of downgradient well owners.

A well will also be placed in existing private well PW1788, at the base of the Racine Dolomite, as recommended in the Investigation Report. This well is outside the western edge of the Lime Kiln Park Landfill plume and will monitor groundwater for potential changes to the plume in a western direction.

The well previously scheduled to be constructed in PW1720 will not be completed, as discussed in our August 31, 1999, meeting. The homeowner has requested that the private well be abandoned and that it not be used for future monitoring. The well, located east of the plume, was determined to be unnecessary since both it and PW717HC (also east of the plume) have never had detections.

Bullet Item No. 3 - Well Nest at PW1749

Comment: Private well PW1749 within the contaminant plume should also be set up for multi-depth discreet sampling for the purpose of monitoring possible downward migration of contaminants.

PW8A
PW8B

Response: A well will be placed in existing private well PW1749 to monitor groundwater concentrations within the plume as discussed in the monitoring plan contained in the

Investigation Report. The well will be set at the base of the Racine Dolomite, the deepest elevation at which compounds were detected. A second well will be located in the Manchester Road right-of-way, at approximately 90 to 100 feet below ground surface, the depth of the highest compound concentrations measured during the field investigation. The nested wells will help monitor the downgradient vertical distribution of VOCs in groundwater.

Bullet Item No. 4 – Need for Additional Monitoring Wells

Comment: Additional monitoring wells could be required until the extent and degree of contamination is determined.

Response: The need for additional wells will be evaluated based upon the sampling results from the newly installed downgradient well, MW-7B. Well installation information and groundwater sample results from MW-7B do not contain compounds associated with the landfill and will be submitted in a letter report. This report will discuss the adequacy of the monitoring system to evaluate the nature and extent of contamination. This will include the need for and feasibility of additional wells.

Bullet Item No. 5 – Determination of Natural Attenuation as a Remedial Option

Comment: If results of additional investigation or sampling show that the contaminant plume is not stable or decreasing, natural attenuation will not be an acceptable remedial option, and a more aggressive remedy will be required.

Response: The site will be monitored as described in Table 13 of the Investigation Report and this letter to evaluate the effectiveness of natural attenuation processes that are occurring within the plume. An updated monitoring plan has been included with this letter. Data contained in the Investigation Report suggests that the plume is, at a minimum, stable based upon the amount of time the landfill has been present and the size of the plume. To date, no VOCs have been detected in private wells downgradient of the site along Lakefield Road. In addition, breakdown products such as TCE, vinyl chloride, cis- and trans-1,2-dichloroethane, methane, ethane, and ethene have been detected in groundwater samples, which suggests that natural attenuation is occurring. Should further investigation support that natural attenuation is occurring at the landfill, Earth Tech will request that natural attenuation be considered as the site remedy. If natural attenuation is not supported, a more aggressive remedy will need to be evaluated.

Bullet Item No. 6 – Natural Attenuation Monitoring Frequency

Comment: Once the site has been fully characterized, groundwater monitoring to determine the feasibility of using natural attenuation as a remedy should be done on a quarterly basis for at least 2 years.

Response: Groundwater sampling required for evaluating the feasibility of natural attenuation will be collected on a quarterly basis as discussed at the August 31, 1999, meeting. Previous monitoring results will be used as part of the quarterly data needed. Wells at the site or within the plume (Table 13, List A) will be monitored quarterly, and private wells outside the plume (Table 13, List B) will be monitored semi-annually. The updated monitoring plan is included in Attachment D.

Should the investigation outlined above indicate that natural attenuation is a likely remedy for the site after eight rounds of sampling, a new monitoring program will be proposed. At that time, a recommendation to reduce the number of samples and sample frequency may be submitted.

Please contact me at (920) 451-2465 if you have any further comments on our approach. We have tentatively scheduled drilling during the week of February 7, 2000.

Very truly yours,

Earth Tech, Inc.

Joan U. Underwood /rjg

Joan E. Underwood, P.G., P.H.G.
Project Manager

Enclosure: As Noted

c: Darrell Hofland – Village of Grafton
Mark Gottlieb – Village of Grafton
Charles Sweeney – Michael Best & Friedrich
Paul Malloy – Houseman, Feind, Gallo, & Malloy

\\shbs02\data\WORK\graftn01\admin\CORRESPN\scope2000.doc

RUST ENVIRONMENT & INFRASTRUCTURE

FIELD BORING LOG W/ATMOSPHERIC MONITORING

BORING NO. B-1

SITE: Grafton Lime Kiln Landfill PROJECT NO. 101688

WATER LEVEL READINGS

DATE/TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH
56 ~~2-16-98~~			

DRILLING METHOD: Geoprobe

LOG BY: Grimm

FIRM/DRILLER: North Slate

PHYSICAL SETTING:

ABANDONMENT DATE: 2-16-98

ABANDONMENT METHOD: Gravity - chips

GROUND SURFACE ELEV.:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 845 2-16-98

DATE/TIME COMPLETE: 905 2-16-98

WELL INSTALLATION DATE: NA

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	%LEL
			topsoil 0.5 feet								2.3	
2			clayey material with small gravel			2	1.4					
			clayey material with small gravel			2	1.5				1.7	
4												
			Sand at 6 feet			2	0.0				0.4	
6												
						2	1.5				1.0	
8			trash present, glass, rock at 7.0 feet									
10												
			EOH 8.0 feet									

RUST ENVIRONMENT & INFRASTRUCTURE

FIELD BORING LOG W/ATMOSPHERIC MONITORING

BORING NO. B-2

SITE: Crofton Lime Kiln Landfill   PROJECT NO. 101688

DRILLING METHOD: Geo probe

LOG BY: Garman

FIRM/DRILLER: Alec North Shore

PHYSICAL SETTING:

WATER LEVEL READINGS

DATE/TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: 2-16-98

ABANDONMENT METHOD: Gravity-chips

GROUND SURFACE ELEV.:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 905 2-16-98

DATE/TIME COMPLETE: 915 2-16-98

WELL INSTALLATION DATE: NA

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	%LEL
2			some topsoil development			2	1.8				0.6	
						2	1.5				0.8	
4			Rock - medium gravel present									
5						1	0.7				1.4	
			Hit rock at ~~5~~ 4.7 feet									
			EOH 4.7 feet									

RUST ENVIRONMENT & INFRASTRUCTURE

FIELD BORING LOG W/ATMOSPHERIC MONITORING

BORING NO. B-3

SITE: Grafton Lime Kiln Landfill PROJECT NO. 101688

[redacted]LING METHOD: Geoprobe

LOG BY: Cruman

FIRM/DRILLER: Alec North Shore

PHYSICAL SETTING:

WATER LEVEL READINGS

DATE/TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: 2-16-98

ABANDONMENT METHOD: Gravity-Bent Chips

GROUND SURFACE ELEV.:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 2-18-98 920

DATE/TIME COMPLETE: 2-18-98 935

WELL INSTALLATION DATE: NA

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	SAMPLING DATA B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	AIR MONITORING TIME	PID	O2/LEL	
			topsoil 0.5 feet			2	2				0.5		
2													
			clayey material with small gravel								2.0		
4			↓			2	0.9						
						2	0.8				30		
6													
			weathered bedrock			1.7	1.0				4.2		
8			Bedrock at 7.7 feet										
			EoH 7.7 feet										

