FINAL FEASIBILITY STUDY REPORT

OLD CORTLAND COUNTY LANDFILL
TOWN OF SOLON
CORTLAND COUNTY, NEW YORK

JULY, 1998

PREPARED FOR:

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EXECUTIVE SUMMARY

The following Draft Feasibility Study (FS) Report on the Old Cortland County Landfill was prepared by Barton & Loguidice, P.C. (B&L), on behalf of Cortland County in accordance with the requirements of the Order on Consent (#B7-0486-12-95) for closure of the landfill. The order was issued by the New York State Department of Environmental Conservation (NYSDEC), effective May 31, 1996. The Old Cortland County Landfill is listed as Class 2 site on the New York State Registry of Inactive Hazardous Waste Disposal Sites (Site Number 7-12-001). The facility is located in the Town of Solon, Cortland County, New York. This report is provided as the concluding phase of the Remedial Investigation/Feasibility Study (RI/FS) conducted by B&L to evaluate the potential effectiveness of a variety of remedial alternatives.

The evaluation of remedial alternatives was conducted in accordance with techniques presented in Federal (USEPA) and State Agency (NYSDEC) guidance documents. The FS Report presents a culmination of the following major items:

- A summary of the major findings of the remedial investigation including: site hydrogeologic conditions, nature and extent of contamination, contaminant fate and transport, and ecological and human health risk assessments;
- Identification of areas of concern, contaminants of concern, remedial action objectives for media of concern, and associated general response actions;
- Identification of potential remedial technologies available to meet general response actions;

- Development of remedial alternatives from the assortment of identified potential technologies, and initial screening based on restrictions of implementability at the site; and

- Detailed analysis of the remedial alternatives including evaluations of: overall protection of human health and the environment; overall compliance with chemical-specific, action-specific and location-specific standards, criteria and guidelines (SCGs); long-term effectiveness; reduction in toxicity, mobility and volume; short-term effectiveness; implementability; and cost-benefit.

Identified remedial action objectives included:

- Remove the threat of exposure to drums and associated contaminated soil areas within the Drum Area and the Isolated Buried Waste Area;

- Minimize the volume of leachate generation and groundwater contamination;

- Prevent potential dermal contact with or incidental ingestion of exposed waste;

- Provide for long-term monitoring of overburden and bedrock groundwater;

- Protect against future development within the areas of identified groundwater contamination and potential usage of groundwater as a resource

- Minimize the volume of contaminated groundwater discharge to surface water;

- Minimize the migration of contaminated surface water to downstream locations;
- Minimize the future exposure of contaminated surface water and sediment to wildlife; and
- Attainment of SCGs (or appropriate assigned background concentrations) for groundwater, surface water and sediments.

Subsequent general response actions included:

<u>For Waste Disposal Areas</u> -

- Appropriate disposal of drums containing liquid waste residues;
- Containment of the waste volume within each separate waste disposal area by capping;
- Consolidation of waste areas through excavation of isolated and thin waste areas;
- Complete removal of waste volume – off-site disposal site; or
- Complete removal of waste volume – on-site land disposal.

<u>For Groundwater and Surface Water</u> -

- Reduction of leachate generation by capping and/or waste removal;
- Establish quarterly water quality sampling schedule for all groundwater monitoring well and surface water sampling locations;

- Impose deed restrictions against the use of the site groundwater as a drinking water source; and

- Monitor natural attenuation throughout the environmental monitoring program.

Potential remedial technology options were discussed separately within two major divisions: 1) those which apply to source control, and 2) the remediation of groundwater. These include: access restrictions, waste containment, waste removal and consolidation, subsurface barriers, leachate collection, sediment removal, surface water and sediment isolation, surface water containment, treatment of surface water and leachate, groundwater collection with aquifer restoration and the treatment of groundwater.

Several of the technologies listed above were deemed impractical on the basis of the general absence of risk associated with contaminants identified in the groundwater, surface water and sediments at the site. Through this analysis, it was determined that only those technologies which were associated with source control measures were necessary to bring forward into the development of remedial alternatives.

Four separate remedial alternatives were developed from combinations of applicable source control technology options. Table ES-1 (presented below and in more detail as Table 4.1 in Section 4) identifies the estimated capital and operational & maintenance (O&M) costs, as well as the estimated net present value for each alternative.

TABLE ES-1 REMEDIAL ALTERNATIVE COST SUMMARY OLD CORTLAND COUNTY LANDFILL FEASIBILITY STUDY			
Remedial Alternative	Capital Costs	Annual O&M Costs	Net Present Value
Alternative I	$ 9,000	$14,850	$ 353,000
Alternative II	$5,016,000	$26,850	$5,638,000
Alternative III	$4,972,000	$24,850	$5,548,000
Alternative IV	$4,949,000	$24,850	$5,525,000

The following list summarizes the major items included within each of the remedial alternatives:

- **ALTERNATIVE I – No Action, Long-Term Monitoring**

  No remedial action is incorporated into this alternative. Groundwater and surface water monitoring would be performed on a quarterly basis for 30 years. The inclusion of this alternative was to provide a baseline from which the other alternatives could be evaluated.

- **ALTERNATIVE II – Waste Containment Including Capping Plus Relocation of Exposed Scrap Metal Area and Isolated Buried Waste Area**

  A NYSDEC Part 360 PVC Cap would be installed over the entire limits of the Old Cortland County Landfill and the Buckbee-Mears Sludge Disposal Areas. The Abandoned City of Cortland Landfill, located adjacent to the southern perimeter of the Old County Landfill, would be capped with a modified design of the Part 360 PVC cap to accommodate the continued use of the County's Maintenance Facility and landfill vehicle access areas. This alternative would additionally include the removal and disposal of approximately 80-90 drums scattered at the surface and partially buried within a small, wooded area adjacent to the southern portion of the Abandoned City of Cortland Landfill. A limited number of drums were also encountered within an isolated buried waste area near the settlement ponds. Following the removal and disposal of the drums, the contaminated soils associated with these areas will be excavated and brought to the Old County Landfill for spreading prior to capping.

This alternative also includes posting of warning signs at the perimeter of all property boundaries, imposition of deed restrictions to prevent future development and groundwater usage, and long-term groundwater and surface water monitoring.

- **ALTERNATIVE III – Waste Containment Including Capping Plus Relocation of Exposed Scrap Metal and Isolated Disposal Areas**

  This alternative evaluates the potential benefits associated with the excavation of the Buckbee-Mears Sludge Disposal Areas instead of capping in-place. All of the other remedial components of Alternative II were included as part of this alternative.

- **ALTERNATIVE IV – Waste Containment Including Capping Plus Relocation of Exposed Scrap Metal and Isolated Disposal Areas, With Consolidation of Thin Waste Areas**

  In addition to the remedial components brought forth in Alternative III, the thin waste areas associated with the Abandoned City of Cortland Landfill would be excavated and consolidated with the main waste mass of the Old Cortland County Landfill.

Recommended Remedial Alternative

Based on the detailed analyses of technical feasibility, implementability, environmental effectiveness and cost presented in Sections 3, 4 and 5 of this report, Alternative IV – "Waste Containment Including Capping Plus Relocation of Exposed Scrap Metal and Isolated Disposal Areas, With Consolidation of Thin Waste Areas" is the recommended remedial alternative. This recommendation is based on the demonstrated ability of this alternative to provide the greatest benefit for the lowest cost.

1. INTRODUCTION

The Old Cortland County Landfill is designated by the New York State Department of Environmental Conservation (NYSDEC) as a Class 2 inactive hazardous waste disposal site, and has been listed in the Registry of Inactive Hazardous Waste Disposal Sites in New York (Site Number 7-12-001). The following Feasibility Study (FS) Report has been prepared for Cortland County in accordance with the requirements of the Order on Consent (#B7-0486-12-95), effective May 31, 1996. There has been no solid waste accepted at the landfill since December, 1987.

1.1 Purpose and Organization

This report provides a detailed evaluation of potential remedial actions based on the findings presented in the Final Remedial Investigation Report (Barton & Loguidice, 1998). The FS was conducted in accordance with procedures outlined in the following State and Federal publications:

- "Selection of Remedial Actions at Inactive Hazardous Waste Sites". Revised Technical and Administrative Guidance Memorandum (TAGM). NYSDEC - dated May 15, 1990.

- "Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites". USEPA - dated February, 1991.

- "Accelerated Remedial Actions at Class 2, Non-RCRA Regulated Landfills". NYSDEC Technical and Administrative Guidance Memorandum HWR-92-4044 - dated March 9, 1992.

- "Inactive Hazardous Waste Disposal Site Remedial Program". 6 NYCRR Part 375. NYSDEC - dated May, 1992.

- "Presumptive Remedy for CERCLA Municipal Landfill Sites". USEPA OSWER Directive No. 9355.0-49FS - dated September, 1993.

- "Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites". USEPA OSWER Directive No. 9220.4-17 - dated December, 1997.

The development of remedial alternatives was accomplished through various screening stages. Initial screenings were based on general remediation objectives, while subsequent stages evaluated specific alternatives based on implementability and effectiveness in accordance with site conditions and available technology. The FS Report is organized into six sections as follows:

- **Section 1.0 - INTRODUCTION:** Summarizes the findings of the Remedial Investigation and Risk Assessment. Establishes applicable or relevant and appropriate New York State and Federal Standards, Criteria and Guidelines (SCGs).

- **Section 2.0 - REMEDIAL ACTION OBJECTIVES:** Presents the site specific areas of concern, the remedial action objectives for each area of concern, and discusses the general response actions to identified objectives.

- **Section 3.0 - PRELIMINARY TECHNOLOGY SCREENING:** Identifies and screens available remedial action technologies on the basis of site implementability.

- **Section 4.0 - DEVELOPMENT AND SCREENING OF ALTERNATIVES:** Identifies and screens remedial alternatives on the basis of their effectiveness in attaining SCGs, implementability and cost.

- **Section 5.0 - DETAILED ANALYSIS OF ALTERNATIVES:** Presents a detailed analysis of the remedial alternatives remaining from the previous screening stages. This analysis includes a cost/benefit comparison between alternatives and presents the recommended remedial alternative.

- **Section 6.0 - REFERENCES**

1.2 General Site Conditions

1.2.1 Site Description

The Old Cortland County Landfill site is located on the east side of Abandoned Town Line Road in the northwest corner of the Town of Solon, approximately 5 miles northeast of the City of Cortland, New York. The landfill is part of a 539.9 acre parcel of land currently owned by Cortland County which encompasses the Old County Landfill, the

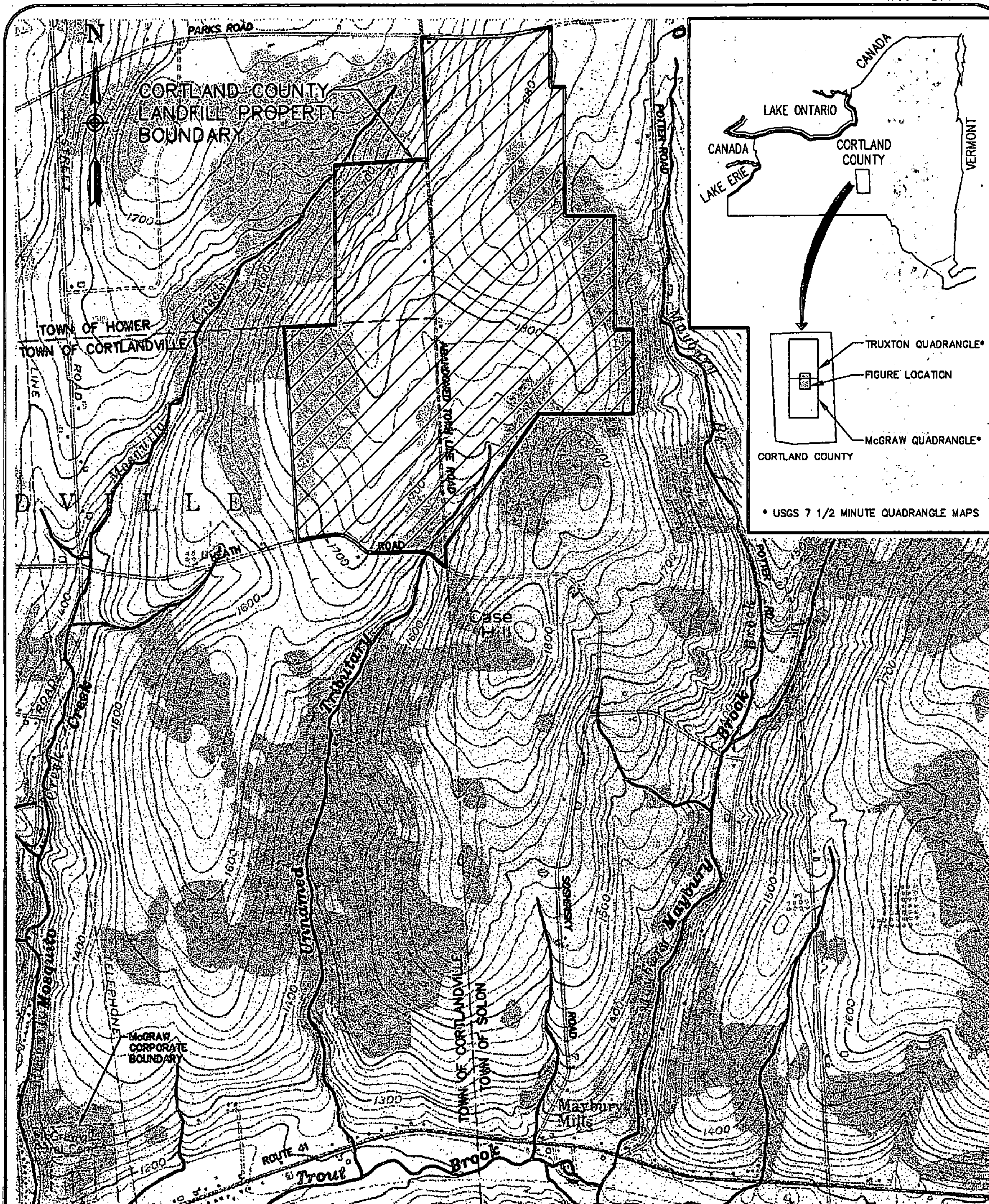
Abandoned City of Cortland Landfill, the Buckbee-Mears Sludge Disposal Areas, the closed Pine Tree Landfill, and the currently active Cortland County Landfill. The lined Pine Tree Landfill site and the active County Landfill site are not part of the inactive hazardous waste site that is the subject of this investigation. A site location map is provided as Figure 1.1.

The County landfill property occupies portions of the Towns of Solon, Cortlandville and Homer. The Old County Landfill, as stated above, is located entirely within the Town of Solon. The County property is bordered by Maybury Brook to the east, Mosquito Creek to the west, Heath Road to the south and Parks Road to the north. The unnamed tributary originates at the outflow of the settlement ponds situated south of the Old County Landfill, and flows southward beyond the property boundary to Trout Brook. Trout Brook is located approximately 1.8 miles to the south of the site.

1.2.2 Site History

Landfilling activities began at the site in the 1940's, when it was operated as a private disposal site by Fay Towslee, the former land owner. The City of Cortland leased the land from Mr. Towslee in the mid-1960's for use as a landfill. The City's lease of what is now referred to as the Abandoned City of Cortland Landfill continued until February 10, 1972, when Cortland County purchased the land from Mr. Towslee (Pitman, 1998).

On April 1, 1972, Cortland County stopped using the Abandoned City of Cortland Landfill and began landfilling operations in an area adjacent to the north side of the City dump. The County operated this area (what is now referred to as the Old Cortland County



APPROXIMATE SCALE: 1" = 2,000'

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OLD CORTLAND COUNTY LANDFILL
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SITE LOCATION MAP

TOWN OF SOLON — CORTLAND COUNTY

Figure 1-1
Project No. 331.22

Landfill) as a combined municipal solid waste (MSW) and construction and demolition debris (C&D) landfill from April 1, 1972 until December 3, 1987, and as a C&D disposal site until early 1992 (Pitman, 1998).

On December 3, 1987, the lined Pine Tree Landfill site was opened by Cortland County as an interim disposal site, in an area approximately 1,000 feet south of the southern side of the Old Cortland County Landfill. As of December 3, 1987, the Old Cortland County Landfill no longer received MSW for disposal, but it continued to be used for C&D disposal until early 1992 (Pitman, 1998).

On September 16, 1991, disposal at the lined Pine Tree Landfill ended. On October 25, 1991, Cortland County began disposing of waste in the first lined cell in its current landfill, the West Side Extension Sanitary Landfill, located on the west side of abandoned Town Line Road across from the lined Pine Tree Landfill, the Abandoned City of Cortland Landfill and the Old County Landfill. Between September 16th and October 25th, an interim disposal arrangement with the Auburn Landfill was utilized (Pitman, 1998).