RUST ENVIRONMENT & INFRASTRUCTURE

FIELD BORING LOG W/ATMOSPHERIC MONITORING

BORING NO. B-4

SITE: Grafton Lime Kiln Landfill PROJECT NO. 101688

DRILLING METHOD: Geoprobe

LOG BY: Gramann

FIRM/DRILLER: Alec North Shore

PHYSICAL SETTING:

WATER LEVEL READINGS

DATE/TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: 2-16-98

ABANDONMENT METHOD: Gravity - Bent. Chips

GROUND SURFACE ELEV.:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 2-16-98 935

DATE/TIME COMPLETE: 2-16-98 955

WELL INSTALLATION DATE: NA

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O2 / LEL
			SG ~~0-6~~ topsoil 0.5 feet			2	1.7				0.4	
2			clayey material									
			with small gravel			2	0.8				0.8	
4												
						2	1.8				18	
6			trash at 7.0 feet									
			trash, glass, crushed limestone			2	0.9				2.1	
8												
			EOH 8.0 feet									

RUST ENVIRONMENT & INFRASTRUCTURE

FIELD BORING LOG W/ATMOSPHERIC MONITORING

BORING NO. B-5

SITE: Grafton Lime Kiln Landfill PROJECT NO. 101688

WATER LEVEL READINGS

DATE/TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

[redacted]LING METHOD: Geoprobe

LOG BY: Gruman

FIRM/DRILLER: Alec North Shore

PHYSICAL SETTING:

ABANDONMENT DATE: 2-16-98

ABANDONMENT METHOD: Gravity-Bent.Chip

GROUND SURFACE ELEV.:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 2-16-98 1005

DATE/TIME COMPLETE: 2-16-98 1015

WELL INSTALLATION DATE: NA

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	%LEL
			topsoil 4"			2	1.3				0.4	
2			clayey material									
			crushed limestone 3.5-4.0 feet			2	1.0				1.0	
4												
			trash at 4.0, cobbles present, refusal at 5.8			2	1.0				0.3	
6												
			EOH 5.8 feet									

RUST ENVIRONMENT & INFRASTRUCTURE

FIELD BORING LOG W/ATMOSPHERIC MONITORING

BORING NO. B-6

SITE: Grafton Lime Kiln Landfill PROJECT NO. 101688

DRILLING METHOD: Geoprobe

LOG BY: Carmann

FIRM/DRILLER: Alec - North Shore

PHYSICAL SETTING:

WATER LEVEL READINGS

DATE/TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: 2-16-98

ABANDONMENT METHOD: Gravity-Bent Chip

GROUND SURFACE ELEV.:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 2-16-98 1020

DATE/TIME COMPLETE: 2-16- 1035

WELL INSTALLATION DATE: NA

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	%LEL
			Topsoil 0 to 0.4 feet			2	0.8				1.3	
2			clayey material									
			crushed Limestone 3.7 feet			2	0.9				0.1	
4												
						2	0.8				3.4	
6			trash approx 7.0 feet ↓									
						2	0.9				3.4	
8												
			EOH 8.0 feet									

RUST ENVIRONMENT & INFRASTRUCTURE

FIELD BORING LOG W/ATMOSPHERIC MONITORING

BORING NO. B-7

SITE: Grafton Lime Kiln Landfill PROJECT NO. 101688

WATER LEVEL READINGS

DATE/TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

[illegible]LING METHOD: Geoprobe

LOG BY: Crumann

FIRM/DRILLER: Abe North Shore

PHYSICAL SETTING:

ABANDONMENT DATE: 2-16-98

ABANDONMENT METHOD: Gravity-Bent Chip

GROUND SURFACE ELEV.:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 2-16-98 1035

DATE/TIME COMPLETE: 2-16-98 1055

WELL INSTALLATION DATE: N/A

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	%LEL
			Topsoil 1.0 feet			2	1.5				0.2	
2			clayey material w/ gravel			2	1.2				0.3	
4			clayey material w/ gravel			2	1.3				0.2	
6			weathered bedrock Refusal at 8.0 feet			2	1.2				0.1	
8												
			EOH 8.0 feet									

RUST ENVIRONMENT & INFRASTRUCTURE

FIELD BORING LOG W/ATMOSPHERIC MONITORING

BORING NO. B-8

SITE: Grafton Lime Kiln Landfill   PROJECT NO. 101688

DRILLING METHOD: Geoprobe

LOG BY: Gruman

FIRM/DRILLER: Alec North Shore

PHYSICAL SETTING:

WATER LEVEL READINGS

DATE/TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: 2-16-98

ABANDONMENT METHOD: Gravity - Bent Chips

GROUND SURFACE ELEV.:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 2-16-98 1100

DATE/TIME COMPLETE: 2-16-98 1115

WELL INSTALLATION DATE: NA

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	% LEL
			topsoil 0.5 feet			2	1.0				0.0	
2			clayey material with Gravel 3.8 Feet			2	0.5				0.5	
4			sandy material with gravel trash at 5.5 feet			2	1.4				OVER RANGE	
6			EOH 6.0 feet									
8												

RUST ENVIRONMENT & INFRASTRUCTURE

FIELD BORING LOG W/ATMOSPHERIC MONITORING

BORING NO. B-9

SITE: Grafton Lime Kiln Landfill PROJECT NO. 101688

WATER LEVEL READINGS

DATE/TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

[redacted]LING METHOD: Geoprobe

LOG BY: Gruman

FIRM/DRILLER: North Shore

PHYSICAL SETTING:

ABANDONMENT DATE: 2-16-98

ABANDONMENT METHOD: Gravity-Bent Chips

GROUND SURFACE ELEV.:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 2-16-98 1220

DATE/TIME COMPLETE: 2-16-98 1230

WELL INSTALLATION DATE: NA

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	SAMPLING DATA B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	AIR MONITORING TIME	PID	%LEL
			topsoil 0-0.5			2	1.7				0.3	
			gravel at 2.0									
2			some pieces of gravel, limestone			2	1.0				0.3	
4			gravel pieces, sandy			2	1.0				0.2	
6			weathered bedrock			2	0.7				0.1	
			bedrock at 8.0 feet									
8												
			EOH 8.0 feet									

RUST ENVIRONMENT & INFRASTRUCTURE

FIELD BORING LOG W/ATMOSPHERIC MONITORING

BORING NO. B-10

SITE: Grafton Lime Kiln Landfill PROJECT NO. 101688

DRILLING METHOD: Geoprobe

LOG BY: Cowman

FIRM/DRILLER: Alex North Shore

PHYSICAL SETTING:

WATER LEVEL READINGS

DATE/TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: 2-16-98

ABANDONMENT METHOD: Gravity - Bent Chip

GROUND SURFACE ELEV.:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 2-16-98 1235

DATE/TIME COMPLETE: 2-16-98 1315

WELL INSTALLATION DATE: NA

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	% LEL
			top 0.5 is topsoil			2	1.4				6.5	
2			some gravel, sand									
						2	1.0				2.5	
4			fine to large gravel.									
			layers of gravel, limestone			2	1.2				1.4	
6												
			weathered bedrock layers			2	1.1				0.3	
8			gravel at 8.0									
			medium gravel present			2	0.4				0.1	
			wood piece at 9.7 feet									
10												
			large gravel present			2	1.0				0.2	
12												
			Bedrock, weathered 12.0 feet			2	0.6				0.1	
14												
			EOH 14.0 feet									

RUST ENVIRONMENT & INFRASTRUCTURE

FIELD BORING LOG W/ATMOSPHERIC MONITORING

BORING NO. B-11

SITE: Grafton Lime Kiln Landfill PROJECT NO. 101688

___ING METHOD: Geoprobe

LOG BY: Gruneman

FIRM/DRILLER: Alec - North Shore

PHYSICAL SETTING:

WATER LEVEL READINGS

DATE/TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: 2-16-98

ABANDONMENT METHOD: Gravity, Bent Chips

GROUND SURFACE ELEV.:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 2-16-98 1320

DATE/TIME COMPLETE: 2-16-98 1335

WELL INSTALLATION DATE: NA

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	%/LEL
			topsoil 0 - 0.4 feet			2	1.5				0.9	
2			crushed limestone layers									
			layers of sand			2	1.8				0.3	
4												
			medium gravel, may be foundry waste			2	0.3				0.3	
6			trash at 6.5 feet			2	1.0				2.0	
8												
			EOH 8.0 feet									

RUST ENVIRONMENT & INFRASTRUCTURE

FIELD BORING LOG W/ATMOSPHERIC MONITORING

BORING NO. B-12

SITE: Grafton Lime Kiln Landfill PROJECT NO. 101688

DRILLING METHOD: Geoprobe

LOG BY: Gorman

FIRM/DRILLER: Alec North Shore

PHYSICAL SETTING:

WATER LEVEL READINGS

DATE/TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: 2-16-98

ABANDONMENT METHOD: Gravity-Bent Chips

GROUND SURFACE ELEV.:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 2-16-98 1340

DATE/TIME COMPLETE: 2-16-98 1420

WELL INSTALLATION DATE: N/A

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	% LEL
			top 0.4 feet is topsoil some gravel			2	1.7				0.7	
2			small gravel and some sand			2	1.3				0.3	
4			black, some small gravel			2	0.7				0.2	
6			maybe foundry waste at 5.5 feet reddish color			2	1.2				1.2	
8			medium to large gravel maybe foundry waste			2	1.5				0.6	
10			more reddish sand also some trash			2	1.3				0.4	
12			EOH 12.0 feet			~~2~~	~~1.4~~	SG 2-16-98				

RUST ENVIRONMENT & INFRASTRUCTURE

FIELD BORING LOG W/ATMOSPHERIC MONITORING

BORING NO. B-13

SITE: Grafton Lime Kiln Landfill PROJECT NO. 10688

[redacted]LING METHOD: Geoprobe

LOG BY: Grumman

FIRM/DRILLER: Alec North Shore

PHYSICAL SETTING:

WATER LEVEL READINGS

DATE/TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: 2-16-98

ABANDONMENT METHOD: Gravity - Bent. chips

GROUND SURFACE ELEV.:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 2-16-98 1425

DATE/TIME COMPLETE: 2-16-98 1440

WELL INSTALLATION DATE: N/A

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	% LEL
			0.3 feet topsoil			2	2.0				0.2	
2												
			medium gravel			2	1.8				28	
4			black material maybe trash at 3.8									
			black trash material - odor present			2	1.8				14	
6												
			EOH 6.0 feet									

RUST ENVIRONMENT & INFRASTRUCTURE

FIELD BORING LOG W/ATMOSPHERIC MONITORING

BORING NO. B-14

SITE: Grafton Lime Kiln Landfill PROJECT NO. 101688

DRILLING METHOD: Geoprobe

LOG BY: Gramann

FIRM/DRILLER: Alex-North Shore

PHYSICAL SETTING:

WATER LEVEL READINGS

DATE/TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: 2-16-98

ABANDONMENT METHOD: Gravity - Bent. Chips

GROUND SURFACE ELEV.:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 2-16-98 1445

DATE/TIME COMPLETE: 2-16-98 1500

WELL INSTALLATION DATE:

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	% LEL
			topsoil 0 2 feet; limestone, crushed, layers			2	1.2				1.2	
2			rocks, weathered bedrock			2	0.6				0.6	
4			weathered bedrock			2	0.6				1.2	
6			refusal at 6.0 feet									
			EOH 6.0 feet									

RUST ENVIRONMENT & INFRASTRUCTURE

FIELD BORING LOG W/ATMOSPHERIC MONITORING

BORING NO. B-15

SITE: Grafton Lime Kiln Landfill PROJECT NO. 101688

LING METHOD: Geoprobe

LOG BY: Grumann

FIRM/DRILLER: Alec - North Shore

PHYSICAL SETTING:

WATER LEVEL READINGS

DATE/TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: 2-16-98

ABANDONMENT METHOD: gravity, bent chips

GROUND SURFACE ELEV.:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 2-16-98 1510

DATE/TIME COMPLETE: 2-16-98 1535

WELL INSTALLATION DATE: NA

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	% LEL
			topsoil to 0.3 feet			2	2.0				0.8	
2			small gravel									
			very little small gravel			2	2.0				1.1	
4												
			clayey 4-5 feet			2	1.2				3.7	
6			black 5-6, maybe foundry waste									
						2	1.0				0.3	
8			7.0 to 8.0 black, waste material									
			black material 8.0 to 9.5			2	1.0				1.3	
10			red fine material 9.5									
			EOH 10.0 feet									

RUST ENVIRONMENT & INFRASTRUCTURE

FIELD BORING LOG W/ATMOSPHERIC MONITORING

BORING NO. B-16

SITE: Grafton Lime Kiln Landfill PROJECT NO. 101688

DRILLING METHOD: Geoprobe

LOG BY: Grumann

FIRM/DRILLER: Alec - North Shore

PHYSICAL SETTING:

WATER LEVEL READINGS

DATE/TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: 2-17-98

ABANDONMENT METHOD: Gravity - Bent. Chips

GROUND SURFACE ELEV.:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 2-17-98 0835

DATE/TIME COMPLETE: 2-17-98 0845

WELL INSTALLATION DATE: NA

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2/LEL
			topsoil 0.5 feet			2	1.5				0.3	
2			few medium gravel									
			medium gravel			2	1.4				0.1	
4			black material 3.5 feet									
			clayey material 4.0 to 5.0			2	1.4				1.7	
6			black material - trash 5.0 feet									
			EOH 6.0 feet									

RUST ENVIRONMENT & INFRASTRUCTURE

FIELD BORING LOG W/ATMOSPHERIC MONITORING

BORING NO. B-17

SITE: Grafton Lime Kiln Landfill PROJECT NO. 101688

DRILLING METHOD: Geoprobe

LOG BY: Carumann

FIRM/DRILLER: Alec - North Shore

PHYSICAL SETTING:

WATER LEVEL READINGS

DATE/TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: 2-17-98

ABANDONMENT METHOD: Gravity - Bent chips

GROUND SURFACE ELEV.:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 2-17-98 0845

DATE/TIME COMPLETE: 2-17-98 0900

WELL INSTALLATION DATE: NA

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2/LEL
			topsoil to 0.5 feet			2	1.9				6.1	
			few medium gravel and crushed limestone									
2			some medium gravel			2	1.5				6.3	
			black layer 3.5 to 3.7 feet									
4			trash and gravel particles 4.0			2	1.9				29	
6												
			EOH 6.0 feet									

RUST ENVIRONMENT & INFRASTRUCTURE

FIELD BORING LOG W/ATMOSPHERIC MONITORING

BORING NO. B-18

SITE: Grafton Lime Kiln Landfill PROJECT NO. 101688

DRILLING METHOD: Geoprobe

WATER LEVEL READINGS

DATE/TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

GROUND SURFACE ELEV.:
COORDINATE TYPE:
NORTH:
EAST:

LOG BY: Grumann
FIRM/DRILLER: Alec - North Shore
PHYSICAL SETTING:

ABANDONMENT DATE: 2-17-98
ABANDONMENT METHOD: Gravity - Rest Chips

DATE/TIME START: 2-17-98 0905
DATE/TIME COMPLETE: 2-17-98 0915
WELL INSTALLATION DATE: N/A

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2/LEL
			topsoil 0.3 feet			2	2.0				0.1	
			few small gravel									
2												
						2	1.2				0.2	
4			black material 3.5 to 3.6									
			Medium gravel present Refusal at 5 feet			1	0.9				0.1	
6												
			EOH 5.0 feet									

ATTACHMENT B

HELP MODEL SIMULATIONS

E A R T H T E C H

A tyco INTERNATIONAL LTD. COMPANY

CALCULATION SHEET

PROJECT NO. 30250

CLIENT		SUBJECT HELP Model	Prepared By TCR Date 01/24/00
PROJECT	Limekiln Landfill	Summary	Reviewed By Date
	Village of Grafton, WI		Approved By [signature] Date 1/28/2000

Objective

This analysis consisted of preparing HELP Model runs to determine the amount of infiltration through the existing clay cover at the site at the end of 100 years. The results are then used to prepare the groundwater impact assessment.

Design Criteria and Assumptions

This analysis consisted of 6 HELP Model runs, with each run covering 10 years. Refer to the attached HELP Model output files (only years 51-60 are included with this memorandum). In general, the default soil parameters (porosity, field capacity, wilting point and hydraulic conductivity) were used/input into the program. However, values for the hydraulic conductivity for the barrier soil exist from field tests and this value was used instead of the default.

The thickness of cover varies at the site, therefore two cases were analyzed using the HELP Model. One case for the minimum thickness of clay cover, and one case for the average thickness of clay cover. The area of the site is 1.33 acres, this value was used in the HELP Model. The cross section of the landfill that was input into the HELP Model follows, along with whether default parameters or user specified parameters were used:

a. topsoil and rooting zone material, 6 inches- HELP Model version 3.0 default soil number 9 was used.
b. barrier soil layer, 24 inches- HELP Model version 3.0 default soil number 16 was used with a modified saturated hydraulic conductivity of 1.0×10^{-6} cm/sec.
c. waste material, 288 inches- HELP Model version 3.0 default soil number 18 was used with a modified saturated hydraulic conductivity of 1.0×10^{-2} cm/sec.

The following depths were used for the minimum case;
rooting zone material- 6 inches
barrier soil- 24 inches
waste material- 288 inches

The following depths were used for the average case;
rooting zone material- 12 inches
barrier soil- 52 inches
waste material- 288 inches

For the first run, the initial moisture contents were set equal to the field capacity of the soil type. Then, the final water storage values from the first run were input as initial soil water contents for the second run. Likewise, each successive run used the fina water storage values from the previous run as the initial soil water contents.

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY

CALCULATION SHEET

PROJECT NO. 30250

CLIENT		SUBJECT	HELP Model
PROJECT	Limekiln Landfill		Summary
	Village of Grafton, WI		

Prepared By TCR Date 01/24/00
Reviewed By ____ Date ____
Approved By ____ Date ____

Calculations/Results

Results at the end of the 100-year modeling period for the minimum cover are as follows:

Average annual percolation through the cover (i.e., 24 inches of clay)	17208.8 cf/year
Average annual head on the cover	0.548 inches
Peak daily percolation through the cover (24 inches of clay)	205.28 cf/year
Peak daily average head on the cover	6.00 inches

Results at the end of the 100-year modeling period for the average cover are as follows:

Average annual percolation through the cover (i.e., 52 inches of clay)	16273.6 cf/year
Average annual head on the cover	0.940 inches
Peak daily percolation through the cover (52 inches of clay)	201.840 cf/year
Peak daily average head on the cover	11.912 inches

These results are shown on the attached pages of the HELP Model output files.

Minimum Case

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              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:      d:\grafton\min4.D4
TEMPERATURE DATA FILE:        d:\grafton\min7.D7
SOLAR RADIATION DATA FILE:    d:\grafton\min13.D13
EVAPOTRANSPIRATION DATA:      d:\grafton\MIN11.D11
SOIL AND DESIGN DATA FILE:    d:\grafton\MIN51-60.D10
OUTPUT DATA FILE:             d:\grafton\MIN51-60.OUT


TIME:   8:49     DATE:   1/24/2000


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

     TITLE:  Limekiln Park Landfill, Village of Grafton, Wisconsin

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


     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   9
           THICKNESS                    =       6.00   INCHES
           POROSITY                     =       0.5010 VOL/VOL
           FIELD CAPACITY               =       0.2840 VOL/VOL
           WILTING POINT                =       0.1350 VOL/VOL
           INITIAL SOIL WATER CONTENT   =       0.2280 VOL/VOL
           EFFECTIVE SAT. HYD. COND.    =   0.190000006000E-03 CM/SEC
         NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
                  FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

LAYER 2

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4270	VOL/VOL
FIELD CAPACITY	=	0.4180	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999997000E-06	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 48

THICKNESS	=	288.00	INCHES
POROSITY	=	0.6710	VOL/VOL
FIELD CAPACITY	=	0.2920	VOL/VOL
WILTING POINT	=	0.0770	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2920	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	70.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.330	ACRES
EVAPORATIVE ZONE DEPTH	=	6.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.368	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	3.006	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.810	INCHES
INITIAL SNOW WATER	=	1.553	INCHES
INITIAL WATER IN LAYER MATERIALS	=	95.712	INCHES
TOTAL INITIAL WATER	=	97.265	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
MILWAUKEE WISCONSIN

STATION LATITUDE	=	42.57 DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00

START OF GROWING SEASON (JULIAN DATE) = 130
END OF GROWING SEASON (JULIAN DATE) = 283
EVAPORATIVE ZONE DEPTH = 6.0 INCHES
AVERAGE ANNUAL WIND SPEED = 11.60 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 72.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 70.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 74.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 75.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR MILWAUKEE WISCONSIN