The Resource Conservation and Recovery Act (RCRA) of 1976 states that generators of hazardous wastes must initiate "record keeping practices that accurately identify the quantities of such hazardous wastes generated, the constituents thereof which are significant in quantity or in potential harm to human health or the environment, and the disposition of such wastes" (RCRA Section 3002(a)(I). In 1984, the Hazardous and Solid Waste Amendments to RCRA were passed into law, requiring the "submission of reports to the Administrator (or the State Agency in and case in which such agency carries out a permit program pursuant to this subtitle) at least once every two years..." (RCRA Section 3002(a)(6).

As a result, it was identified that hazardous wastes, believed to have been generated by one or more local industrial manufacturing sites, had been disposed at the Old County Landfill site. Specifically, during approximately the first two years of County operation (i.e., in 1972 and 1973) a number of 55-gallon drums were disposed of within a portion of the landfill. These drums reportedly contained liquid and hazardous wastes which had been generated from local industries. Also, in areas located between the Abandoned City of Cortland Landfill and the lined Pine Tree Landfill, on the east side of Abandoned Town Line Road, ferrous hydroxide sludge which had been generated by the Buckbee-Mears Corporation was disposed. The disposal of this industrial sludge began in the late summer of 1976 and ended in early 1978 (Pitman, 1998).

The Final Remedial Investigation Report (Barton & Loguidice, 1998) presented the findings of the various site investigations performed to identify the hydrogeologic, ecologic and water quality conditions. A separate Ecologic Evaluation, and Baseline Human Health and Ecological Risk Assessment were also performed as part of the RI and presented in the Final RI Report. A brief summary of the site conditions is presented herein.

1.2.3 Site Hydrogeology

The unconsolidated geologic materials that mantle the higher and fill the lower elevations of the site area consist of glacial till deposited during the last glacial advance. The underlying (and exposed in areas of the site) bedrock is comprised of the Ithaca Member of the Upper Devonian Age Genesee Group. This sequence consists of interbedded gray shales and siltstones, with occasional fine-grained sandstone layers. The glacial till immediately overlies bedrock at all locations within the area of the site investigation.

The glacial till appears to be lodgement in origin, is very dense, and consists predominantly of fine-grained (silt and clay) materials with lesser amounts of gravel and sand. Occasional, and apparently discontinuous, layers and lenses of clay and sandier zones are present throughout the till, possibly indicative of inter-glacial episodes marking minor advances and retreats of the ice mass with associated meltwater deposition. Within the vicinity of the Old County Landfill, the till ranges in thickness from 0 feet in areas of bedrock exposure along the northern and western perimeters, to 16-1/2 feet along the southern portion of the east landfill perimeter, in the area of MW-6A/6B. The till unit becomes significantly thicker to the south of the Old County Landfill, where it was noted to be well over 100 feet thick in the area of the closed Pine Tree Landfill.

Groundwater occurs in the unconsolidated deposits and bedrock at the site. In general, groundwater flow is toward the south for both units. The horizontal hydraulic gradient of the potentiometric surface for the overburden ranges from 0.06 feet/foot to the south of the Old County Landfill, to 0.11 feet/foot beneath the landfill. Temporary observation well EB-1 identified approximately 11 feet of water above the bottom of the waste, suggesting that a minor amount of mounding is present within the northern section of the landfill. This mounding occurs very near to the apparent edge of the overburden aquifer; and therefore, does not appear to have a significant effect on the overall distribution of groundwater to downgradient areas. The horizontal hydraulic gradient of the bedrock piezometric surface is 0.05 feet/foot.

In-situ variable head testing indicated a mean horizontal hydraulic conductivity of 1.65×10^{-4} cm/sec for the glacial till unit, and 5.64×10^{-5} cm/sec for the bedrock unit. The laboratory determinations of vertical hydraulic conductivity for two undisturbed samples obtained from the till at MW-2A and MW-7A averaged 1.73×10^{-7} cm/sec, nearly three orders of magnitude less permeable in the vertical direction than horizontal ($k_h/k_v = 1{,}000$).

A groundwater flow model was developed along Geologic Cross-Section A-A' from head elevations observed in on-site wells, measured or calculated horizontal and vertical hydraulic conductivities, and an assumed effective porosity. This model predicts that a net upward vertical hydraulic gradient is present within the southern portion of the site, suggesting that groundwater to the south of the landfill flows from bedrock to the overburden, and then discharges from the overburden to on-site surface water bodies. These results are consistent with the piezometric surface maps developed both for the overburden and bedrock units. These maps indicate that the overburden and bedrock piezometric groundwater contours coincide with the surface topography and stream elevations in these areas. The results are also consistent with water level observations and determined vertical hydraulic gradients, which suggest that groundwater flows from the bedrock upwards to the overburden within the southern portion of the site.

1.2.4 Nature and Extent of Contamination

The nature and extent of the contamination were characterized at the site. This involved a detailed analysis of the water quality at each groundwater, surface water, sediment and soil sampling location in order to identify possible impacts from the landfill. In accordance with the Remedial Investigation Work Plan (Barton & Loguidice, 1996), each sample was tested for TCL (target compound list) volatile and semi-volatile organic compounds, pesticides, PCBs, total metals, and for NYSDEC Part 360 Baseline Leachate Indicators. All groundwater and surface water samples were also tested for dissolved metals.

In addition to the laboratory analytical testing program, an electromagnetic (EM) terrain conductivity survey was conducted along the entire landfill perimeter as well as within areas to the south of the landfill, where groundwater contamination, if present, was most likely to be identified. The purpose was to identify areas of anomalously high conductivity and modify the remaining investigation tasks accordingly, taking into consideration the potential that these anomalies may indicate the possible presence of subsurface inorganic contamination.

Trenching investigations conducted at the site in an effort to confirm the location and condition of the drums reportedly buried in the landfill were unsuccessful. Supplemental site walkovers and excavations performed to identify the limits of the Abandoned City of Cortland Landfill discovered, however, the presence of approximately 80-90 drums in an area to the south of the Abandoned City site and north of the Buckbee-Mears sludge disposal areas. The majority of the drums were empty and heavily rusted. A representative number of those which still contained either liquid or solid wastes were sampled for toxicity characteristics. Soil samples collected from excavations completed within the drum disposal area were analyzed for volatile and semi-volatile organic compounds and PCBs.

The extent and nature of contamination identified in groundwater, surface water, sediments and soil are summarized below. Tables 1.1 through 1.7 (included at the end of this section) present the analytical data for soil groundwater, surface water, sediment and waste samples collected during the Remedial Investigation. Plate 1 (located in the pocket at the end of this report) presents the layout of Remedial Investigation locations referred to herein.

- **Groundwater** - Groundwater samples were collected from each of the 12 newly installed monitoring wells, and from four existing monitoring wells in August and October, 1997. Three of the overburden monitoring well locations (MW-2A, MW-6A and MW-7A) appear to indicate a mild contaminant influence associated with the landfill. Of these, only MW-2A and MW-6A exhibit VOC contamination slightly in excess of groundwater standards, while MW-7A detected very low levels (below standards) of VOCs and slightly elevated inorganic and leachate indicator parameters. MW-1A exhibits a very mild leachate impact in the form of inorganic contamination only. MW-2B appears to be the only location which indicates a slight landfill leachate impact to bedrock groundwater.

  Very few individual volatile organic compounds are represented at the mildly contaminated groundwater monitoring locations. These include: vinyl chloride, chloroethane, 1,1-dichloroethane, 1,2-dichloroethene, benzene, toluene, chlorobenzene, ethylbenzene and total xylenes. Inorganic contaminants and leachate indicator parameters detected at groundwater monitoring locations include: arsenic, barium, boron, chromium, copper, iron, lead, magnesium, manganese, sodium, chloride, ammonia, total phenols and total dissolved solids.

- **Surface Water** - Surface water samples were collected from five sampling locations in October, 1997. SW-1 and SW-2 were collected from the unnamed tributary; SW-3 was sampled within the first settlement pond; and SW-4 and SW-5 were collected from Maybury Brook. Two of these locations (SW-1 and SW-2) were dry during the previous August, 1997 sampling event; and therefore, could not be sampled. One leachate sample was collected within the ditch at the southern landfill perimeter.

  Three of the surface water sampling locations (SW-1, SW-2 and SW-3) appear to indicate a mild influence from the landfill. They occur as a line of points within the site drainage features to the south of the landfill, exhibiting a decreasing impact with distance from the landfill.

  There were no volatile or semi-volatile organic compounds detected at any of the surface water sampling locations. The leachate sample (collected in the ditch which eventually discharges to the first settlement pond) exhibited total VOC concentrations ranging from 46 μg/L to 147 μg/L between the two sampling events. Organic compounds represented in the leachate sample included: chloroethane, acetone, benzene, chlorobenzene, ethylbenzene and total xylenes. Inorganic contaminants and slightly elevated leachate indicator parameters identified at surface water sampling locations SW-1, SW-2 and SW-3 included:

aluminum, iron, lead, BOD_5, chloride, COD, color, ammonia, nitrate, total alkalinity, total dissolved solids, total Kjeldhal nitrogen, total organic carbon and total hardness.

- **Sediment** - Six sediment locations were sampled during the August, 1997 sampling round. Sediment locations which exhibited apparent contamination (SED-1, SED-2, SED-3 and SED-6), are associated with mildly contaminated surface water sampling locations SW-1, SW-2 and SW-3. SED-6 was collected from the fourth settlement pond, for which there was no associated surface water sampling location.

Unlike the observed decrease in the impact to surface water locations, concentrations of contaminants detected at sediment sampling locations do not decrease downstream from the first settlement pond to the farthest downstream sediment sampling location. Rather, SED-1 clearly represents the location which exhibits the greatest impact. These conditions are apparently attributable to prior site activities leading to the development of the four settlement ponds. During these activities, sediments, which were present within the earlier 13-pond system, were excavated and placed on the landfill. These activities did not extend to the location of SED-1; and therefore, account for the difference in observed sediment contaminant concentrations.

Organic contaminants detected at sediment sample SED-1 included: acetone, bis (2 ethyl hexyl) phthalate, 2-butanone, and toluene. One SVOC (isophorone) was detected at SED-2. Inorganic contaminants detected in sediment samples SED-1, SED-2, SED-3 and SED-6 included: arsenic, chromium, copper, iron, manganese, nickel and zinc.

- **Buckbee-Mears Waste and Drum Waste Samples** - Samples were collected of the sludge waste associated with the Buckbee-Mears disposal areas and from several of the drums containing residues of prior liquid and solid wastes. Samples were also taken from excavations completed within the drum disposal area for contaminant characterization. The liquid samples were analyzed for TCLP toxicity characteristics and the solid samples (sludge, waste and soil) were analyzed for TCL (target compound list) volatile and semi-volatile organic compounds and PCBs. The sludge samples were also tested for pesticides, leachate indicators and total inorganics. One of the objectives for performing these analyses was to determine the need to identify specific handling, transport and disposal procedures for the liquid drum wastes, as part of alternative remedial technologies considered for the remediation of these disposal areas. Test results of the liquid waste samples did not exhibit any parameters in exceedance of hazardous waste limits.

1.2.5 Ecological Assessment

The Ecological Assessment evaluated environmental, terrestrial and aquatic resources in the vicinity of the landfill and the surrounding environment. There were no ecological impacts identified which were determined to be attributable to the landfill.

Differences in the composition of the benthic organisms in Maybury Brook and the unnamed tributary is believed to be likely due to man-made and natural differences in the streams themselves.

1.2.6 Contaminant Fate and Transport

The migration of contaminants to off-site receptors appears to be limited by site hydrogeologic conditions and natural attenuation factors. Modeling of the overburden and upper bedrock units has shown that groundwater discharge largely occurs to the surface waters present in the southern portion of the site. Analytical testing of the surface water at sampling locations downstream from the Old County Landfill indicates an absence of VOC and SVOC contamination. In addition, contaminant concentrations associated with leachate indicators and inorganics illustrate significant decreases between successive downstream samples. Groundwater testing also identifies significant decreases in organic and inorganic contaminant concentrations within a relatively short distance from the landfill perimeter. Comparison of surface water to sediment contaminant concentrations indicates high precipitation rates for both organic and inorganic constituents. As a result of these observations, it appears that the migration of contaminants both by means of groundwater and surface water transport, is limited to areas within close proximity to the source of generation.

1.2.7 Baseline Human Health and Ecological Risk Assessment

Carcinogenic and Non-carcinogenic risks were evaluated for exposure pathways associated with residents, recreators, and trespassers, and for various wildlife and vegetation communities which may come in contact with contaminants at the site following closure. Hazard Indices and USEPA risk target levels were met for all exposure pathways evaluated for recreators and trespassers, and for wildlife and vegetation communities.

A minimal risk associated with the unlikely ingestion of groundwater at the site by humans in the future was the only pathway for which a reference hazard level was exceeded. This hazard level was exceeded for this scenario on the basis of manganese concentrations detected in areas immediately downgradient from the landfill. The extreme implausibility for this scenario to ever occur, renders this risk as unrealistic; and therefore, will not be considered in the following evaluations of site remediation requirements.

1.3 Standards, Criteria and Guidelines (SCGs)

The successful development and implementation of remedial alternatives is based on the compliance of each alternative with New York State and Federal standards, criteria and guidelines (SCGs). In addition, each alternative must exhibit the ability to comply with the following three separate categories of SCGs:

a. **Chemical-Specific SCGs:** These include health or risk-based concentration limits or ranges of concentrations for the site-specific chemicals of concern, that establish the acceptable levels at which organic and inorganic parameters can be present within or discharged to specific media.

b. **Location-Specific SCGs:** These include restrictions placed on potential remediation technologies as a result of the geographical or physical position of a landfill with respect to the surrounding environment. Wetland and floodplain restrictions are the most common location-specific SCGs for municipal landfill sites.

c. **Action-Specific SCGs:** These include restrictions or controls placed on potential remedial actions on the basis of the types of hazardous substance(s) present.

Several inorganic constituents, specifically metals, are present as naturally occurring components to the background water quality at the site. For many of these (e.g., iron, magnesium, manganese and sodium) their concentrations at background locations were often detected in excess of established standards or guidance values. As a result of these conditions, the level of chemical-specific remediation for certain parameters will be set as the concentrations detected at background locations.

Applicable or relevant and appropriate New York State and Federal SCGs for each of the three categories listed above have been applied to the development of each remedial alternative.

TABLE 1.1
OLD CORTLAND COUNTY LANDFILL FEASIBILITY STUDY
SOIL / WASTE ANALYTICAL RESULTS
LEACHATE INDICATORS - AUGUST, 1997 SAMPLING

PARAMETER *	SAMPLE LOCATION					
	SOIL SAMPLES			WASTE SAMPLES		
	CL - SB - 01	CL - SB - 02	CL - FB - 02 (1)	CL - TP - 01	CL - TP - 02	CL - FB - 01 (1)
BOD5	NA	NA	<2	NA	NA	<2
Bromide	<28.1	<28.6	<0.5	155	56.7	<0.5
Chloride	269	266	<2.0	<690	418	<2.0
COD	3660	4000	<15	63600	19800	<15
Hexavalent Chromium	<1.1	<1.1	<0.02	<3.4	<1.6	<0.02
Ammonia	21.7	2.7	0.02	258	459	0.02
Nitrate	<11.2	<11.4	<0.1	<34.0	21.8	<0.1
Total Phenols	<0.11	<0.11	<1.0	<0.34	<0.16	<1.0
Sulfate	<281	<286	<5.0	<862	<405	<5.0
Total Alkalinity	1050	1390	<1.0	25000	9950	<1.0
Total Kjeldahl Nitrogen	447	301	<0.2	1830	1610	<0.2
TOC	1140	2340	<0.5	22400	9550	<0.5
Total Solids (%)	89.1	87.5	NA	29.0	61.7	NA
Total Hardness	44900	91400	<5.0	276000	162000	<5.0

NOTES: * Results reported in mg/kg
< indicates that the analyte was not detected above the instrument detection limit.
NA - not applicable
(1) Results for field blanks ("FB") reported in mg/L
Soil Sample CL-SB-01 collected at boring completed for MW-2A (5'-9').
Soil Sample CL-SB-02 collected at boring completed for MW-7A (6'-7').
Waste Sample CL-TP-01 collected at excavation completed for TP-43 (composite of 0'-10').
Waste Sample CL-TP-02 collected at excavation completed for TP-45A (composite of 0'-10').