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
1.64	1.33	2.58	3.37	2.66	3.59
3.54	3.09	2.88	2.25	1.98	2.03

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR MILWAUKEE WISCONSIN

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
18.70	23.00	32.10	44.60	54.80	64.90
70.50	69.30	61.90	50.90	37.30	25.10

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR MILWAUKEE WISCONSIN AND STATION LATITUDE = 42.57 DEGREES

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	30.71	148264.812	100.00
RUNOFF	5.637	27213.621	18.35
EVAPOTRANSPIRATION	21.260	102641.352	69.23
PERC./LEAKAGE THROUGH LAYER 2	4.059290	19597.846	13.22
AVG. HEAD ON TOP OF LAYER 2	0.6542		
PERC./LEAKAGE THROUGH LAYER 3	4.073891	19668.340	13.27

CHANGE IN WATER STORAGE	-0.261	-1258.462	-0.85
SOIL WATER AT START OF YEAR	95.712	462087.531	
SOIL WATER AT END OF YEAR	97.004	468326.781	
SNOW WATER AT START OF YEAR	1.553	7497.729	5.06
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.032	0.00

****

****

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.08	183846.469	100.00
RUNOFF	10.380	50115.676	27.26
EVAPOTRANSPIRATION	21.513	103860.961	56.49
PERC./LEAKAGE THROUGH LAYER 2	4.540327	21920.246	11.92
AVG. HEAD ON TOP OF LAYER 2	0.8963		
PERC./LEAKAGE THROUGH LAYER 3	4.541174	21924.336	11.93
CHANGE IN WATER STORAGE	1.646	7945.489	4.32
SOIL WATER AT START OF YEAR	97.004	468326.781	
SOIL WATER AT END OF YEAR	96.891	467780.656	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.759	8491.626	4.62
ANNUAL WATER BUDGET BALANCE	0.0000	0.002	0.00

****

****

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	34.55	166804.000	100.00

RUNOFF	8.009	38666.016	23.18
EVAPOTRANSPIRATION	24.295	117294.305	70.32
PERC./LEAKAGE THROUGH LAYER 2	3.864268	18656.301	11.18
AVG. HEAD ON TOP OF LAYER 2	0.6530		
PERC./LEAKAGE THROUGH LAYER 3	3.862827	18649.344	11.18
CHANGE IN WATER STORAGE	-1.617	-7805.691	-4.68
SOIL WATER AT START OF YEAR	96.891	467780.656	
SOIL WATER AT END OF YEAR	96.331	465075.500	
SNOW WATER AT START OF YEAR	1.759	8491.626	5.09
SNOW WATER AT END OF YEAR	0.702	3391.094	2.03
ANNUAL WATER BUDGET BALANCE	0.0000	0.029	0.00

****

****

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	26.83	129532.617	100.00
RUNOFF	6.911	33366.336	25.76
EVAPOTRANSPIRATION	18.427	88963.180	68.68
PERC./LEAKAGE THROUGH LAYER 2	1.592617	7688.998	5.94
AVG. HEAD ON TOP OF LAYER 2	0.1951		
PERC./LEAKAGE THROUGH LAYER 3	1.586109	7657.574	5.91
CHANGE IN WATER STORAGE	-0.094	-454.514	-0.35
SOIL WATER AT START OF YEAR	96.331	465075.500	
SOIL WATER AT END OF YEAR	96.731	467007.156	
SNOW WATER AT START OF YEAR	0.702	3391.094	2.62
SNOW WATER AT END OF YEAR	0.208	1004.934	0.78
ANNUAL WATER BUDGET BALANCE	0.0000	0.038	0.00

****

****

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	34.65	167286.703	100.00
RUNOFF	7.984	38543.770	23.04
EVAPOTRANSPIRATION	24.187	116773.414	69.80
PERC./LEAKAGE THROUGH LAYER 2	3.441912	16617.209	9.93
AVG. HEAD ON TOP OF LAYER 2	0.4077		
PERC./LEAKAGE THROUGH LAYER 3	3.446581	16639.748	9.95
CHANGE IN WATER STORAGE	-0.967	-4670.207	-2.79
SOIL WATER AT START OF YEAR	96.731	467007.156	
SOIL WATER AT END OF YEAR	95.972	463341.875	
SNOW WATER AT START OF YEAR	0.208	1004.934	0.60
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.016	0.00

****

****

ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	32.43	156568.797	100.00
RUNOFF	5.090	24572.377	15.69
EVAPOTRANSPIRATION	21.175	102229.953	65.29
PERC./LEAKAGE THROUGH LAYER 2	3.724703	17982.494	11.49
AVG. HEAD ON TOP OF LAYER 2	0.6400		
PERC./LEAKAGE THROUGH LAYER 3	3.740451	18058.523	11.53
CHANGE IN WATER STORAGE	2.425	11707.943	7.48
SOIL WATER AT START OF YEAR	95.972	463341.875	
SOIL WATER AT END OF YEAR	96.087	463896.250	

SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	2.310	11153.555	7.12
ANNUAL WATER BUDGET BALANCE	0.0000	0.006	0.00

****

****

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	32.88	158741.328	100.00
RUNOFF	4.716	22768.912	14.34
EVAPOTRANSPIRATION	23.443	113179.602	71.30
PERC./LEAKAGE THROUGH LAYER 2	4.791316	23131.996	14.57
AVG. HEAD ON TOP OF LAYER 2	0.6441		
PERC./LEAKAGE THROUGH LAYER 3	4.805127	23198.672	14.61
CHANGE IN WATER STORAGE	-0.084	-405.863	-0.26
SOIL WATER AT START OF YEAR	96.087	463896.250	
SOIL WATER AT END OF YEAR	97.091	468746.531	
SNOW WATER AT START OF YEAR	2.310	11153.555	7.03
SNOW WATER AT END OF YEAR	1.222	5897.434	3.72
ANNUAL WATER BUDGET BALANCE	0.0000	0.002	0.00

****

****

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	27.86	134505.312	100.00
RUNOFF	4.991	24097.088	17.92
EVAPOTRANSPIRATION	20.159	97324.508	72.36
PERC./LEAKAGE THROUGH LAYER 2	3.283669	15853.228	11.79

AVG. HEAD ON TOP OF LAYER 2	0.4798		
PERC./LEAKAGE THROUGH LAYER 3	3.252198	15701.289	11.67
CHANGE IN WATER STORAGE	-0.542	-2617.607	-1.95
SOIL WATER AT START OF YEAR	97.091	468746.531	
SOIL WATER AT END OF YEAR	96.040	463670.219	
SNOW WATER AT START OF YEAR	1.222	5897.434	4.38
SNOW WATER AT END OF YEAR	1.731	8356.136	6.21
ANNUAL WATER BUDGET BALANCE	0.0000	0.040	0.00

****

****

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	31.85	153768.625	100.00
RUNOFF	7.590	36643.953	23.83
EVAPOTRANSPIRATION	22.287	107597.977	69.97
PERC./LEAKAGE THROUGH LAYER 2	3.348180	16164.680	10.51
AVG. HEAD ON TOP OF LAYER 2	0.5491		
PERC./LEAKAGE THROUGH LAYER 3	3.356787	16206.232	10.54
CHANGE IN WATER STORAGE	-1.384	-6679.527	-4.34
SOIL WATER AT START OF YEAR	96.040	463670.219	
SOIL WATER AT END OF YEAR	95.756	462299.125	
SNOW WATER AT START OF YEAR	1.731	8356.136	5.43
SNOW WATER AT END OF YEAR	0.631	3047.679	1.98
ANNUAL WATER BUDGET BALANCE	0.0000	-0.015	0.00

****

****

ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	28.83	139188.375	100.00
RUNOFF	3.336	16106.581	11.57
EVAPOTRANSPIRATION	21.636	104458.852	75.05
PERC./LEAKAGE THROUGH LAYER 2	2.998222	14475.114	10.40
AVG. HEAD ON TOP OF LAYER 2	0.3593		
PERC./LEAKAGE THROUGH LAYER 3	2.980684	14390.446	10.34
CHANGE IN WATER STORAGE	0.877	4232.453	3.04
SOIL WATER AT START OF YEAR	95.756	462299.125	
SOIL WATER AT END OF YEAR	95.711	462082.562	
SNOW WATER AT START OF YEAR	0.631	3047.679	2.19
SNOW WATER AT END OF YEAR	1.553	7496.716	5.39
ANNUAL WATER BUDGET BALANCE	0.0000	0.048	0.00

****

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.50	1.22	2.58	3.88	2.77	4.10
	3.62	3.54	2.51	1.85	1.88	2.41
STD. DEVIATIONS	0.43	0.49	1.36	1.29	0.99	2.30
	1.68	1.13	0.74	0.72	1.13	1.03
RUNOFF						
TOTALS	0.547	0.849	2.547	1.451	0.055	0.231
	0.002	0.244	0.123	0.009	0.072	0.334
STD. DEVIATIONS	0.556	0.778	1.948	1.170	0.133	0.637
	0.006	0.564	0.389	0.029	0.161	0.525
EVAPOTRANSPIRATION						
TOTALS	0.525	0.457	0.559	2.475	2.963	3.549

	3.516	3.185	1.906	1.247	0.976	0.480
STD. DEVIATIONS	0.111	0.145	0.302	1.048	1.232	1.313
	1.522	0.459	0.736	0.557	0.278	0.086

PERCOLATION/LEAKAGE THROUGH LAYER 2

TOTALS	0.0183	0.0376	0.2392	0.6473	0.3911	0.3407
	0.2345	0.2772	0.1671	0.3505	0.4556	0.4051
STD. DEVIATIONS	0.0515	0.0732	0.2385	0.2750	0.3300	0.2634
	0.2167	0.1923	0.2172	0.3900	0.4250	0.3406

PERCOLATION/LEAKAGE THROUGH LAYER 3

TOTALS	0.0153	0.0431	0.2408	0.6408	0.4022	0.3337
	0.2314	0.2794	0.1652	0.3508	0.4520	0.4099
STD. DEVIATIONS	0.0429	0.0806	0.2349	0.2832	0.3333	0.2590
	0.2146	0.1944	0.2174	0.3901	0.4220	0.3444

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 2

AVERAGES	0.0010	0.0103	0.2983	1.3814	0.8002	0.6914
	0.3122	0.4975	0.3004	0.6144	0.9783	0.6890
STD. DEVIATIONS	0.0021	0.0311	0.6229	1.0183	0.8667	0.8151
	0.3886	0.5881	0.4777	1.1680	1.2874	0.9265

****

****

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

	INCHES	CU. FEET	PERCENT
PRECIPITATION	31.87 (3.446)	153850.7	100.00
RUNOFF	6.464 (2.0839)	31209.43	20.286
EVAPOTRANSPIRATION	21.838 (1.8169)	105432.41	68.529
PERCOLATION/LEAKAGE THROUGH LAYER 2	3.56445 (0.89240)	17208.811	11.18540
AVERAGE HEAD ON TOP OF LAYER 2	0.548 (0.196)		
PERCOLATION/LEAKAGE THROUGH LAYER 3	3.56458 (0.89950)	17209.449	11.18581

CHANGE IN WATER STORAGE	0.000	(1.2996)	-0.60	0.000

****

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 10

	(INCHES)	(CU. FT.)
PRECIPITATION	3.51	16945.930
RUNOFF	2.188	10561.0420
PERCOLATION/LEAKAGE THROUGH LAYER 2	0.042519	205.27782
AVERAGE HEAD ON TOP OF LAYER 2	6.000	
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.059386	286.70996
SNOW WATER	5.05	24387.1875
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.5010	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1350	

****

****

FINAL WATER STORAGE AT END OF YEAR 10

LAYER	(INCHES)	(VOL/VOL)
1	1.3683	0.2280
2	10.2480	0.4270
3	84.0947	0.2920
SNOW WATER	1.553	

****
****

AVERAGE CASE

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              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:      d:\grafton\MIN4.D4
TEMPERATURE DATA FILE:        d:\grafton\min7.D7
SOLAR RADIATION DATA FILE:    d:\grafton\min13.D13
EVAPOTRANSPIRATION DATA:      d:\grafton\MIN11.D11
SOIL AND DESIGN DATA FILE:    d:\grafton\AVE51-60.D10
OUTPUT DATA FILE:             d:\grafton\AVE51-60.OUT


TIME:    9:18     DATE:   1/24/2000


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

     TITLE:  Limekiln Park Landfill, Village of Grafton, Wisconsin

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


     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    9
           THICKNESS                    =       12.00    INCHES
           POROSITY                     =        0.5010 VOL/VOL
           FIELD CAPACITY               =        0.2840 VOL/VOL
           WILTING POINT                =        0.1350 VOL/VOL
           INITIAL SOIL WATER CONTENT   =        0.4438 VOL/VOL
           EFFECTIVE SAT. HYD. COND.    =   0.190000006000E-03 CM/SEC
         NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
                    FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

LAYER 2

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	52.00	INCHES
POROSITY	=	0.4270	VOL/VOL
FIELD CAPACITY	=	0.4180	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999997000E-06	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	288.00	INCHES
POROSITY	=	0.6710	VOL/VOL
FIELD CAPACITY	=	0.2920	VOL/VOL
WILTING POINT	=	0.0770	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2919	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	70.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.330	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	5.326	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	6.012	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.620	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	111.595	INCHES
TOTAL INITIAL WATER	=	111.595	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
MILWAUKEE WISCONSIN

STATION LATITUDE	=	42.57	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	

START OF GROWING SEASON (JULIAN DATE)	=	130
END OF GROWING SEASON (JULIAN DATE)	=	283
EVAPORATIVE ZONE DEPTH	=	12.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	11.60 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	72.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	70.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	74.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	75.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR MILWAUKEE WISCONSIN

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
1.64	1.33	2.58	3.37	2.66	3.59
3.54	3.09	2.88	2.25	1.98	2.03

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR MILWAUKEE WISCONSIN

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
18.70	23.00	32.10	44.60	54.80	64.90
70.50	69.30	61.90	50.90	37.30	25.10