TABLE 1.1
OLD CORTLAND COUNTY LANDFILL FEASIBILITY STUDY
SOIL / WASTE ANALYTICAL RESULTS
VOLATILE ORGANIC COMPOUNDS - AUGUST, 1997 SAMPLING

	SAMPLE LOCATION					
	SOIL SAMPLES			WASTE SAMPLES		
PARAMETER *	CL - SB - 01	CL - SB - 02	CL - FB - 02 (1)	CL - TP - 01	CL - TP - 02	CL - FB - 01 (1)
Chloromethane	<11	<11	<10	<34	<16	<10
Vinyl Chloride	<11	<11	<10	<34	<16	<10
Bromomethane	<11	<11	<10	<34	<16	<10
Chloroethane	<11	<11	<10	<34	<16	<10
1,1-Dichloroethene	<11	<11	<10	<34	<16	<10
Carbon Disulfide	<11	<11	<10	<34	<16	<10
Acetone	41 B	5 JB	<10	270 B	220 B	3 J
Methlyene Chloride	<11	1 JB	2 JB	6 JB	2 JB	6 JB
1,2-Dichloroethene (total)	<11	<11	<10	<34	<16	<10
1,1-Dichloroethane	<11	<11	<10	<34	<16	<10
Chloroform	<11	<11	<10	<34	60	<10
1,2-Dichloroethane	<11	<11	<10	<34	<16	<10
2-Butanone	3 J	<11	<10	120	<16	<10
1,1,1-Trichloroethane	<11	<11	<10	<34	<16	<10
Carbon Tetrachloride	<11	<11	<10	<34	<16	<10
Trichloroethene	<11	<11	<10	<34	<16	<10
Benzene	<11	<11	<10	<34	<16	<10
1,2-Dichloropropane	<11	<11	<10	<34	<16	<10
Bromodichloromethane	<11	<11	<10	<34	<16	<10
cis-1,3-Dichloropropene	<11	<11	<10	<34	<16	<10
trans-1,3-Dichloropropene	<11	<11	<10	<34	<16	<10
1,1,2-Trichlorethane	<11	<11	<10	<34	<16	<10
Dibromochloromethane	<11	<11	<10	<34	<16	<10
Bromoform	<11	<11	<10	<34	<16	<10
4-Methyl-2-Pentanone	<11	<11	<10	<34	<16	<10
Toluene	<11	<11	3 J	11 J	19	<10
Tetrachloroethene	<11	<11	<10	<34	<16	<10
2-Hexanone	<11	<11	<10	<34	<16	<10
Chlorobenzene	<11	<11	<10	<34	<16	<10
Ethylbenzene	<11	<11	<10	<34	<16	<10
Xylenes (total)	<11	<11	<10	<34	<16	<10
Styrene	<11	<11	<10	<34	<16	<10
1,1,2,2-Tetrachloroethane	<11	<11	<10	<34	<16	<10
Total VOCs **	3	ND	3	131	79	3

NOTES: * Results reported in ug/kg
** Total Volatile Organic Compounds (sum of all compounds believed to represent site contamination).
< indicates that the analyte was not detected above the instrument detection limit.
ND - not detected
(1) Results for field blanks ("FB") reported in mg/L
B - indicates that the analyte was also detected in the laboratory QA/QC blank and is likely due to laboratory contamination.
J - indicates an estimated value.

TABLE 1.1
OLD CORTLAND COUNTY LANDFILL FEASIBILITY STUDY
SOIL / WASTE ANALYTICAL RESULTS
SEMI-VOLATILE ORGANIC COMPOUNDS - AUGUST, 1997 SAMPLING

Page 3 of 6

	SAMPLE LOCATION					
	SOIL SAMPLES			WASTE SAMPLES		
PARAMETER *	CL - SB - 01	CL - SB - 02	CL - FB - 02 (1)	CL - TP - 01	CL - TP - 02	CL - FB - 01 (1)
Phenol	<370	<380	<10	<1100	220 J	<10
bis(2-Chloroethyl)ether	<370	<380	<10	<1100	<540	<10
2-Chlorophenol	<370	<380	<10	<1100	<540	<10
1,3-Dichlorobenzene	<370	<380	<10	<1100	<540	<10
1,4-Dichlorobenzene	<370	<380	<10	<1100	<540	<10
1,2-Dichlorobenzene	<370	<380	<10	<1100	<540	<10
2-Methylphenol	<370	<380	<10	<1100	<540	<10
2,2'-oxybis(1-Chloropropane)	<370	<380	<10	<1100	<540	<10
4-Methylphenol	<370	<380	<10	<1100	210 J	<10
N-Nitroso-di-n-propylamine	<370	<380	<10	<1100	<540	<10
Hexachloroethane	<370	<380	<10	<1100	<540	<10
Nitrobenzene	<370	<380	<10	<1100	<540	<10
Isophorone	<370	<380	<10	<1100	<540	<10
2-Nitrophenol	<370	<380	<10	<1100	<540	<10
2,4-Dimethylphenol	<370	<380	<10	<1100	<540	<10
bis(2-Chloroethoxy)methane	<370	<380	<10	<1100	<540	<10
2,4-Dichlorophenol	<370	<380	<10	<1100	<540	<10
1,2,4-Trichlorobenzene	<370	<380	<10	<1100	<540	<10
Naphthalene	<370	<380	<10	<1100	<540	<10
4-Chloroaniline	<370	<380	<10	<1100	<540	<10
Hexachlorobutadiene	<370	<380	<10	<1100	<540	<10
4-Chloro-3-methylphenol	<370	<380	<10	<1100	<540	<10
2-Methylnaphthalene	<370	<380	<10	<1100	<540	<10
Hexachlorocyclopentadiene	<370	<380	<10	<1100	<540	<10
2,4,6-Trichlorophenol	<370	<380	<10	<1100	<540	<10
2,4,5-Trichlorophenol	<940	<950	<25	<2900	<1400	<25
2-Chloronaphthalene	<370	<380	<10	<1100	<540	<10
2-Nitroaniline	<940	<950	<25	<2900	<1400	<25
Dimethylphthalate	<370	<380	<10	<1100	<540	<10
Acenaphthylene	<370	<380	<10	<1100	<540	<10

NOTES: * Results reported in ug/kg
< indicates that the analyte was not detected above the instrument detection limit.
(1) Results for field blanks ("FB") reported in mg/L
J - indicates an estimated value.

TABLE 1.1
OLD CORTLAND COUNTY LANDFILL FEASIBILITY STUDY
SOIL / WASTE ANALYTICAL RESULTS
SEMI-VOLATILE ORGANIC COMPOUNDS cont. - AUGUST, 1997 SAMPLING

PARAMETER *	SAMPLE LOCATION					
	SOIL SAMPLES			WASTE SAMPLES		
	CL - SB - 01	CL - SB -02	CL - FB - 02 (1)	CL - TP - 01	CL - TP - 02	CL - FB - 01 (1)
2,6-Dinitrotoluene	<370	<380	<10	<1100	<540	<10
3-Nitroaniline	<940	<950	<25	<2900	<1400	<25
Acenaphthene	<370	<380	<10	<1100	<540	<10
2,4-Dinitrophenol	<940	<950	<25	<2900	<1400	<25
4-Nitrophenol	<940	<950	<25	<2900	<1400	<25
Dibenzofuran	<370	<380	<10	<1100	<540	<10
2,4-Dinitrotoluene	<370	<380	<10	<1100	<540	<10
Diethylphthalate	190 J	160 J	<10	<1100	<540	<10
Flourene	<370	<380	<10	<1100	<540	<10
4-Chlorophenyl-phenylether	<370	<380	<10	<1100	<540	<10
4-Nitroaniline	<940	<950	<25	<2900	<1400	<25
4,6-Dinitro-2-methylphenol	<940	<950	<25	<2900	<1400	<25
N-Nitrosodiphenylamine	<370	<380	<10	<1100	<540	<10
4-Bromophenyl-phenylether	<370	<380	<10	<1100	<540	<10
Hexachlorobenzene	<370	<380	<10	<1100	<540	<10
Pentachlorophenol	<940	<950	<25	<2900	<1400	<25
Phenanthrene	<370	<380	<10	<1100	<540	<10
Anthracene	<370	<380	<10	<1100	<540	<10
Carbazole	<370	<380	<10	<1100	<540	<10
Di-n-butylphthalate	<370	<380	<10	<1100	<540	<10
Flouranthene	<370	<380	<10	<1100	<540	<10
Pyrene	<370	<380	<10	<1100	<540	<10
Butylbenzylphthalate	<370	<380	<10	<1100	<540	<10
Benzo(a)anthracene	<370	<380	<10	<1100	<540	<10
3,3'-Dichlorobenzidine	<370	<380	<10	<1100	<540	<10
Chrysene	<370	<380	<10	<1100	<540	<10
bis(2-Ethylhexyl)phthalate	<370	<380	<10	430 J	<540	<10
Di-n-octylphthalate	<370	<380	<10	<1100	<540	<10
Benzo(b)flouranthene	<370	<380	<10	<1100	<540	<10
Benzo(k)flouranthene	<370	<380	<10	<1100	<540	<10
Benzo(a)pyrene	<370	<380	<10	<1100	<540	<10
Indeno(1,2,3-cd)pyrene	<370	<380	<10	<1100	<540	<10
Dibenz(a,h)anthracene	<370	<380	<10	<1100	<540	<10
Benzo(g,h,i)perylene	<370	<380	<10	<1100	<540	<10

NOTES: * Results reported in ug/kg
< indicates that the analyte was not detected above the instrument detection limit.
(1) Results for field blanks ("FB") reported in mg/L
B - indicates that the analyte was also detected in the laboratory QA/QC blank and is likely due to laboratory contamination.
J - indicates an estimated value.

TABLE 1.1
OLD CORTLAND COUNTY LANDFILL FEASIBILITY STUDY
SOIL / WASTE ANALYTICAL RESULTS
PESTICIDES / PCBs - AUGUST, 1997 SAMPLING

	SAMPLE LOCATION					
	SOIL SAMPLES			WASTE SAMPLES		
PARAMETER *	CL - SB - 01	CL - SB - 02	CL - FB - 02 (1)	CL - TP - 01	CL - TP - 02	CL - FB - 01 (1)
alpha-BHC	<1.9	<1.9	<0.050	<5.9	<2.8	<0.050
beta-BHC	<1.9	<1.9	<0.050	<5.9	<2.8	<0.050
delta-BHC	<1.9	<1.9	<0.050	<5.9	<2.8	<0.050
gamma -BHC (Lindane)	<1.9	<1.9	<0.050	<5.9	<2.8	<0.050
Heptachlor	<1.9	<1.9	<0.050	<5.9	<2.8	<0.050
Aldrin	<1.9	<1.9	<0.050	<5.9	<2.8	<0.050
Heptachlor epoxide	<1.9	<1.9	<0.050	<5.9	<2.8	<0.050
Endosulfan I	<1.9	<1.9	<0.050	15	2.7 J	<0.050
Dieldrin	<3.7	<3.8	<0.10	<11	<5.3	<0.10
4,4'-DDE	<3.7	<3.8	<0.10	<11	<5.3	<0.10
Endrin	<3.7	<3.8	<0.10	<11	<5.3	<0.10
Endosulfan II	<3.7	<3.8	<0.10	7.5 J	<5.3	<0.10
4,4'-DDD	<3.7	<3.8	<0.10	<11	<5.3	<0.10
Endosulfan sulfate	<3.7	<3.8	<0.10	<11	<5.3	<0.10
4,4'-DDT	<3.7	<3.8	<0.10	7.2 J	<5.3	<0.10
Methoxychlor	<19	<19	<0.50	110	<28	<0.50
Endrin ketone	<3.7	<3.8	<0.10	<11	<5.3	<0.10
Endrin aldehyde	<3.7	<3.8	<0.10	<11	<5.3	<0.10
alpha-Chlordane	<1.9	<1.9	<0.050	<5.9	<2.8	<0.050
gamma-Chlordane	<1.9	<1.9	<0.050	<5.9	<2.8	<0.050
Toxaphene	<190	<190	<5.0	<590	<280	<5.0
Aroclor-1016	<37	<38	<1.0	<110	<53	<1.0
Aroclor-1221	<75	<76	<2.0	<230	<110	<2.0
Aroclor-1232	<37	<38	<1.0	<110	<53	<1.0
Aroclor-1242	<37	<38	<1.0	<110	<53	<1.0
Aroclor-1248	<37	<38	<1.0	<110	<53.	<1.0
Aroclor-1254	<37	<38	<1.0	<110	<53	<1.0
Aroclor-1260	<37	<38	<1.0	<110	<53	<1.0

NOTES: * Results reported in ug/kg
< indicates that the analyte was not detected above the instrument detection limit.
(1) Results for field blanks ("FB") reported in mg/L
J - indicates an estimated value.

TABLE 1.1
OLD CORTLAND COUNTY LANDFILL FEASIBILITY STUDY
SOIL / WASTE ANALYTICAL RESULTS
TOTAL INORGANICS - AUGUST, 1997 SAMPLING

PARAMETER *	SAMPLE LOCATION					
	SOIL SAMPLES			WASTE SAMPLES		
	CL - SB - 01	CL - SB -02	CL - FB - 02 (1)	CL - TP - 01	CL - TP - 02	CL - FB - 01 (1)
Aluminum	18000	16200	41.8 B	2850	13800	31.4 B
Antimony	0.85 B	0.76 B	<3.0	<10.3	<1.9	<3.0
Arsenic	11.2	8.6	<2.4	14.9 B	11.0	<2.4
Barium	245	174	<0.30	85.1 B	148	<0.30
Beryllium	0.69 B	0.65 B	0.10 B	0.23 B	0.58 B	0.20 B
Boron	3.3 B	4.0 B	13.2 B	8.3 B	3.8 B	13.4 B
Cadmium	<0.07	<0.07	<0.30	<1.0	<0.19	<0.30
Calcium	1490	1710	36.4 B	15400	8680	91.1 B
Chromium	23.6	21.4	<0.40	11000	4090	<0.40
Cobalt	15.1	11.8	<1.1	11.7 B	11.7 B	<1.1
Copper	16.0	22.3	13.1 B	72.6 B	29.5	<0.70
Iron	40100	34000	50.2 B	346000	121000	4.5 B
Lead	9.0	10.8	<1.0	<3.4	6.3	<1.0
Magnesium	5250	4870	9.8 B	2650 B	5360	<8.1
Manganese	593	611	1.1 B	764	636	<0.30
Mercury	<0.05	<0.05	<0.10	<0.16	<0.07	<0.10
Nickel	33.6	29.5	<1.3	46.3	31.9	<1.3
Potassium	1410	1940	<8.4	439 B	1370 B	<8.4
Selenium	<0.63	<0.63	<2.8	<9.7	<1.8	<2.8
Silver	<0.20	<0.20	<0.90	<3.1	<0.58	<0.90
Sodium	136 B	149 B	170 B	224 B	181 B	68.1 B
Thallium	<0.58	<0.58	<2.6	<9.0	<1.7	<2.6
Vanadium	20.7	19.3	<1.2	<4.1	16.8 B	<1.2
Zinc	74.8	70.2	20.2 B	117	88.7	13.1 B
Cyanide	<0.56	<0.57	<10.0	<1.7	<0.81	<10.0

NOTES: * Results reported in mg/kg dry weight
< indicates that the analyte was not detected above the instrument detection limit.
(1) Results for field blanks ("FB") reported in mg/L
B - indicates that the reported value is less than the Contract Required Detection Limit (CRDL) but greater than the instrument detection limit (IDL).