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR MILWAUKEE WISCONSIN AND STATION LATITUDE = 42.57 DEGREES

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	30.71	148264.812	100.00
RUNOFF	4.199	20273.428	13.67
EVAPOTRANSPIRATION	22.525	108749.070	73.35
PERC./LEAKAGE THROUGH LAYER 2	3.989510	19260.957	12.99
AVG. HEAD ON TOP OF LAYER 2	1.0752		
PERC./LEAKAGE THROUGH LAYER 3	3.985547	19241.822	12.98

CHANGE IN WATER STORAGE	0.000	0.516	0.00
SOIL WATER AT START OF YEAR	111.595	538770.187	
SOIL WATER AT END OF YEAR	111.595	538770.687	
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	-0.022	0.00

****

****

ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.08	183846.469	100.00
RUNOFF	7.567	36533.984	19.87
EVAPOTRANSPIRATION	24.263	117137.703	63.71
PERC./LEAKAGE THROUGH LAYER 2	5.263766	25412.936	13.82
AVG. HEAD ON TOP OF LAYER 2	1.6890		
PERC./LEAKAGE THROUGH LAYER 3	5.280263	25492.584	13.87
CHANGE IN WATER STORAGE	0.970	4682.185	2.55
SOIL WATER AT START OF YEAR	111.595	538770.687	
SOIL WATER AT END OF YEAR	110.806	534961.250	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.759	8491.626	4.62
ANNUAL WATER BUDGET BALANCE	0.0000	0.005	0.00

****

****

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	34.55	166804.000	100.00

RUNOFF	6.522	31487.547	18.88
EVAPOTRANSPIRATION	26.086	125939.406	75.50
PERC./LEAKAGE THROUGH LAYER 2	3.811365	18400.891	11.03
AVG. HEAD ON TOP OF LAYER 2	1.6888		
PERC./LEAKAGE THROUGH LAYER 3	3.792143	18308.090	10.98
CHANGE IN WATER STORAGE	-1.850	-8931.079	-5.35
SOIL WATER AT START OF YEAR	110.806	534961.250	
SOIL WATER AT END OF YEAR	110.013	531130.687	
SNOW WATER AT START OF YEAR	1.759	8491.626	5.09
SNOW WATER AT END OF YEAR	0.702	3391.094	2.03
ANNUAL WATER BUDGET BALANCE	0.0000	0.036	0.00

****

****

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	26.83	129532.617	100.00
RUNOFF	5.522	26657.502	20.58
EVAPOTRANSPIRATION	19.932	96229.422	74.29
PERC./LEAKAGE THROUGH LAYER 2	1.949564	9412.298	7.27
AVG. HEAD ON TOP OF LAYER 2	0.5834		
PERC./LEAKAGE THROUGH LAYER 3	1.938136	9357.125	7.22
CHANGE IN WATER STORAGE	-0.562	-2711.514	-2.09
SOIL WATER AT START OF YEAR	110.013	531130.687	
SOIL WATER AT END OF YEAR	109.945	530805.375	
SNOW WATER AT START OF YEAR	0.702	3391.094	2.62
SNOW WATER AT END OF YEAR	0.208	1004.934	0.78
ANNUAL WATER BUDGET BALANCE	0.0000	0.078	0.00

****

****

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	34.65	167286.703	100.00
RUNOFF	6.930	33455.031	20.00
EVAPOTRANSPIRATION	25.353	122399.648	73.17
PERC./LEAKAGE THROUGH LAYER 2	2.763473	13341.771	7.98
AVG. HEAD ON TOP OF LAYER 2	0.5375		
PERC./LEAKAGE THROUGH LAYER 3	2.763505	13341.925	7.98
CHANGE IN WATER STORAGE	-0.396	-1909.834	-1.14
SOIL WATER AT START OF YEAR	109.945	530805.375	
SOIL WATER AT END OF YEAR	109.758	529900.437	
SNOW WATER AT START OF YEAR	0.208	1004.934	0.60
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.059	0.00

****

****

ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	32.43	156568.797	100.00
RUNOFF	4.256	20549.182	13.12
EVAPOTRANSPIRATION	22.901	110562.477	70.62
PERC./LEAKAGE THROUGH LAYER 2	3.137692	15148.465	9.68
AVG. HEAD ON TOP OF LAYER 2	0.8630		
PERC./LEAKAGE THROUGH LAYER 3	3.129931	15110.996	9.65
CHANGE IN WATER STORAGE	2.143	10346.191	6.61
SOIL WATER AT START OF YEAR	109.758	529900.437	
SOIL WATER AT END OF YEAR	109.591	529093.125	

SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	2.310	11153.555	7.12
ANNUAL WATER BUDGET BALANCE	0.0000	-0.043	0.00

****

****

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	32.88	158741.328	100.00
RUNOFF	2.343	11309.734	7.12
EVAPOTRANSPIRATION	25.989	125473.695	79.04
PERC./LEAKAGE THROUGH LAYER 2	4.389811	21193.566	13.35
AVG. HEAD ON TOP OF LAYER 2	0.8223		
PERC./LEAKAGE THROUGH LAYER 3	4.400246	21243.947	13.38
CHANGE IN WATER STORAGE	0.148	713.963	0.45
SOIL WATER AT START OF YEAR	109.591	529093.125	
SOIL WATER AT END OF YEAR	110.827	535063.187	
SNOW WATER AT START OF YEAR	2.310	11153.555	7.03
SNOW WATER AT END OF YEAR	1.222	5897.434	3.72
ANNUAL WATER BUDGET BALANCE	0.0000	-0.018	0.00

****

****

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	27.86	134505.312	100.00
RUNOFF	3.911	18884.008	14.04
EVAPOTRANSPIRATION	21.345	103049.117	76.61
PERC./LEAKAGE THROUGH LAYER 2	3.128876	15105.900	11.23

AVG. HEAD ON TOP OF LAYER 2	0.5631		
PERC./LEAKAGE THROUGH LAYER 3	3.131641	15119.252	11.24
CHANGE IN WATER STORAGE	-0.528	-2547.106	-1.89
SOIL WATER AT START OF YEAR	110.827	535063.187	
SOIL WATER AT END OF YEAR	109.790	530057.375	
SNOW WATER AT START OF YEAR	1.222	5897.434	4.38
SNOW WATER AT END OF YEAR	1.731	8356.136	6.21
ANNUAL WATER BUDGET BALANCE	0.0000	0.044	0.00

****

****

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	31.85	153768.625	100.00
RUNOFF	6.573	31735.617	20.64
EVAPOTRANSPIRATION	23.845	115120.547	74.87
PERC./LEAKAGE THROUGH LAYER 2	2.843535	13728.302	8.93
AVG. HEAD ON TOP OF LAYER 2	1.0067		
PERC./LEAKAGE THROUGH LAYER 3	2.859435	13805.068	8.98
CHANGE IN WATER STORAGE	-1.428	-6892.611	-4.48
SOIL WATER AT START OF YEAR	109.790	530057.375	
SOIL WATER AT END OF YEAR	109.462	528473.187	
SNOW WATER AT START OF YEAR	1.731	8356.136	5.43
SNOW WATER AT END OF YEAR	0.631	3047.679	1.98
ANNUAL WATER BUDGET BALANCE	0.0000	-0.001	0.00