TABLE 1.2
OLD CORTLAND COUNTY LANDFILL FEASIBILITY STUDY
DRUM (LIQUID) SAMPLING ANALYTICAL RESULTS
TCLP PARAMETER LIST - JANUARY, 1998 SAMPLING

PARAMETER *	40CFR261 Hazardous Waste Limit (mg/L)	SAMPLE LOCATION	
		DRUM #1	DRUM #4 (TP-65)
TCLP VOCs by EPA 8240			
Benzene	0.5	<0.03	<0.03
Carbon Tetrachloride	0.5	<0.03	<0.03
Chlorobenzene	100	<0.03	<0.03
Chloroform	6	<0.03	<0.03
1,4-Dichlorobenzene	7.5	<0.03	<0.03
1,2-Dichloroethane	0.5	<0.03	<0.03
1,1-Dichloroethene	0.7	<0.03	<0.03
Methyl Ethyl Ketone	200	<0.1	<0.1
Tetrachloroethene	0.7	<0.03	<0.03
Trichloroethane	0.5	<0.03	<0.03
Vinyl Chloride	0.2	<0.02	<0.02
TCLP SVOCs by EPA 8270			
Total Cresol	200	<10	<10
2,4-Dinitrotoluene	0.13	<5	<5
Hexachlorobenzene	0.13	<5	<5
Hexachlorobutadiene	0.5	<5	<5
Nitrobenzene	2	<5	<5
Pentachlorophenol	100	<10	<10
Pyridine	5	<5	<5
2,4,5-Trichlorophenol	400	<5	<5
2,4,6-Trichlorophenol	2	<5	<5
Benzoic Acid	-	27	52
Benzyl Alcohol	-	11	21
PCBs by EPA 8080			
Aroclor 1016	50	<25	<25
Aroclor 1221	50	<25	<25
Aroclor 1232	50	<25	<25
Aroclor 1242	50	<25	<25
Aroclor 1248	50	<25	<25
Aroclor 1254	50	<25	<25
Aroclor 1260	50	<25	<25
Total PBCs	50	<25	<25
TCLP Herbicides by EPA 8150			
2,4-D	10	<1	<0.1
2,4,5-TP	1	<0.1	<0.01
TCLP Pesticides by EPA 8080			
Chlordane	0.03	<0.03	<0.03
Endrin	0.02	<0.005	<0.005
Heptachlor	0.008	<0.005	<0.005
Lindane	0.4	<0.1	<0.1
Methoxychlor	10	<1	<1
Toxaphene	0.5	<0.1	<0.1
Heptachlor Epoxide	0.008	<0.005	<0.005
MISC. TCLP PARAMETERS			
CORROSIVITY			
Ph	>2 SU and <12.5 SU	NA	NA
IGNITABILITY			
Flash Point	60 degrees C	>60	>60
RCRA REACTIVITY			
Reactive Sulfide	500	<50	<50
Reactive Cyanide	250	<1	<1
TCLP METALS			
Arsenic	5	<0.5	<0.5
Barium	100	1.8	1.2
Cadmium	1	0.01	<0.005
Chromium	5	<0.05	<0.05
Lead	5	0.1	<0.05
Mercury	0.2	<0.0004	<0.0004
Selenium	1	<0.5	<0.5
Silver	5	<0.05	<0.05

NOTES: * Results reported in mg/L unless otherwise noted.
< indicates that the analyte was not detected above the instrument detection limit.
SU - standard units
NA - not analyzed

TABLE 1.3
OLD CORTLAND COUNTY LANDFILL FEASIBILITY STUDY
SOIL AND DRUM (SOLIDS) ANALYTICAL RESULTS
VOLATILE ORGANIC COMPOUNDS - JANUARY, 1998 SAMPLING

PARAMETER *	SAMPLE LOCATION		
	DRUMS	TEST PITS	
	DRUM #2	TP-70	TP-76
Chloromethane	<650	<350	<19000
Vinyl Chloride	<430	<230	<13000
Bromomethane	<650	<350	<19000
Chloroethane	<650	<350	<19000
1,1-Dichloroethene	<650	<350	<19000
Carbon Disulfide	<650	<350	<19000
Acetone	<2200	<1200	<63000
Methlyene Chloride	<650	<350	<19000
cis-1,2-Dichloroethene	<650	<350	<19000
trans-1,2-Dichloroethene	<650	<350	<19000
1,1-Dichloroethane	<650	<350	<19000
Chloroform	<650	<350	<19000
1,2-Dichloroethane	<650	<350	<19000
2-Butanone	<2200	<1200	<63000
1,1,1-Trichloroethane	<650	<350	<19000
Carbon Tetrachloride	<650	<350	<19000
Trichloroethene	<650	<350	<19000
Benzene	<650	<350	<19000
1,2-Dichloropropane	<650	<350	<19000
Bromodichloromethane	<650	<350	<19000
cis-1,3-Dichloropropene	<650	<350	<19000
trans-1,3-Dichloropropene	<650	<350	<19000
1,1,2-Trichlorethane	<650	<350	<19000
Dibromochloromethane	<650	<350	<19000
Bromoform	<650	<350	<19000
4-Methyl-2-Pentanone	<2200	<1200	<63000
Toluene	1400	<350	<19000
Tetrachloroethene	<650	<350	<19000
2-Hexanone	<2200	<1200	<63000
Chlorobenzene	<650	<350	<19000
Ethylbenzene	<650	590	<19000
m-Xylene and p-Xylene	7000	22000	<19000
o-Xylene	40000	40000	4900000
Styrene	<650	<350	<19000
1,1,2,2-Tetrachloroethane	<650	<350	<19000
Total VOCs **	48400	62590	4900000

NOTES: * Results reported in ug/kg

** Total Volatile Organic Compounds (sum of all compounds believed to represent site contamination).

< indicates that the analyte was not detected above the instrument detection limit.

TABLE 1.3
OLD CORTLAND COUNTY LANDFILL FEASIBILITY STUDY
SOIL AND DRUM (SOLIDS) ANALYTICAL RESULTS
SEMI-VOLATILE ORGANIC COMPOUNDS - JANUARY, 1998 SAMPLING

PARAMETER *	SAMPLE LOCATION		
	DRUMS	TEST PITS	
	DRUM #2	TP-70	TP-76
Phenol	<14,000,000	<120,000	<83,000
bis(2-Chloroethyl)ether	<14,000,000	<120,000	<83,000
2-Chlorophenol	<14,000,000	<120,000	<83,000
1,3-Dichlorobenzene	<14,000,000	<120,000	<83,000
1,4-Dichlorobenzene	<14,000,000	<120,000	<83,000
1,2-Dichlorobenzene	<14,000,000	<120,000	<83,000
2-Methylphenol	<14,000,000	<120,000	<83,000
2,2'-oxybis(1-Chloropropane)	<14,000,000	<120,000	<83,000
4-Methylphenol	<14,000,000	<120,000	<83,000
N-Nitroso-di-n-propylamine	<14,000,000	<120,000	<83,000
Hexachloroethane	<14,000,000	<120,000	<83,000
Nitrobenzene	<14,000,000	<120,000	<83,000
Isophorone	<14,000,000	<120,000	<83,000
2-Nitrophenol	<14,000,000	<120,000	<83,000
2,4-Dimethylphenol	<14,000,000	7000	<83,000
bis(2-Chloroethoxy)methane	<14,000,000	<120,000	<83,000
2,4-Dichlorophenol	<14,000,000	<120,000	<83,000
1,2,4-Trichlorobenzene	<14,000,000	<120,000	<83,000
Naphthalene	<14,000,000	<120,000	<83,000
4-Chloroaniline	<14,000,000	<120,000	<83,000
Hexachlorobutadiene	<14,000,000	<120,000	<83,000
4-Chloro-3-methylphenol	<14,000,000	<120,000	<83,000
2-Methylnaphthalene	<14,000,000	<120,000	<83,000
Hexachlorocyclopentadiene	<14,000,000	<120,000	<83,000
2,4,6-Trichlorophenol	<14,000,000	<120,000	<83,000
2,4,5-Trichlorophenol	<14,000,000	<120,000	<83,000
2-Chloronaphthalene	<14,000,000	<120,000	<83,000
2-Nitroaniline	<70,000,000	<580,000	<400,000
Dimethylphthalate	<14,000,000	<120,000	<83,000
Acenaphthylene	<14,000,000	<120,000	<83,000

NOTES: * Results reported in ug/kg
< indicates that the analyte was not detected above the instrument detection limit.

TABLE 1.3
OLD CORTLAND COUNTY LANDFILL FEASIBILITY STUDY
SOIL AND DRUM (SOLIDS) ANALYTICAL RESULTS
SEMI-VOLATILE ORGANIC COMPOUNDS cont. - JANUARY, 1998 SAMPLING

PARAMETER *	SAMPLE LOCATION		
	DRUMS	TEST PITS	
	DRUM #2	TP-70	TP-76
2,6-Dinitrotoluene	<14,000,000	<120000	<83000
3-Nitroaniline	<70,000,000	<580000	<83000
Acenaphthene	<14,000,000	<120000	<83000
2,4-Dinitrophenol	<70,000,000	<580000	<83000
4-Nitrophenol	<70,000,000	<580000	<83000
Dibenzofuran	<14,000,000	<120000	<83000
2,4-Dinitrotoluene	<14,000,000	<120000	<400000
Diethylphthalate	<14,000,000	<120000	<83000
Flourene	<14,000,000	<120000	<83000
4-Chlorophenyl-phenylether	<14,000,000	<120000	<83000
4-Nitroaniline	<70,000,000	<580000	<400000
4,6-Dinitro-2-methylphenol	<70,000,000	<580000	<83000
N-Nitrosodiphenylamine	<14,000,000	<120000	<83000
4-Bromophenyl-phenylether	<14,000,000	<120000	<83000
Hexachlorobenzene	<14,000,000	<120000	<83000
Pentachlorophenol	<28,000,000	<240000	<170000
Phenanthrene	<14,000,000	<120000	<83000
Anthracene	<14,000,000	<120000	<83000
Carbazole	<14,000,000	<120000	<83000
Di-n-butylphthalate	<14,000,000	<120000	<83000
Flouranthene	<14,000,000	<120000	<83000
Pyrene	<14,000,000	<120000	<83000
Butylbenzylphthalate	<14,000,000	<120000	<83000
Benzo(a)anthracene	<14,000,000	<120000	<83000
3,3'-Dichlorobenzidine	<14,000,000	<120000	<83000
Chrysene	<14,000,000	<120000	<83000
bis(2-Ethylhexyl)phthalate	<14,000,000	4000	<83000
Di-n-octylphthalate	<14,000,000	6000	<83000
Benzo(b)flouranthene	<14,000,000	<120000	<83000
Benzo(k)flouranthene	<14,000,000	<120000	<83000
Benzo(a)pyrene	<14,000,000	<120000	<83000
Indeno(1,2,3-cd)pyrene	<14,000,000	<120000	<83000
Dibenz(a,h)anthracene	<14,000,000	<120000	<83000
Benzo(g,h,i)perylene	<14,000,000	<120000	<83000

NOTES: * Results reported in ug/kg
< indicates that the analyte was not detected above the instrument detection limit.

TABLE 1.3
OLD CORTLAND COUNTY LANDFILL FEASIBILITY STUDY
SOIL AND DRUM (SOLIDS) ANALYTICAL RESULTS
PCBs - JANUARY, 1998 SAMPLING

PARAMETER *	SAMPLE LOCATION		
	DRUMS	TEST PITS	
	DRUM #2	TP-70	TP-76
Aroclor-1016	<4	<3	<3
Aroclor-1221	<4	<3	<3
Aroclor-1232	<4	<3	<3
Aroclor-1242	<4	<3	<3
Aroclor-1248	<4	<3	<3
Aroclor-1254	<4	<3	<3
Aroclor-1260	<4	<3	<3

NOTES: * Results reported in mg/kg dry weight
< indicates that the analyte was not detected above the instrument detection limit.

TABLE 1.3
OLD CORTLAND COUNTY LANDFILL FEASIBILITY STUDY
SOIL AND DRUM (SOLIDS) ANALYTICAL RESULTS
PETROLEUM FINGERPRINT ANALYSIS - JANUARY, 1998 SAMPLING

NYSDOH Method 1310-FID LIST *	SAMPLE LOCATION		
	DRUMS	TEST PITS	
	DRUM #2	TP-70	TP-76
Gasoline	<70	<30	<40
Fuel #1 (Kerosene)	<70	<30	<40
Fuel #2	<70	<30	<40
Lubricating/Insulating/Hydrualic Oil Group	<70	<30	<40
Unidentified Hydrocarbons	600000	2000	6800
Total Petroleum Hydrocarbons	600000	2000	6800

NOTES: * Results reported in mg/kg dry weight
< indicates that the analyte was not detected above the instrument detection limit.

TABLE 1.4
OLD CORTLAND COUNTY LANDFILL FEASIBILITY STUDY
SUMMARY OF CONTAMINATED BEDROCK MONITORING WELL LOCATIONS

NOTES APPLICABLE TO ALL RESULTS SHOWN IN THIS TABLE:

1. (1) "Standard or [GV]" refers to the 6 NYCRR Part 703 Groundwater Standards or [Guidance Values].
2. - Indicates that a standard or guidance value has not been assigned.
3. < Indicates that the analyte was not detected above the instrument detection limit under the lab's QA/QC procedures for this project, and there was no other evidence of the analyte being present.
4. Landfill related contaminant levels that are in excess of applicable standards or guidance values, and that are not due to background conditions, are shown in a **bigger and bolder font.**
5. For downgradient (i.e., non-background) sampling locations, concentrations in excess of applicable standards or guidance values – but which are not considered to be landfill related – are shown in a box. Such designations have been made based on one or more of the following factors: (a) the concentrations are within the range of background levels; (b) the exceedances are not reproduced between sampling events; (c) a comparison of total and dissoved inorganic concentrations; and/or (d) a consideration of overall water quality signature.

LEACHATE INDICATORS

Results reported in mg/L except where noted otherwise.

PARAMETER	Standard or [GV] (1)	(Background Well) CL-CD-1RA		D-1		CL-MW-1B		CL-MW-2B		CL-MW-3A		CL-MW-3B		CL-MW-4A		CL-MW-5A		CL-MW-6B	
		AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97
BOD5	-	<2	<2	<2	19	<2	<2	2	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	2
Bromide	[2]	1.0	1.2	0.7	0.6	<0.5	<0.5	1.1	0.9	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloride	250	<2.0	2.5	7.8	7.8	<2.0	<2.0	**267**	238	31.4	28.7	32.0	33.6	79.1	74.6	44.5	10.1	38.2	35.0
COD	-	<15	<15	<15	<15	<15	<15	58	61	19	<15	22	<15	37	22	16	<15	40	19
Color (units)	-	<5	20	<5	<5	<5	<5	5	10	<5	<5	<5	<5	<5	<5	20	<5	<5	20
Ammonia	2	0.04	0.11	0.70	0.03	<0.02	0.04	0.95	1.3	<0.02	0.09	<0.02	0.04	<0.02	0.2	<0.02	0.18	0.09	2.5
Nitrate	10	<0.1	<0.1	0.1	0.2	0.2	<0.1	<0.1	<0.1	<0.1	0.19	<0.1	<0.1	<0.1	<0.10	0.8	<0.10	0.6	<0.10
Total Phenols (ug/L)	1	<1.0	<1.0	<1.0	2.3	<1.0	<1.0	**4.4**	**3.9**	2.7	<1.0	2.3	1.1	1.8	<1.0	1.1	<1.0	3.2	<1.0
Sulfate	250	10.8	15.3	<5.0	<5.0	5.2	<5.0	<5.0	<5.0	16.0	13.0	13.8	12.4	9.8	11.5	22.0	11.5	27.1	22.2
Total Alkalinity	-	134	132	146	145	94.8	93.6	577	673	145	146	235	190	253	355	130	115	240	224
Total Dissolved Solids	500	163	150	162	161	143	86	**1640**	**1230**	320	269	349	332	**550**	493	116	156	98	280
Total Kjeldhal Nitrogen	-	0.2	0.21	1.4	<0.20	<0.2	<0.20	2.6	2.0	0.4	0.24	0.3	<0.20	0.5	0.40	0.4	0.24	0.6	3.3
TOC	-	2.1	<1.0	4.7	1.1	9.3	<1.0	12.3	11.9	4.5	1.9	7.9	3.7	7.7	5.6	2.7	<1.0	6.0	5.8
Total Hardness	-	160	160	60	78	88	140	960	900	1250	200	280	300	380	464	250	140	300	240

VOLATILE ORGANIC COMPOUNDS

Results reported in ug/L

PARAMETER	Standard or [GV] (1)	(Background Well) CL-CD-1RA		D-1		CL-MW-1B		CL-MW-2B		CL-MW-3A		CL-MW-3B		CL-MW-4A		CL-MW-5A		CL-MW-6B	
		AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97
Chloroethane	5	<10	<10	<10	<10	<10	<10	4 J	3 J	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Acetone	[50]	<10	<10	<10	<10	<10	<10	<10	<10	2 J	<10	<10	<10	<10	<10	<10	<10	<10	<10
Methlyene Chloride	5	2 JB	<10	1 JB	<10	<10	<10	1 JB	<10	5 JB	<10	<10	<10	6 JB	<10	7 JB	<10	<10	<10
1,2-Dichloroethene (total)	5	<10	<10	<10	<10	<10	<10	1 J	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
1,1-Dichloroethane	5	<10	<10	<10	<10	<10	<10	1 J	1 J	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Benzene	0.7	<10	<10	<10	<10	<10	<10	**2 J**	**2 J**	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Toluene	5	<10	<10	<10	<10	<10	<10	1 J	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Chlorobenzene	5	<10	<10	<10	<10	<10	<10	1 J	1 J	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total VOCs **	5	ND	ND	ND	ND	ND	ND	**10**	7	2	ND	ND	ND	ND	ND	ND	ND	ND	ND

NOTES:** Total Volatile Organic Compounds (sum of all compounds believed to represent site contamination).