****

****

ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	28.83	139188.375	100.00
RUNOFF	2.070	9993.107	7.18
EVAPOTRANSPIRATION	23.447	113199.758	81.33
PERC./LEAKAGE THROUGH LAYER 2	2.429903	11731.329	8.43
AVG. HEAD ON TOP OF LAYER 2	0.5679		
PERC./LEAKAGE THROUGH LAYER 3	2.414525	11657.087	8.38
CHANGE IN WATER STORAGE	0.899	4338.425	3.12
SOIL WATER AT START OF YEAR	109.462	528473.187	
SOIL WATER AT END OF YEAR	109.439	528362.625	
SNOW WATER AT START OF YEAR	0.631	3047.679	2.19
SNOW WATER AT END OF YEAR	1.553	7496.716	5.39
ANNUAL WATER BUDGET BALANCE	0.0000	0.001	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.50	1.22	2.58	3.88	2.77	4.10
	3.62	3.54	2.51	1.85	1.88	2.41
STD. DEVIATIONS	0.43	0.49	1.36	1.29	0.99	2.30
	1.68	1.13	0.74	0.72	1.13	1.03
RUNOFF						
TOTALS	0.324	0.651	2.347	1.347	0.060	0.123
	0.000	0.005	0.000	0.000	0.000	0.133
STD. DEVIATIONS	0.328	0.580	1.864	1.049	0.135	0.388
	0.000	0.014	0.000	0.000	0.000	0.316
EVAPOTRANSPIRATION						
TOTALS	0.510	0.459	0.569	2.495	3.392	3.988

	3.914	3.521	2.074	1.231	0.943	0.472
STD. DEVIATIONS	0.139	0.145	0.315	1.067	1.193	1.282
	1.641	0.465	0.664	0.499	0.271	0.081

PERCOLATION/LEAKAGE THROUGH LAYER 2

TOTALS	0.0209	0.0087	0.1774	0.7226	0.8919	0.4604
	0.0932	0.1137	0.1149	0.1188	0.2905	0.3577
STD. DEVIATIONS	0.0411	0.0275	0.2551	0.3712	0.3831	0.3826
	0.1918	0.2359	0.2621	0.3099	0.3713	0.4100

PERCOLATION/LEAKAGE THROUGH LAYER 3

TOTALS	0.0176	0.0109	0.1742	0.7183	0.8924	0.4593
	0.0951	0.1130	0.1213	0.1175	0.2866	0.3634
STD. DEVIATIONS	0.0382	0.0345	0.2542	0.3717	0.3804	0.3828
	0.1947	0.2402	0.2697	0.3077	0.3745	0.4157

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 2

AVERAGES	0.0046	0.0002	0.6133	3.6456	3.3038	1.2144
	0.2301	0.4270	0.3101	0.1566	0.4756	0.8950
STD. DEVIATIONS	0.0108	0.0006	1.3192	2.4788	2.5092	2.3406
	0.6713	0.9620	0.8873	0.4916	1.0421	1.6633

****

****

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

	INCHES		CU. FEET	PERCENT
PRECIPITATION	31.87	(3.446)	153850.7	100.00
RUNOFF	4.989	(1.9265)	24087.92	15.657
EVAPOTRANSPIRATION	23.568	(1.9905)	113786.07	73.959
PERCOLATION/LEAKAGE THROUGH LAYER 2	3.37075	(0.99239)	16273.641	10.57755
AVERAGE HEAD ON TOP OF LAYER 2	0.940	(0.439)		
PERCOLATION/LEAKAGE THROUGH LAYER 3	3.36954	(0.99854)	16267.788	10.57375

CHANGE IN WATER STORAGE	-0.060	(1.1802)	-291.09	-0.189

****

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 10

	(INCHES)	(CU. FT.)
PRECIPITATION	3.51	16945.930
RUNOFF	2.126	10262.8457
PERCOLATION/LEAKAGE THROUGH LAYER 2	0.041807	201.84032
AVERAGE HEAD ON TOP OF LAYER 2	11.912	
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.058091	280.45831
SNOW WATER	5.05	24387.1875
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.5010	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1350	

****

****

FINAL WATER STORAGE AT END OF YEAR 10

LAYER	(INCHES)	(VOL/VOL)
1	3.1581	0.2632
2	22.2040	0.4270
3	84.0774	0.2919
SNOW WATER	1.553	

****
****

ATTACHMENT C

CALCULATION SHEETS

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY

CALCULATION SHEET

PROJECT NO. 30250

CLIENT		SUBJECT	Throughflow Calculation Summary
PROJECT	Lime Kiln Landfill, Village of Grafton, WI		

Prepared By BJL Date 01/24/00
Reviewed By RJA Date 01/28/2000
Approved By JE Date 01/28/2000

Objective

Calculate groundwater throughflow for waste material at Lime Kiln Park Landfill

Equation

Darcy's Law

Q = KIA

Where: Q = volume of water flowing through waste
K = hydraulic conductivity of bedrock in contact with waste
I = horizontal hydraulic gradient from Figure 5 of the Investigation Report
A = Cross-sectional area of waste perpendicular to groundwater flow

Assumptions

K = 1.8 x 10^{-3} cm/sec (Earth Tech, Investigation Report, January, 1999)

I = change in head between the 710 and 695 contours divided by the distance between the contours directly upradient of the landfill (Figure 5, (Earth Tech, Investigation Report, January, 1999)

= 15 ft / 550 ft = 0.027 ft/ft

A = waste width perpendicular to flow * saturated thickness of waste

= 250 ft * 7 ft = 1750 ft^2

Calculations/Results

Q = 1.8x10^{-3} cm/sec * 2834 ft/day conversion * 365 day/year * 0.027 ft/ft * 1750 ft^2

Q = 89,000 ft^3/yr of water flows through waste material below the water table.

ATTACHMENT D

UPDATED MONITORING PLAN

TABLE 13

MONITORING PLAN
VILLAGE OF GRAFTON

Parameter List

Analysis A.	VOCs
Analysis B.	Natural Attenuation Parameters - Methane, Ethane, Ethene, Chloride, Dissolved Metals, Nitrate
Analysis C.	Indicator Parameters - DO, ORP, pH, Alkalinity, Temperature, Conductivity

Well Groups

Well List 1

P-2A - Downgradient of landfill
P-2B - Downgradient of landfill
P-3B - Sidegradient of landfill
P-4B - Upgradient of landfill
*P-7B - Downgradient of plume
*P-8A - Nested With 1749, at a shallow depth
LH-01 - Groundwater within waste
LH-02 - Groundwater within waste
*PW1788MD (converted to discrete well) - Sidegradient of plume - west side
*PW1749MD (converted to discrete well) - Downgradient degree of plume

Well List 2 - Private wells downgradient of plume

PW717HC (Sidegradient)
PW1716LR
PW461HR
PW1587LR
PW1530LR

Recommended Monitoring Plan

Well List 1
Quarterly analysis of List A, B, C (March, June, September, December)

Well List 2
Semi-annual analysis of List A (June, December)

*Wells to be installed.