ND - not detected B - indicates that the analyte was also detected in the blank and is not considered to be landfill related. J - indicates an estimated value.

SEMI-VOLATILE ORGANIC COMPOUNDS

Results reported in ug/L

PARAMETER	Standard or [GV] (1)	(Background Well) CL-CD-1RA		D-1		CL-MW-1B		CL-MW-2B		CL-MW-3A		CL-MW-3B		CL-MW-4A		CL-MW-5A		CL-MW-6B	
		AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97
Diethylphthalate	[50]	1 J	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	1 J	<10	<10	<10	<10	<10
Di-n-butylphthalate	50	<10	<10	1 J	<10	<10	<10	<10	<10	<10	<10	<10	<10	1 J	<10	<10	<10	<10	<10
bis(2-Ethylhexyl)phthalate	50	<10	<10	<10	6 J	<10	<10	<10	1 JB	<10	<10	<10	<10	3 J	<10	2 J	<10	<10	<10

B - Indicates that the analyte was also detected in the blank and is not considered to be landfill related. J - indicates an estimated value.

PESTICIDES/PCBs (No Contamination Detected)

TABLE 1.4 – Continued
SUMMARY OF CONTAMINATED BEDROCK MONITORING WELL LOCATIONS
TOTAL INORGANICS
Results reported in ug/L

PARAMETER	Standard or [GV] (1)	(Background Well) CL-CD-1RA AUG '97	CL-CD-1RA OCT '97	D-1 AUG '97	D-1 OCT '97	CL-MW-1B AUG '97	CL-MW-1B OCT '97	CL-MW-2B AUG '97	CL-MW-2B OCT '97	CL-MW-3A AUG '97	CL-MW-3A OCT '97	CL-MW-3B AUG '97	CL-MW-3B OCT '97	CL-MW-4A AUG '97	CL-MW-4A OCT '97	CL-MW-5A AUG '97	CL-MW-5A OCT '97	CL-MW-6B AUG '97	CL-MW-6B OCT '97
Aluminum	-	587	5240	<8.3	52.1 B	662	134 B	2030	5310	21700	2390	2010	184 B	1610	1320	10100	228	8590	642
Antimony	[3]	3.5 B	3.1 B	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	3.4 B	<3.0	<3.0	<3.0	<3.0	4.5 B	<3.0	<3.0	<3.0
Arsenic	25	3.2 B	4.0 B	<2.4	<2.4	<2.4	<2.4	7.0 B	8.3 B	12.7	<2.4	<2.4	<2.4	<2.4	<2.4	6.1 B	<2.4	9.0 B	8.4 B
Barium	1000	168 B	229	236	273	168 B	154 B	**1590**	**1360**	567	343	402	291	803	**1260**	**1580**	502	521	480
Beryllium	[3]	<0.10	1.1 B	<0.10	<0.10	0.10 B	<0.10	0.23 B	0.37 B	1.0 B	0.13 B	0.10 B	0.13 B	0.10 B	0.13 B	0.63 B	<0.10	0.40 B	0.10 B
Boron	1000	22.7 B	25.3 B	306	299	19.7 B	24.7 B	355	292	70.9	28.6 B	66.2 B	62.6 B	76.5 B	124	34.8 B	21.0 B	145	145
Cadmium	10	<0.30	1.1 B	<0.30	0.33 B	<0.30	<0.30	0.30 B	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	0.40 B	4.2 B	<0.30	<0.30	<0.30
Calcium	-	41500	45700	19500	23800	26700	24700	288000	245000	57800	53700	73800	74400	110000	127000	45800	32100	70500	55600
Chromium	50	4.2 B	8.9 B	<0.40	<0.40	2.0 B	<0.40	4.0 B	8.6 B	24.9	2.2 B	3.2 B	<0.40	1.5 B	0.93 B	9.2 B	<0.40	9.2 B	1.7 B
Cobalt	-	<1.1	5.3 B	<1.1	<1.1	<1.1	<1.1	9.1 B	14.1 B	12.1 B	1.9 B	2.0 B	1.4 B	3.6 B	3.5 B	10.5 B	<1.1	11.2 B	5.6 B
Copper	200	4.0 B	8.5 B	3.3 B	7.0 B	4.0 B	2.5 B	6.9 B	11.8 B	31.5	7.6 B	5.1 B	1.8 B	6.6 B	7.6 B	18.1 B	3.7 B	11.6 B	5.1 B
Iron	300	1010	10300	97.7 B	462	1330	226	**4300**	**10700**	26600	3580	3040	372	2200	1990	11500	460	**10600**	**3000**
Lead	25	1.7 B	4.9	<1.0	1.5 B	<1.0	<1.0	4.4	5.8	7.7	<1.0	1.3 B	<1.0	3.1	2.4 B	11.4	<1.0	4.4	<1.0
Magnesium	[35000]	9500	10400	4970 B	5190	6470	5840	**61700**	**49900**	17000	11000	22800	21500	24300	26000	14800	9450	19000	12700
Manganese	300	190	352	24.5	35.7	195	146	**8240**	**7430**	732	174	120	69.7	**1170**	**2150**	465	66.1	**3430**	**4170**
Nickel	-	<1.3	10.4 B	<1.3	<1.3	<1.3	<1.3	12.9 B	18.8 B	24.8 B	3.8 B	3.6 B	1.8 B	4.4 B	6.3 B	11.0 B	<1.3	14.4 B	5.9 B
Potassium	-	1010 B	1910 B	2030 B	1610 B	1560 B	529 B	3000 B	2900 B	7430	1870 B	2050 B	1200 B	2010 B	2020 B	3030 B	897 B	4080 B	2720 B
Sodium	20000	5410	4760 B	38900	40200	7380	6180	**64100**	**53900**	10400	6540	11200	9780	13300	15700	**31600**	9530	**38000**	**31400**
Thallium	[4]	<2.6	<2.6	<2.6	<2.6	<2.6	<2.6	3.7 B	<2.6	<2.6	<2.6	<2.6	<2.6	<2.6	<2.6	<2.6	<2.6	<2.6	<2.6
Vanadium	-	<1.2	8.6 B	<1.2	<1.2	<1.2	<1.2	2.9 B	7.5 B	29.6 B	3.9 B	3.0 B	<1.2	1.6 B	1.9 B	10.2 B	1.2 B	8.3 B	1.2 B
Zinc	300	24.0	36.6	31.2	36.5	35.1	16.3 B	103	48.4	112	26.5	62.1	15.5 B	50.1	23.8	105	21.2	89.4	24.8
Iron & Manganese	500	1200	10652	122.2	497.7	1525	372	**12540**	**18130**	27332	3754	3160	441.7	3370	4140	11985	526.1	**14030**	**7170**

NOTE: B - Indicates that the reported value is less than the Contract Required Detection Limit (CRDL), but greater than the instrument detection limit.

DISSOLVED INORGANICS
Results reported in ug/L

PARAMETER	Standard or [GV] (1)	(Background Well) CL-CD-1RA AUG '97	CL-CD-1RA OCT '97	D-1 AUG '97	D-1 OCT '97	CL-MW-1B AUG '97	CL-MW-1B OCT '97	CL-MW-2B AUG '97	CL-MW-2B OCT '97	CL-MW-3A AUG '97	CL-MW-3A OCT '97	CL-MW-3B AUG '97	CL-MW-3B OCT '97	CL-MW-4A AUG '97	CL-MW-4A OCT '97	CL-MW-5A AUG '97	CL-MW-5A OCT '97	CL-MW-6B AUG '97	CL-MW-6B OCT '97
Aluminum	-	19.8 B	44.2 B	<8.3	23.4 B	14.6 B	20.9 B	17.9 B	15.4 B	<8.3	15.8	16.0 B	27.3 B	17.3 B	22.6 B	<8.3	19.0 B	<8.3	13.2 B
Antimony	[3]	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	**3.8 B**	<3.0	<3.0	<3.0	<3.0	<3.0	**5.9 B**	<3.0	<3.0	<3.0
Arsenic	25	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	3.6 B	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	4.8 B	7.3 B
Barium	1000	163 B	173 B	252	231	151 B	155 B	**1550**	**1450**	242	276	257	271	686	1060	267	396	398	478
Beryllium	[3]	<0.10	0.67 B	0.10 B	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10 B	<0.10	0.10 B	<0.10	<0.10	<0.10	<0.10	<0.10
Boron	1000	19.9 B	28.5 B	314	257	19.5 B	16.2 B	334	321	32.4 B	27.5 B	53.1 B	55.9 B	73.0 B	120	28.0 B	21.8 B	125	140
Cadmium	10	<0.30	0.63 B	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Calcium	-	40700	39500	21500	19100	24800	24500	281000	274000	57900	54600	73200	71900	112000	129000	42100	34100	67700	56300
Chromium	50	<0.40	1.2 B	<0.40	<0.40	0.80 B	0.73 B	0.90 B	1.4 B	<0.4	<0.40	<0.40	<0.40	<0.4	<0.40	<0.4	0.40 B	<0.40	0.87 B
Cobalt	-	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	6.7 B	6.1 B	<1.1	<1.1	<1.1	<1.1	2.4 B	2.2 B	1.4 B	<1.1	5.2 B	4.1 B
Copper	200	2.6 B	1.2 B	1.6 B	<0.70	<0.70	<0.70	2.2 B	<0.70	2.4 B	0.83 B	2.4 B	0.70 B	6.9 B	1.1 B	5.7 B	<0.70	1.1 B	<0.70
Iron	300	23.8 B	39.4 B	106	122	17.2 B	14.1 B	**582**	**595**	6.1 B	11.4 B	9.1 B	19.1 B	5.0 B	37.2 B	8.1 B	11.7 B	**346**	**1420**
Magnesium	[35000]	9650	8300	5570	4630 B	6620	5880	**61700**	**55000**	12900	10900	23000	20900	25200	26100	12600	10200	17300	12900
Manganese	300	168	146	26.9	25.4	141	134	**8070**	**8000**	123	94.1	61.7	55.3	**1080**	**2080**	95.1	43.3	**3300**	**3990**
Nickel	-	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	9.3 B	9.7 B	<1.3	1.7 B	<1.3	1.4 B	2.1 B	5.1 B	<1.3	<1.3	4.6 B	4.8 B
Potassium	-	911 B	951 B	2070 B	1600 B	1630 B	514 B	2800 B	2340 B	2750 B	1420 B	1620 B	1270 B	1710 B	1930 B	1190 B	840 B	2970 B	2770 B
Sodium	20000	5500	5290	41000	38100	7530	6590	**62500**	**62800**	10200	7980	11100	10200	13500	16100	**31900**	10300	**38200**	**33300**
Zinc	300	82.5	14.8 B	18.8 B	14.6 B	39.6	15.2 B	63.5	23.0	24.9	38.7	37.5	15.5 B	39.3	16.6 B	26.2	18.2 B	65.1	20.7
Iron & Manganese	500	191.8	187.4	132.9	147.4	158.2	148.1	**8652**	**8595**	129.1	105.5	70.8	74.4	**1085**	**2117.2**	103.2	55	**3646**	**5410**

NOTE: B - Indicates that the reported value is less than the Contract Required Detection Limit (CRDL), but greater than the instrument detection limit.

TABLE 1.5
OLD CORTLAND COUNTY LANDFILL FEASIBILITY STUDY
SUMMARY OF CONTAMINATED OVERBURDEN MONITORING WELL LOCATIONS

NOTES APPLICABLE TO ALL RESULTS SHOWN IN THIS TABLE:

1. (1) "Standard or [GV]" refers to the 6 NYCRR Part 703 Groundwater Standards or [Guidance Values].
2. - indicates that a standard or guidance value has not been assigned.
3. < indicates that the analyte was not detected above the instrument detection limit under the lab's QA/QC procedures for this project, and there was no other evidence of the analyte being present.
4. Landfill related contaminant levels that are in excess of applicable standards or guidance values, and that are not due to background conditions, are shown in a **bigger and bolder font.**
5. For downgradient (i.e., non-background) sampling locations, concentrations in excess of applicable standards or guidance values -- but which are not considered to be landfill related -- are shown in a box. Such designations have been made based on one or more of the following factors: (a) the concentrations are within the range of background levels; (b) the exceedances are not reproduced between sampling events; (c) a comparison of total and dissoved inorganic concentrations; and/or (d) a consideration of overall water quality signature.

LEACHATE INDICATORS

		(Background Well)		*Results reported in mg/L except where noted otherwise.*										(Well thru Waste)	
	Standard	CL-CD-1		DO-2		CL-MW-1A		CL-MW-2A		CL-MW-6A		CL-MW-7A		CL-EB-1	
PARAMETER	or [GV] (1)	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97
BOD5	-	<2	<2	<2	<2	5	<2	6	3	3	6	<2	2	680	23
Bromide	[2]	0.7	0.9	0.7	0.6	1.2	0.8	0.8	<0.5	0.9	1.0	0.6	<0.5	**5.2**	**2.7**
Chloride	250	<2.0	<2.0	23.3	26.3	152	46.0	156	149	79.1	71.8	**300**	**276**	**1220**	**1260**
COD	-	52	49	16	19	305	64	127	136	94	82	43	112	1670	1080
Color (units)	-	10	30	50	10	5	20	30	60	60	80	20	5	750	300
Ammonia	2	0.09	0.63	<0.02	0.50	**6.0**	**2.6**	**23.0**	**9.1**	1.6	0.02	0.93	0.89	**544**	**271**
Nitrate	10	0.1	0.39	0.2	0.12	<0.1	<0.10	<0.1	0.14	<0.1	<0.10	<0.1	0.20	<0.1	<0.10
Total Phenols (ug/L)	1	<1.0	<1.0	<1.0	<1.0	**3.0**	**1.5**	**7.1**	**6.6**	**3.0**	**1.8**	**5.1**	**2.7**	**174**	**73.5**
Sulfate	250	14.6	17	16.0	16.9	20.6	14.6	<5.0	<5.0	13.8	30.6	27.4	20.2	<5.0	<5.0
Total Alkalinity	-	132	130	197	222	160	145	702	784	357	325	569	660	214	3110
Total Dissolved Solids	500	156	145	292	494	494	214	**1180**	**986**	**595**	472	**1220**	**1240**	**2370**	**3660**
Total Kjeldahl Nitrogen	-	<0.2	0.90	0.6	0.63	18.0	3.8	31.5	21.2	1.5	<0.20	1.1	1.4	730	467
TOC	-	2.1	1.1	4.3	1.2	4.2	1.6	42.5	24.1	14.0	10.6	10.1	12.6	413	241
Total Hardness	-	600	500	290	260	4000	240	1300	720	650	550	1010	1150	2300	1200

VOLATILE ORGANIC COMPOUNDS

		(Background Well)		*Results reported in ug/L.*										(Well thru Waste)	
	Standard	CL-CD-1		DO-2		CL-MW-1A		CL-MW-2A		CL-MW-6A		CL-MW-7A		CL-EB-1	
PARAMETER	or [GV] (1)	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97
Vinyl Chloride	2	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	2 J	**5 J**	<10	<10
Chloroethane	5	<10	<10	<10	<10	<10	<10	5 J	4 J	<10	1 J	<10	1 J	<10	<10
Acetone	[50]	<10	<10	<10	<10	10	<10	<10	<10	<10	<10	<10	<10	41	3 J
Methlyene Chloride	5	2 JB	<10	3 JB	<10	<10	<10	1 JB	<10	<10	<10	1 JB	<10	2 JB	<10
1,2-Dichloroethene (total)	5	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	1 J	2 J	<10	<10
1,1-Dichloroethane	5	<10	<10	<10	<10	<10	<10	<10	<10	1 J	1 J	3 J	4 J	<10	<10
2-Butanone	[50]	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	**57**	<10
Benzene	0.7	<10	<10	<10	<10	<10	<10	**5 J**	**6 J**	<10	<10	<10	<10	**13**	**14**
4-Methyl-2-Pentanone	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	6 J	<10
Toluene	5	<10	<10	<10	<10	<10	<10	1 J	<10	<10	<10	<10	<10	**73**	**18**
Chlorobenzene	5	<10	<10	<10	<10	<10	<10	5 J	5 J	<10	<10	<10	<10	**61**	**35**
Ethylbenzene	5	<10	<10	<10	<10	<10	<10	2 J	1 J	<10	<10	<10	<10	**140**	**160**
Xylenes (total)	5	<10	<10	<10	<10	<10	<10	5 J	<10	<10	<10	<10	<10	**350**	**450**
Styrene	5	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	**6 J**	2 J
Total VOCs **	5	ND	ND	ND	ND	**10**	ND	**23**	**16**	1	2	**6**	**12**	**747**	**682**

NOTES: ** Total Volatile Organic Compounds (sum of all compounds believed to represent site contamination). J - indicates an estimated value.
ND - not detected B - indicates that the analyte was also detected in the blank and is not considered to be landfill related.

SEMI-VOLATILE ORGANIC COMPOUNDS

		(Background Well)		*Results reported in ug/L.*										(Well thru Waste)	
	Standard	CL-CD-1		DO-2		CL-MW-1A		CL-MW-2A		CL-MW-6A		CL-MW-7A		CL-EB-1	
PARAMETER	or [GV] (1)	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97
Phenol	1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	**18**	<10
1,4-Dichlorobenzene (2)	4.7	<10	<10	<10	<10	<10	<10	1 J	2 J	<10	<10	<10	<10	4 J	4 J
2,4-Dimethylphenol	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	43
Naphthalene	[10]	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	**17**	**14**
2-Methylnaphthalene	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	4 J	2 J
Diethylphthalate	[50]	<10	<10	<10	<10	<10	<10	<10	1 J	<10	<10	<10	<10	20	6 J
bis(2-Ethylhexyl)phthalate	50	1 J	<10	<10	<10	<10	<10	<10	<10	2 J	<10	<10	<10	<10	2 J

NOTES: J - indicates an estimated value. (2) Standard applies to the sum of 1,2-Dichlorobenzene and 1,4-Dichlorobenzene isomers.

PESTICIDES/PCBs (No contamination detected)

TABLE 1.5 – Continued
SUMMARY OF CONTAMINATED OVERBURDEN MONITORING WELL LOCATIONS
TOTAL INORGANICS
Results reported in ug/L.

PARAMETER	Standard or [GV] (1)	(Background Well) CL-CD-1 (A) AUG '97	CL-CD-1 (A) OCT '97	DO-2 (A) AUG '97	DO-2 (A) OCT '97	CL-MW-1A AUG '97	CL-MW-1A OCT '97	CL-MW-2A AUG '97	CL-MW-2A OCT '97	CL-MW-6A AUG '97	CL-MW-6A OCT '97	CL-MW-7A AUG '97	CL-MW-7A OCT '97	(Well thru Waste) CL-EB-1 AUG '97	CL-EB-1 OCT '97
Aluminum	-	71600	54400	724000	7490	724000	16900	79300	59100	59100	38600	40000	88400	82300	23200
Antimony	[3]	4.4 B	<3.0	<3.0	3.0 B	<3.0	<3.0	4.9 B	<3.0	3.6 B	<3.0	<3.0	<3.0	5.5 B	<3.0
Arsenic	25	35.4	34.5	3.4 B	5.2 B	353	13.4	63.1	53.7	47.6	40.4	17.6	45.9	45.3	20.5
Barium	1000	799	650	316	269	8110	258	1750	1490	1790	1630	1360	1990	2120	1200
Beryllium	[3]	2.8 B	2.3 B	0.30 B	0.37 B	28.7	0.83 B	3.7 B	2.5 B	2.3 B	1.7 B	1.5 B	3.7 B	2.5 B	0.90 B
Boron	1000	40.6 B	45.6 B	44.0 B	28.4 B	87.3 B	66.5 B	1210	961	282	320	332	410	5410	4030
Cadmium	10	<0.30	0.67 B	<0.30	0.40 B	<0.30	<0.30	<0.30	1.6 B	<0.30	1.1 B	0.47 B	2.0 B	21.5	14.4
Calcium	-	103000	113000	72600	68300	430000	48600	186000	172000	99400	82200	234000	271000	174000	104000
Chromium	50	120	107	11.2	13.4	1070	26.5	112	96.7	85.9	70.5	55.6	146	158	60.3
Cobalt	-	53.4	51.8	4.2 B	6.5 B	590	16.8 B	71.9	62.8	56.0	46.3 B	31.1	79.1	75.1	38.9 B
Copper	200	134	103	14.7 B	16.2 B	996	25.4	104	77.9	97.3	68.9	63.7	129	601	189
Iron	300	128000	115000	10700	13400	1550000	35700	154000	131000	111000	85500	65900	174000	197000	66700
Lead	25	49.5	43.8	3.9	4.7	454	12.3	56.1	43.6	16.8	11.3	25.1	58.5	246	156
Magnesium	[35000]	39000	35400	14500	13600	309000	15600	61600	53600	37600	28800	67000	88300	182000	135000
Manganese	300	6550	7800	386	697	24600	783	35700	31600	14500	12700	5870	9550	3670	1470
Mercury	2	<0.10	<0.10	<0.10	<0.10	1.4	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	2.0	0.54
Nickel	-	117	113	10.4 B	14.3 B	1330	36.4 B	151	132	112	96.3	78.3	192	394	284
Potassium	-	11200	7610	2920 B	2580 B	77500	6970	23400	17000	14400	10100	10400	13500	415000	346000
Selenium	10	6.5	3.3 B	<2.8	<2.8	<28	<2.8	<2.8	<2.8	<2.8	<2.8	4.1 B	4.7 B	5.0	<2.8
Silver	50	<0.90	<0.90	<0.90	<0.90	<9.0	<0.90	2.4 B	1.4 B	1.3 B	<0.90	<0.90	<0.90	8.4 B	1.9 B
Sodium	20000	6420	5620	10700	11900	37300	26000	119000	102000	53300	46800	118000	113000	994000	821000
Thallium	[4]	<2.6	<2.6	<2.6	<2.6	<26	<2.6	4.0 B	<2.6	<2.6	<2.6	<2.6	<2.6	<2.6	4.2 B
Vanadium	-	92.8	75.9	10.6 B	10.9 B	856	24.3 B	102	86.6	72.6	53.0	48.7 B	127	108	35.5 B
Zinc	300	347	286	68.4	57.7	3360	87.4	400	278	271	177	200	408	1580	544
Cyanide	100	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	13.7
Iron & Manganese	500	134550	122800	11086	14097	1574600	36483	189700	162600	125500	98200	71770	183550	200670	68170

NOTES: (A) Concentrations in well CL-CD-1 appear to be anomalous and are not considered to be representative of background conditions; DO-2 used as background for total inorganics.

B - indicates that the reported value is less than the Contract Required Detection Limit (CRDL), but greater than the instrument detection limit (IDL).

DISSOLVED INORGANICS
Results reported in ug/L.

PARAMETER	Standard or [GV] (1)	(Background Well) CL-CD-1 AUG '97	CL-CD-1 OCT '97	DO-2 AUG '97	DO-2 OCT '97	CL-MW-1A AUG '97	CL-MW-1A OCT '97	CL-MW-2A AUG '97	CL-MW-2A OCT '97	CL-MW-6A AUG '97	CL-MW-6A OCT '97	CL-MW-7A AUG '97	CL-MW-7A OCT '97	(Well thru Waste) CL-EB-1 AUG '97	CL-EB-1 OCT '97
Aluminum	-	46.2 B	36.6 B	<8.3	19.1 B	16.3 B	40.7 B	<8.3	48.2 B	14.2 B	38.2 B	<8.3	75.5 B	175 B	61.1 B
Arsenic	25	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	12.3	13.9	19.8	18.9	<2.4	<2.4	13.8	8.1 B
Barium	1000	64.9 B	68.1 B	195 B	194 B	137 B	68.0 B	787	786	847	880	822	887	1170	602
Beryllium	[3]	0.60 B	<0.10	<0.10	<0.10	<0.10	<0.10	0.17 B	0.10 B	0.10 B	<0.10	0.10 B	<0.10	0.20 B	0.13 B
Boron	1000	20.8 B	16.0 B	22.5 B	22.3 B	63.1 B	56.1 B	1210	992	284	333	331	396	5430	3880
Cadmium	10	0.57 B	<0.30	<0.30	<0.30	<0.30	<0.30	0.53 B	<0.30	<0.30	<0.30	0.30 B	<0.30	0.30 B	<0.30
Calcium	-	40500	38100	74600	72200	67600	40300	183000	183000	104000	88700	220000	255000	138000	90300
Chromium	50	0.8 B	<0.40	<0.4	<0.40	<0.4	<0.40	3.5 B	5.7 B	1.9 B	2.7 B	0.80 B	1.1 B	14.1	9.2 B
Cobalt	-	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	10.7 B	9.5 B	6.3 B	6.0 B	1.7 B	3.1 B	27.7 B	24.9 B
Copper	200	9.0 B	<0.70	1.9 B	<0.70	0.80 B	<0.70	16.2 B	<0.70	1.4 B	0.77 B	8.6 B	<0.70	33.8	1.5 B
Iron	300	56.8 B	44.7 B	17.4 B	15.8 B	34.8 B	47.1 B	5400	11500	7810	8070	9.0 B	753	21900	1110
Lead	25	<1.0	<1.0	<1.0	<1.0	5.2	<1.0	<1.0	1.1 B	<1.0	<1.0	<1.0	<1.0	3.1	<1.0
Magnesium	[35000]	10000	8940	12800	11900	15400	8690	41000	38500	21000	17300	56200	59900	168000	125000
Manganese	300	5.9 B	38.3	7.3 B	15.1	220	174	30400	30900	14100	12900	4530	7120	797	611
Nickel	-	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	17.9 B	16.2 B	9.6 B	10.8 B	12.9 B	19.6 B	319	242
Potassium	-	1370 B	1710 B	1020 B	1060 B	10600	4920 B	17500	14200	7640	7400	5280	3980 B	382000	328000
Sodium	20000	5440	5600	10200	12500	59300	27100	121000	115000	55400	55000	120000	129000	911000	780000
Thallium	[4]	<2.6	<2.6	<2.6	<2.6	<2.6	<2.6	3.0 B	<2.6	<2.6	<2.6	<2.6	<2.6	2.6 B	2.6 B
Vanadium	-	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	7.1 B	1.8 B
Zinc	300	15.0 B	12.8 B	34.7	22.6	120	16.1 B	117	20.7	47.0	21.9	45.5	18.6 B	180	23.1
Iron & Manganese	500	62.7	83.0	24.7	30.9	225.2	221.1	35800	42400	21910	20970	4539	7873	22697	1721

NOTE: B - indicates that the reported value is less than the Contract Required Detection Limit (CRDL), but greater than the instrument detection limit (IDL).

TABLE 1.6
OLD CORTLAND COUNTY LANDFILL FEASIBILITY STUDY
SUMMARY OF CONTAMINATED SURFACE WATER SAMPLING LOCATIONS AND LEACHATE ANALYTICAL RESULTS

NOTES APPLICABLE TO ALL RESULTS SHOWN IN THIS TABLE:

1. (1) "Standard or [GV]" refers to the 6 NYCRR Part 703 Surface Water Standards or [Guidance Values].
2. Class C(T) surface water standards have been applied to samples collected within Maybury Brook, as well as those collected within the unnamed tributary. Although these standards do not apply to leachate samples, exceedances for the leachate samples have been highlighted (see Note #5) for comparative purposes.
3. - indicates that a standard or guidance value has not been assigned. ND = Not Detected. NR = No Reading. J - indicates an estimated value.
4. < indicates that the analyte was not detected above the instrument detection limit under the lab's QA/QC procedures for this project, and there was no other evidence of the analyte being present.
5. Landfill related contaminant levels in surface water that are in excess of applicable standards or guidance values, and that are not due to background conditions, are shown in a **bigger and bolder font.**

LEACHATE INDICATORS

Results reported in mg/L except where noted otherwise.

						Background Samples		Background Samples		*LEACHATE SAMPLE*	
	Standard	CL-SW-1	CL-SW-2	CL-SW-3		CL-SW-4		CL-SW-5		CL-LS-1	
PARAMETER	or [GV] (1)	OCT '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97
BOD5	-	<2	<2	11	2	<2	<2	<2	<2	21	26
Bromide	-	<0.5	<0.5	1.4	0.9	<0.5	<0.5	0.6	0.7	2.1	1.3
Chloride	-	119	110	239	193	3.1	2.6	<2.0	2.9	432	785
COD	-	40	34	106	76	<15	<15	<15	<15	290	533
Color (units)	-	30	30	60	60	<5	5	<5	10	300	300
Ammonia *	34.4	0.15	<0.02	5.8	5.2	0.06	0.10	<0.02	<0.02	**82.1**	0.05
Nitrate	-	0.16	0.48	0.3	2.2	<0.1	<0.10	0.5	<0.10	0.2	0.17
Total Phenols (ug/L)	-	2.3	1.1	8.3	5.1	1.8	1.5	1.3	1.8	32.9	30.8
Sulfate	-	14.3	13.9	<5.0	11.5	7.3	11.5	7.5	12.9	<5.0	<5.0
Total Alkalinity	-	177	150	332	346	94.8	73.4	83.1	75.2	1100	1840
Total Dissolved Solids	-	427	364	851	714	137	89	116	88	1740	2370
Total Kjeldahl Nitrogen	-	1.1	0.68	11.0	7.4	0.2	0.27	<0.2	0.24	136	0.21
TOC	-	15.2	10.7	33.2	24.9	2.1	2.4	2.1	2.3	81.3	123
Total Hardness	-	172	152	310	300	140	88	120	90	800	800

* Standard for ammonia interpolated using average of background temperature and pH values.

VOLATILE ORGANIC COMPOUNDS

Results reported in ug/L

						Background Samples		Background Samples		*LEACHATE SAMPLE*	
	Standard	CL-SW-1	CL-SW-2	CL-SW-3		CL-SW-4		CL-SW-5		CL-LS-1	
PARAMETER	or [GV] (1)	OCT '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97
Chloroethane	-	<10	<10	<10	<10	<10	<10	<10	<10	1 J	<10
Acetone	-	<10	<10	<10	<10	<10	<10	<10	<10	5 J	4 J
Methlyene Chloride	-	<10	<10	1 JB	<10	1 JB	<10	<10	<10	1 JB	<10
Benzene	[6]	<10	<10	<10	<10	<10	<10	<10	<10	4 J	5 J
Chlorobenzene	5	<10	<10	<10	<10	<10	<10	<10	<10	4 J	**6 J**
Ethylbenzene	-	<10	<10	<10	<10	<10	<10	<10	<10	16	54
Xylenes (total)	-	<10	<10	<10	<10	<10	<10	<10	<10	16	78
Total VOCs **	-	ND	ND	ND	ND	ND	ND	ND	ND	46	147

** Total Volatile Organic Compounds (sum of all compounds believed to represent site contamination)

B - indicates that the analyte was also detected in the blank and is not considered to be landfill related.

SEMI-VOLATILE ORGANIC COMPOUNDS

Results reported in ug/L

						Background Samples		Background Samples		*LEACHATE SAMPLE*	
	Standard	CL-SW-1	CL-SW-2	CL-SW-3		CL-SW-4		CL-SW-5		CL-LS-1	
PARAMETER	or [GV] (1)	OCT '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97
1,4-Dichlorobenzene (2)	5	<10	<10	<10	<10	<10	<10	<10	<10	2 J	3 J
2,4-Dimethylphenol (3)	5	<10	<10	<10	<10	<10	<10	<10	<10	2 J	<10
Naphthalene	-	<10	<10	<10	<10	<10	<10	<10	<10	3 J	11
2-Methylnaphthalene	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	2 J
Diethylphthalate	-	<10	<10	<10	<10	<10	<10	<10	<10	1 J	1 J
N-Nitrosodiphenylamine	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	1 J

(2) Value applies to the sum of all Dichlorobenzene isomers.

(3) Value applies to the sum of all unchlorinated phenolic compounds.

PESTICIDES/PCBs (No contamination detected)

TABLE 1.6 – Continued
SUMMARY OF CONTAMINATED SURFACE WATER SAMPLING LOCATIONS AND LEACHATE ANALYTICAL RESULTS
TOTAL INORGANICS
Results reported in ug/L

PARAMETER	Standard or [GV] (1)	CL-SW-1	CL-SW-2	CL-SW-3		Background Samples CL-SW-4		Background Samples CL-SW-5		*LEACHATE SAMPLE* CL-LS-1	
		OCT '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97
Aluminum	100	49.9 B	92.9 B	**158 B**	57.6 B	66.6 B	41.6 B	43.1 B	188 B	**569**	**673**
Arsenic	-	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	5.3 B	3.0 B
Barium	-	174 B	126	766	567	74.3 B	59.7 B	68.0 B	56.2 B	1330	799
Beryllium	1100	<0.10	0.10 B	0.10 B	<0.10	0.53 B	0.97 B	<0.10	<0.10	0.10 B	0.10 B
Boron	10000	515	406	1010	915	25.6 B	16.1 B	20.0 B	26.0 B	2240	3390
Cadmium (a)	1.04	<0.30	<0.30	<0.30	<0.30	0.47 B	1.0 B	<0.30	<0.30	<0.30	<0.30
Calcium	-	32300	33600	59100	67300	34400	26100	32000	26200	162000	145000
Chromium (b)	188	<0.40	<0.40	3.6 B	<0.40	0.80 B	0.63 B	<0.40	<0.40	4.2 B	7.9 B
Cobalt	5	<1.1	<1.1	1.9 B	<1.1	<1.1	<1.1	<1.1	<1.1	**8.7 B**	**11.1 B**
Copper (c)	10.7	<0.70	<0.70	1.8 B	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	2.3 B
Iron	300	267	165	**1300**	263	79.2 B	30.9 B	44.9 B	249	**66800**	**52000**
Lead (d)	2.78	<1.0	<1.0	**2.9 B**	<1.0	<1.0	<1.0	<1.0	<1.0	1.8 B	**8.4**
Magnesium	-	20200	17000	36300	33100	4410 B	3770 B	4000 B	3650 B	67000	101000
Manganese	-	95.6	35.0	756	225	22.9	1.9 B	11.6 B	11.9 B	2920	1670
Nickel (e)	117	9.3 B	7.2 B	21.3 B	16.9 B	<1.3	<1.3	<1.3	<1.3	32.9 B	52.7
Potassium	-	13700	10600	31400	28400	1150 B	1020 B	981 B	1140 B	103000	193000
Sodium	-	88500	73300	140000	134000	3180 B	3140 B	2850 B	3300 B	273000	500000
Thallium	8	<2.6	<2.6	<2.6	<2.6	<2.6	<2.6	<2.6	<2.6	<2.6	3.1 B
Vanadium	14	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	1.2 B	2.1 B
Zinc (f)	74.8	10.3 B	14.3 B	[131]	12.3 B	15.5 B	15.7 B	25.2	15.9 B	27.3	38.5

(a) Standard derived from: exp(0.7852 [ln(ppm hardness)] - 3.490); hardness is average of SW-4 and SW-5.
(b) Standard derived from: exp(0.819 [ln(ppm hardness)] + 1.561); hardness is average of SW-4 and SW-5.
(c) Standard derived from: exp(0.8545 [ln(ppm hardness)] - 1.465); hardness is average of SW-4 and SW-5.
(d) Standard derived from: exp(1.266 [ln(ppm hardness)] - 4.661); hardness is average of SW-4 and SW-5.
(e) Standard derived from: exp(0.76 [ln(ppm hardness)] + 1.06); hardness is average of SW-4 and SW-5.
(f) Standard derived from: exp(0.85 [ln(ppm hardness)] + 0.5); hardness is average of SW-4 and SW-5.
B - indicates that the reported value is less than the Contract Required Detection Limit (CRDL), but greater than the instrument detection limit.
[131] This concentration of zinc is not considered to be landfill related since it is approx. 3 to 5 orders of magnitude higher than what was detected in the leachate samples.

DISSOLVED INORGANICS
Results reported in ug/L

PARAMETER	Standard or [GV] (1)	CL-SW-1	CL-SW-2	CL-SW-3		Background Samples CL-SW-4		Background Samples CL-SW-5		*LEACHATE SAMPLE* CL-LS-1	
		OCT '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97	AUG '97	OCT '97
Aluminum	100	33.1 B	37.1 B	35.6 B	34.4 B	21.8 B	29.9 B	29.0 B	37.3 B	37.6 B	46.0 B
Barium	-	179 B	112 B	749	552	67.6 B	57.6 B	62.2 B	55.0 B	792	463
Beryllium	1100	0.10 B	0.10 B	0.10 B	0.10 B	<0.10	<0.10	0.10 B	<0.10	0.10 B	0.10 B
Boron	10000	535	365	1160	898	18.1 B	20.9 B	18.1 B	27.3 B	2400	3200
Cadmium (a)	1.04	<0.30	<0.30	<0.30	<0.30	0.30 B	<0.30	<0.30	<0.30	<0.30	<0.30
Calcium	-	33500	29900	65200	66700	32100	25200	29400	26300	173000	133000
Chromium (b)	188	<0.40	<0.40	1.0 B	<0.40	<0.40	<0.40	<0.40	<0.40	3.2 B	4.9 B
Cobalt	5	<1.1	<1.1	1.4 B	<1.1	<1.1	<1.1	<1.1	<1.1	**8.6 B**	**10.5 B**
Copper (c)	10.7	<0.70	<0.70	<0.70	3.5 B	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70
Iron	300	92.4 B	22.7 B	10.4 B	22.2 B	3.2 B	4.9 B	9.6 B	5.5 B	249	**335**
Magnesium	-	20900	15100	41100	32700	4030 B	3620 B	3690 B	3600 B	73200	95900
Manganese	-	92.0	27.6	1.5 B	191	7.6 B	1.7 B	9.0 B	2.2 B	2980	1460
Nickel (d)	117	9.5 B	6.3 B	21.5 B	16.6 B	<1.3	<1.3	<1.3	<1.3	35.8 B	49.6
Potassium	-	14300	9350	34600	28100	1030 B	969 B	903 B	1090 B	111000	183000
Sodium	-	92700	65300	157000	133000	2920 B	3050 B	2710 B	3310 B	297000	475000
Zinc (e)	74.8	14.3 B	15.6 B	19.9 B	21.3	43.7	13.6 B	14.9 B	12.4 B	**76.9**	14.9 B

(a) Standard derived from: exp(0.7852 [ln(ppm hardness)] - 3.490); hardness is average of SW-4 and SW-5.
(b) Standard derived from: exp(0.819 [ln(ppm hardness)] + 1.561); hardness is average of SW-4 and SW-5.
(c) Standard derived from: exp(0.8545 [ln(ppm hardness)] - 1.465); hardness is average of SW-4 and SW-5.
(d) Standard derived from: exp(0.76 [ln(ppm hardness)] + 1.06); hardness is average of SW-4 and SW-5.
(e) Standard derived from: exp(0.85 [ln(ppm hardness)] + 0.5); hardness is average of SW-4 and SW-5.
B - indicates that the reported value is less than the Contract Required Detection Limit (CRDL), but greater than the instrument detection limit.

TABLE 1.7
OLD CORTLAND COUNTY LANDFILL FEASIBILITY STUDY
SUMMARY OF CONTAMINATED SEDIMENT SAMPLING LOCATIONS

NOTES APPLICABLE TO ALL RESULTS SHOWN IN THIS TABLE:
1. - Indicates that a sediment guidance criterion has not been assigned.
2. < Indicates that the analyte was not detected above the instrument detection limit under the lab's QA/QC procedures for this project, and there was no other evidence of the analyte being present.
3. Landfill related contaminant levels that are in excess of applicable standards or guidance criteria, and that are not due to background conditions, are shown in a **bigger and bolder font.**
4. Samples were collected in August, 1997.

LEACHATE INDICATORS

Results reported in mg/kg except where noted otherwise.

PARAMETER	NYS Sediment Guidance Critera in ug/kg	CL-SED-1	CL-SED-2	CL-SED-3	Background Samples CL-SED-4	CL-SED-5	CL-SED-6	FIELD BLANK (1)
BOD5	-	11200	611	1280	<210	<227	1220	<2
Bromide	-	69.1	76.3	104	52.4	45.4	54.2	<0.5
Chloride	-	<375	<109	<230	<105	<114	125	<2.0
COD	-	202000	13900	34100	3570	6240	15000	<15
Ammonia	-	246	<1.1	<2.3	<1.0	<1.1	<1.2	<0.02
Nitrate	-	<18.7	13.4	<11.5	<5.2	<5.7	<6.0	<0.1
Total Phenols	-	2.2	0.22	0.30	<0.10	<0.11	<0.12	<1.0
Total Alkalinity	-	3990	186	1200	184	148	193	<1.0
Total Kjeldahl Nitrogen	-	3250	309	2900	129	224	502	<0.2
TOC	-	39700	5020	66900	1470	2050	5550	<0.5
Total Solids (%)	-	26.7	91.6	43.4	95.3	88.1	82.9	NA
Total Hardness	-	300000	109000	115000	42000	90800	72400	<5

(1) Field blank results reported in mg/L. NA - Not Applicable

VOLATILE ORGANIC COMPOUNDS

Results reported in ug/kg except where noted otherwise.

PARAMETER	NYS Sediment Guidance Critera in ug/kg	CL-SED-1	CL-SED-2	CL-SED-3	Background Samples CL-SED-4	CL-SED-5	CL-SED-6	FIELD BLANK (1)
Acetone	-	290	<11	<23	<11	<11	<12	<10
Methlyene Chloride	-	6 JB	3 JB	6 JB	2 JB	4 JB	3 JB	1 JB
2-Butanone	-	110	<11	<23	<11	<11	<12	<10
Toluene	-	6 J	<11	<23	<11	<11	<12	<10
Total VOCs **	-	406	ND	ND	ND	ND	ND	ND

** Total Volatile Organic Compounds (sum of all compounds believed to represent site contamination). (1) Field blank results reported in mg/L.

ND - not detected. J - indicates an estimated value.

B - indicates that the analyte was also detected in the blank and is not considered to be landfill related.

TABLE 1.7 -- Continued
SUMMARY OF CONTAMINATED SEDIMENT SAMPLING LOCATIONS
SEMI-VOLATILE ORGANIC COMPOUNDS

Results reported in ug/kg except where noted otherwise.

PARAMETER	NYS Sediment Guidance Critera in ug/kg	CL-SED-1	CL-SED-2	CL-SED-3	Background Samples CL-SED-4	Background Samples CL-SED-5	CL-SED-6	FIELD BLANK (1)
4-Methylphenol	19.9 (2)	**570 J**	<360	<770	<350	<380	<400	<10
Isophorone	-	<1200	39 J	<770	<350	<380	<400	<10
bis(2-Ethylhexyl)phthalate	7,920 (2)	220 J	<360	<770	<350	<350	<400	6 J

(1) Field blank results reported in mg/L. J - indicates an estimated value.

(2) NYSDEC Guidance Criteria based on the percentage of total organic carbon detected at SED-1 (3.97%). Does not apply to field blank.

PESTICIDES/PCBs (No contamination detected)

TOTAL INORGANICS

Results reported in ug/kg except where noted otherwise.

PARAMETER	NYS Sediment Guidance Critera in mg/kg dry wt. **	CL-SED-1	CL-SED-2	CL-SED-3	Background Samples CL-SED-4	Background Samples CL-SED-5	CL-SED-6	FIELD BLANK (1)
Aluminum	-	22000	16600	22900	11700	13300	13200	27.2 B
Arsenic	6	**28.3**	**14.4**	**14.3**	5.1	7.3	5.8	<2.4
Barium	-	815	159	219	84.3	97.7	103	0.40 B
Beryllium	-	0.90 B	0.64 B	0.80 B	0.44 B	0.48 B	0.51 B	0.23 B
Boron	-	19.1 B	6.8 B	6.4 B	1.0 B	1.8 B	2.0 B	8.0 B
Calcium	-	23000	2010	6610	1330	9640	1300	84.8 B
Chromium	26	**30.3**	20.6	**31.3**	16.6	18.0	18.6	<0.40
Cobalt	-	27.1 B	12.3	20.0 B	10.2 B	10.7 B	13.5	<1.1
Copper	16	**27.5**	15.3	**27.5**	18.0	18.1	**17.5**	<0.70
Iron	2%	55900	37100	62700	29100	33000	34000	14.6 B
Lead	31	20.3	15.4	14.7	12.6	9.2	11.6	<1.0
Magnesium	-	6910	5020	9350	4780	6270	5130	<8.1
Manganese	460	**26100**	**1230**	**1220**	501	523	433	0.47 B
Nickel	16	**39.6**	**25.9**	**53.0**	25.7	27.0	**29.3**	<1.3
Potassium	-	3330 B	2080	1480 B	449 B	995 B	889 B	13.6 B
Selenium	-	<2.1	1.7	2.9	2.0	1.8	1.3	<2.8
Sodium	-	347 B	138 B	246 B	46.3 B	62.0 B	113 B	51.0 B
Thallium	-	5.6 B	<0.57	<1.2	<0.55	<0.59	<0.63	3.8 B
Vanadium	-	33.3 B	24.8	29.1	14.6	17.4	17.8	<1.2
Zinc	120	**229**	90.9	**145**	73.3	86.7	76.7	17.4 B

(1) Field blank results reported in mg/L.

** Sediment Guidance Criteria represents the Lowest Effect Level at which a sediment is considered to be moderately impacted.

B - indicates that the reported value is less than the Contract Required Detection Limit (CRDL) but greater than the instrument detection limit.

2. REMEDIAL ACTION OBJECTIVES

The following section presents the site-specific areas of concern, the remedial action objectives for each area of concern, and discusses the general response actions to identified objectives.

Remedial action objectives have been established for each medium on the basis of the nature and extent of site contamination, the potential for human and environmental exposure, and to delineate medium-specific SCGs which must be attained. General response actions have been subsequently formulated for each objective, identifying a variety of nonspecific alternatives that could potentially attain predetermined SCGs.

2.1 Waste Disposal Areas

2.1.1 Areas of Concern

The Remedial Investigation identified the limits of waste associated with the Old Cortland County Landfill, the Abandoned City of Cortland Landfill, the Buckbee-Mears Sludge Disposal Areas, the Exposed Scrap Metal Area and the Isolated Buried Waste Area. While the Old County and Abandoned City of Cortland Landfills are contiguous, the Isolated Buried Waste Area and the Buckbee-Mears Sludge Disposal Areas are separate from the main area of waste disposal. The Exposed Scrap Metal Area includes drums exposed at the surface and coincides with the southernmost area of the Abandoned City Landfill.

Since the search for the reported buried drums associated with the Old County Landfill was unsuccessful, the location(s) of individual "hot spots" within this waste area are unknown. For the purpose of this feasibility study, the two separate Buckbee-Mears sludge disposal areas, the isolated buried waste area, and the drum area will be considered "hot spots" requiring specific remediation. In addition, the limits of the hazardous waste site will be defined by the existing combined limits of the waste areas described above. This boundary is illustrated on Plate 1.

2.1.2 Exposure Routes and Receptors

The identified potential receptors for the waste are trespassers, residents, recreators and/or wildlife that come in direct contact with the waste.

2.1.3 Standards, Criteria and Guidelines for Waste Disposal Areas

Wastes that demonstrate hazardous waste characteristics in accordance with EPA Method 1311 TCLP testing protocols fall under RCRA guidelines for waste disposal and treatment. Liquid samples obtained from some of the drums in the Exposed Scrap Metal Area and the Isolated Buried Waste Area did not exhibit hazardous waste constituents in excess of toxicity characteristic limits in accordance with Code of Federal Regulations 40 CFR 261. In addition, the contaminated soil associated with the Exposed Scrap Metal and the Isolated Buried Waste areas did not exhibit any volatile or semi-volatile organic compounds listed in 40 CFR 261.

NYSDEC Part 360-2.17(n) requires that a sludge be stabilized to a solids content of 20% or greater prior to disposal at a municipal solid waste landfill. The average solids content of the two sludge samples collected from this disposal area was approximately 45%, indicating that this material meets the criteria of this regulation.

Analysis of the sludge revealed the presence of four metals which are regulated under 40 CFR 261. These include arsenic, barium, chromium and lead. The nature of the sludge is such that these metals are most likely present in the form of hydroxide precipitates, and are immobile within the solid matrix. The inferred basic pH, on the basis of elevated total alkalinity, and the elevated total organic carbon concentrations of the sludge, suggests that these individual metals exhibit very low leachability (Knox et al., 1993; Loehr et al., 1979). Additionally, once these disposal areas are capped (either in place or through removal and placement under the landfill cap), there will be virtually no infiltration into these wastes with which to generate leachable quantities of these metals.

2.1.4 Remedial Action Objectives

The remedial action objectives for the waste disposal areas are to:

- remove the threat of exposure to drums and associated contaminated soil areas within the Exposed Scrap Metal Area and the Isolated Buried Waste Area;
- minimize the volume of leachate generation and groundwater contamination; and

- prevent potential dermal contact with or incidental ingestion of exposed waste

2.1.5 General Response Actions

The general response actions for the waste disposal areas that could potentially meet the remedial action objectives are:

- appropriate disposal of drums containing liquid waste residues;
- containment of the waste volume within each separate waste disposal area by capping;
- consolidation of waste areas through excavation of isolated and thin waste areas;
- complete removal of waste volume - off-site disposal site; or
- complete removal of waste volume - on-site land disposal.

2.2 Groundwater

2.2.1 Areas of Concern

The Remedial Investigation (see Plate 1) identified only mild impacts to groundwater in the overburden and bedrock as a result of a landfill leachate influence. These locations coincided with approximate areas of slightly elevated electromagnetic conductivity measurements. In accordance with NYSDEC Risk Assessment Guidelines, the Baseline Human Health Risk Assessment Report concluded that the groundwater exposure pathway demonstrated a minimal risk associated with the future residential ingestion of excessive manganese concentrations. The RI Report further indicated that this scenario was extremely implausible, and rendered the determined risk unrealistic and not worthy of consideration for future groundwater remediation.

As a result, the overburden and bedrock groundwater at the site is not considered an area of concern. Natural attenuation will serve as the mechanism through which the mild impacts to groundwater will be remediated. Natural attenuation is discussed further in Section 3.

2.2.2 Standards, Criteria and Guidelines for Groundwater

The following SCGs were used to develop general response actions to remedial objectives for groundwater:

- 6 NYCRR Parts 700-705 -- Water Quality Regulations for Surface Waters and Groundwaters. NYSDEC - dated September, 1991.

- Technical and Operational Guidance Series 1.1.1. "Water Quality Standards and Guidance Values". NYSDEC - dated November, 1991.

2.2.3 Remedial Action Objectives

The remedial action objectives for groundwater are:

- provide for long-term monitoring of overburden and bedrock groundwater;
- protect against future development within the areas of identified groundwater contamination and potential usage of groundwater as a resource; and
- attainment of SCGs.

2.2.4 General Response Actions

The general response actions for groundwater that could potentially meet the remedial action objectives are:

- reduction of leachate generation by capping and/or waste removal;
- establish quarterly water quality sampling schedule for all groundwater monitoring well locations;
- impose deed restrictions against the use of the site groundwater as a drinking water source; and
- monitor natural attenuation throughout the environmental monitoring program.

2.3 Surface Water/Sediment

2.3.1 Areas of Concern

Three of the five surface water, and four of the six sediment sampling locations, exhibited a mild landfill leachate influence. Mildly impacted locations all occur to the south of the Old Cortland County Landfill, within the settlement ponds and the unnamed tributary. This influence has been attributed to the discharge of contaminated groundwater to the settlement ponds and the unnamed tributary, and the leachate seep which occurs in the ditch along the southern landfill perimeter.

Despite the apparent impact from the landfill, the Baseline Human Health and Ecological Risk Assessment indicated that there were no exposure pathways for surface water which exhibited Hazard Indices above regulatory limits. Therefore, the surface water/sediment is not considered as an area of concern.

2.3.2 Standards, Criteria and Guidelines for Surface Water/Sediment

The following SCGs were used to develop general response actions to remedial objectives for surface water/sediment:

- 6 NYCRR Parts 700-705 -- Water Quality Regulations for Surface Waters and Groundwaters. NYSDEC - dated September, 1991.

- Technical and Operational Guidance Series 1.1.1 "Water Quality Standards and Guidance Values". NYSDEC - dated November, 1991.

- Sediment Criteria - "Technical Guidance for Screening Contaminated Sediments". NYSDEC - dated November, 1993.

2.3.3 Remedial Action Objectives

The remedial action objectives for surface water/sediment are:

- attainment of SCGs (or appropriate assigned background concentrations) for contaminated locations;
- minimize the volume of leachate generation and the discharge of contaminated groundwater to surface water;
- minimize migration of contaminated surface water to downstream locations; and
- minimize future exposure of wildlife to contaminated surface water/sediment.

2.3.4 General Response Actions

The general response actions for surface water/sediment that could potentially meet the remedial action objectives are:

- reduction of leachate generation by capping and/or waste removal;
- establish quarterly water quality sampling schedule for all surface water sampling locations; and
- monitor natural attenuation through the environmental monitoring program.

3. PRELIMINARY SCREENING OF TECHNOLOGIES

3.1 Introduction

In February of 1991, the U.S. Environmental Protection Agency released Directive EPA OSWER 9355.3-11, "Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites" (USEPA, 1991). This document was prepared in order to assist in the development of remedial technologies and to streamline the remedy selection process for cleanups at municipal solid waste landfills. Since that time, a growing number of sites, similar to the Old Cortland County Landfill in the limited extent and severity of contamination, have fallen into a general category of remediation which includes some form of capping as a presumptive remedy, with natural attenuation as the mechanism through which mild groundwater, surface water and sediment impacts are remediated. This trend prompted the development of Directive EPA OSWER 9200.4-17, "Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites" (USEPA, 1997).

The previous section indicated that the groundwater and surface water would not be considered areas of concern. The resulting list of technologies presented in this section highlights those which are associated with source control of the existing identified waste disposal areas. The implementation of source control remediation is essential for the enhancement of natural attenuation, as this will limit the volume of new leachate contribution to groundwater and surface water, and ensure that the documented risks to human health, wildlife and the environment remain at their present "no risk" levels.

3.2 Source Control

3.2.1 Access Restrictions

3.2.1.1 Deed Restrictions

Deed restrictions are used to limit the extent of future land development and/or use of specified properties. Deed restrictions would be imposed on the present County Landfill property to prevent the potential, yet improbable, future usage of the site groundwater for private or public water supplies.

3.2.1.2 Fencing

Fencing is often used to physically limit access to the landfill site or specific areas on site. In addition, signs may be posted at the limits of designated areas to warn potential trespassers of possible health hazards associated with these areas.

The landfill site is located in a sparsely populated portion of the County. Although the extent of the fenced area is limited to the area within the vicinity of the site entrance (controlled by a locked access gate), the densely wooded areas which surround the property provide a natural barrier to sight and sound, and help to limit access. The isolated nature of the site does not warrant the extension of the existing fence or the installation of fencing around the remediation areas. A sign, however, will be posted at the site entrance indicating the Old Cortland County Landfill and associated waste areas as a closed Inactive Hazardous Waste Disposal Site.

3.2.2 Waste Containment

3.2.2.1 Evaluation of Capping Technologies

A properly designed landfill cap provides satisfactory waste containment while reducing surface water (precipitation) infiltration, controls emissions of explosive gases and odors, limits the potential damage caused by vectors, and eliminates possible dermal contact and incidental ingestion of exposed waste by foraging wildlife.

Three alternative cap designs were evaluated on the basis of performance criteria (i.e., reduction of infiltration into the waste; slope stability) and cost. These included a NYSDEC 6 NYCRR Part 360 geomembrane capping system, a Part 360 soil capping system, and a RCRA capping system. Two additional scenarios were evaluated, using variations of the Part 360 geomembrane and soil caps, in which a granular drainage layer was included above the barrier layer to relieve pore water pressure and improve stability.

The cost evaluation of each alternative capping technology incorporates means by which to relieve the potential buildup of landfill derived gases from within the waste, as well as drainage controls to direct surface water from the cap. Landfill gases will be managed through the installation of gas vents at a frequency of four vents per acre, with one of these a deep vent. A greater frequency of gas vents, as recommended by the Guidance on Landfill Closure Regulatory Relief (NYSDEC, 1993a), is an acceptable variance from Part 360 closure regulations which describe the installation of a 12-inch thick gas venting layer with one vent per acre. The additional deeper gas vents are intended to enhance the removal of landfill derived gases within the thicker waste areas.

The surface water control and collection system will include sideslope diversion berms, perimeter drainage channels and corner down chutes. This system will be designed to direct runoff to the corner down chutes as quickly as possible to prevent erosion and saturation of the cap's soil layers.

Additionally, annual operation and maintenance (O&M) costs ranging from $10,000 - $12,000 were estimated for various capping alternatives for the 30-year post-closure monitoring period. These costs will account for periodic mowing, minor erosion repair, snow removal, and other miscellaneous maintenance activities. The cost analysis performed for each of the capping options is presented in summary at the end of this section.

3.2.2.1.1 NYSDEC Part 360 Geomembrane Cap

NYSDEC 6 NYCRR Part 360-2.13(r) states that a geomembrane cover system must consist of, at a minimum, the following: a geomembrane with a minimum thickness of 40 mil that is chemically and physically resistant to the materials it may come in contact with; a barrier protection layer at least 24 inches thick (with the bottom six inches "reasonably free of stones"); and a six-inch thick topsoil layer. For the purpose of performing various analyses regarding cap performance and cost estimation, polyvinyl chloride (PVC) was chosen as the representative geomembrane component. At the time of final design, alternative geomembranes may be considered for the geomembrane component of the capping system. In no case, however, will an alternative geomembrane with inferior performance characteristics be utilized. The evaluation of this capping alternative is discussed in the following sections.

3.2.2.1.1.1 HELP Model Evaluation

The USEPA Hydrologic Evaluation of Landfill Performance (HELP) Model Version 3.05a (Schroeder et al., 1996) was used to estimate the amount of infiltration which will enter the waste for this capping scenario. The HELP model is a quasi-two-dimensional water balance computer model that distributes incident precipitation within a user-specified cap cross-section into surface water runoff, evapotranspiration, lateral drainage, soil moisture storage, and infiltration. The model is limited to the analysis of the distribution of water within the specified cross-section and is not capable of incorporating surface runoff and lateral drainage from an upslope cross-section.

The cross-section input into the HELP model was defined according to Part 360-2.13(r). Default climatological data were selected within the HELP model for the Ithaca, New York Weather Station. The default average annual rainfall for this station is 40.16 inches per year. The average slope and slope length of the landfill cap were input as 25% and 230 feet, respectively.

The permeability of the top 30 inches of the cap (6 inches of topsoil and 24 inches of barrier protection soil) was set equal to 1×10^{-5} cm/sec. This value was chosen to represent a conservative effective permeability of typical cover soils after frost action and the effects of root structure have been considered.

Table 3.1, presented following discussion of the RCRA cap evaluation, summarizes the HELP model results for this capping option. As shown, this design will reduce the amount of infiltration into the waste to approximately 0.71% of the incident precipitation, yielding a performance effectiveness of 99.29%. The entire package of HELP model output data is included as Appendix A.

3.2.2.1.1.2 Slope Stability Analysis

The stability of this capping system was analyzed, using conservative values for cohesion, adhesion and interface friction angle, to determine the long-term factor of safety against sliding. This evaluation was performed using a two-dimensional stability analysis (Giroud & Beech, 1990). The peak daily maximum head (generated using the HELP model) was input into the equations to simulate the saturated portion of the soil layer above the PVC geomembrane.

Table 3.2 presents the summary of the stability analysis results. The HELP model simulation of this cap design resulted in complete saturation of the barrier protection layer under daily maximum head conditions. The stability for this condition results in a factor of safety lower than 1.5; and therefore, does not meet recommended stability criteria. As a result, this capping option will not be considered as a viable remediation technology at this site, and will not be evaluated for cost.

Appendix B includes the engineering calculations completed as part of the analysis of the capping system stability.

3.2.2.1.2 NYSDEC Part 360 Geomembrane Cap With Drainage Layer

The evaluation of this capping alternative included a 12-inch thick drainage layer above the geomembrane. This reduces the protective cover layer thickness from 30 inches to 18 inches. All other components are the same as for the above scenario.

3.2.2.1.2.1 HELP Model Evaluation

The HELP Model input data used to estimate the amount of infiltration which will enter the waste under this capping scenario was identical to that for the above scenario with the exception that the bottom 12 inches of the barrier protection layer was designated as a granular drainage layer with a permeability of $1x10^{-3}$ cm/sec. This layer was incorporated into the cap design to relieve the buildup of water above the PVC and to prevent slope stability problems associated with the saturation of these soils.

Table 3.1, presented on page 3-13, indicates that this design will reduce the amount of infiltration into the waste to approximately 0.56% of the incident precipitation, yielding a performance effectiveness of 99.44%.

3.2.2.1.2.2 Slope Stability Analysis

The stability of this capping system was analyzed in the same manner as above. This analysis indicates that the peak daily maximum head condition will yield a factor of safety in excess of 1.5; therefore, this capping option will be retained for further evaluation in this study. Appendix B includes the engineering calculations completed as part of the analysis of the capping system stability.

3.2.2.1.3 NYSDEC Part 360 Soil Cap

NYSDEC Part 360-2.13(q) states that low permeability barrier soil covers must consist of, at a minimum, the following: 18 inches of soil having a maximum remolded permeability of $1x10^{-7}$ cm/sec, a 24-inch thick barrier protection layer, and a 6-inch topsoil layer. The evaluation of this capping alternative is discussed below.

3.2.2.1.3.1 HELP Model Evaluation

The cap cross-section defined by Part 360-2.13(q) was used as input for the HELP Model, with specified properties for each of the soil units included. The remaining HELP model input data were identical to those used to evaluate the previous capping alternatives.

The permeability of the top 30 inches of soil (6 inches of topsoil and 24 inches of barrier protection soil) was similarly set equal to $1x10^{-5}$ cm/sec to properly represent the expected in-field conditions of this material. The permeability of the 18 inches of barrier soil was modeled at $1x10^{-7}$ cm/sec as defined by Part 360-2.13(q)(1).

The results of this model (Table 3.1) indicate that a Part 360 soil cap will reduce the amount of infiltration into the waste to approximately 4.83% of the incident precipitation, yielding a performance effectiveness of 95.17%. This analysis, therefore, indicates that the soil cap will not be as effective as the geomembrane cap at reducing the amount of infiltration into the waste.

3.2.2.1.3.2 Slope Stability Analysis

The stability of this capping system was analyzed in the same manner as above. Table 3.2 presents the summary of the stability analysis results. The HELP model indicated that the peak daily maximum head results in completed saturation of the barrier protection layer. This condition results in a slope stability factor of safety of less than 1.5. This cap design, therefore, does not satisfy the recommended stability criteria, and as a result will not be considered to be viable capping option. Appendix B includes the engineering calculations completed as part of the analysis of the capping system stability.

3.2.2.1.4 NYSDEC Part 360 Soil Cap With Drainage Layer

The evaluation of this capping alternative included a 12-inch thick drainage layer above the barrier soil.

3.2.2.1.4.1 HELP Model Evaluation

The HELP Model input data used to estimate the amount of infiltration which will enter the waste under this capping scenario was identical to that for the above scenario with the exception that the bottom 12 inches of the barrier protection layer was designated as a granular drainage layer with a permeability of $1x10^{-3}$ cm/sec. This layer was incorporated in the design to prevent slope stability problems caused by the saturation of soil above the barrier soil.

Table 3.1 indicates that this design will reduce the amount of infiltration into the waste to approximately 2.89% of the incident precipitation, yielding a performance effectiveness of 97.11%. Subsequently, the analysis shows that incorporation of the drainage layer results in a more effective capping system than the cap alternative above which does not include a drainage layer.

3.2.2.1.4.2 Slope Stability Analysis

The stability of this capping system was analyzed in the same manner as above. This analysis indicates that the peak daily maximum head condition will yield a factor of safety in excess of 1.5. As a result, this capping option will be retained for further evaluation in this study. Appendix B includes the engineering calculations completed as part of the analysis of the capping system stability.

3.2.2.1.5 RCRA Composite Cap

A RCRA landfill cap differs from a NYSDEC Part 360 cap in that both a soil and a geomembrane barrier are incorporated to form a "composite" barrier layer. This type of design enhances surface water runoff while limiting infiltration through the cap. RCRA cap design also requires the installation of a drainage layer above the barrier layer to avoid the potential build-up of porewater pressure within the materials above the barrier cover layer thereby reducing the possibility for slope failures to occur. This layer will be constructed of a 12-inch layer of suitable high permeability material or appropriate synthetic geonet. The remainder of the RCRA cap design consists of a minimum 24-inch thick horizon, typically constructed from native soils, which serves to protect the underlying layers from the effects of weathering, and is intended to sustain vegetation.

3.2.2.1.5.1 HELP Model Evaluation

The HELP Model input data used to estimate the amount of infiltration which will enter the waste under this capping scenario included the following elements: a 24- inch barrier soil layer with a maximum permeability of $1x10^{-7}$ cm/sec; a geomembrane (assumed to be 20 mil PVC); a 12-inch lateral drainage layer with a minimum permeability of $1x10^{-2}$ cm/sec; and a 24-inch barrier protection layer.

Table 3.1, below, indicates that this design will reduce the amount of infiltration into the waste to approximately 0.003% or 99.99% effective. Subsequently, the analysis shows that this cap design will be marginally more effective at reducing the amount of infiltration into the waste over the Part 360 PVC Cap with Drainage (Part 360 PVC Cap = 99.44% effective). This marginal increase in effectiveness, however, is achieved at a much greater expense due to the composite nature of the RCRA cap design. This analysis is discussed in greater detail in Section 3.2.2.1.6.

TABLE 3.1 HELP MODEL RESULTS OLD CORTLAND COUNTY LANDFILL FEASIBILITY STUDY					
WATER BALANCE COMPONENT	PART 360 PVC W/O DRAIN	PART 360 PVC W/DRAIN	PART 360 SOIL W/O DRAIN	PART 360 SOIL W/DRAIN	RCRA COMPOSITE
Precipitation (in/acre) (%)	40.16 100.00	40.16 100.00	40.16 100.00	40.16 100.00	40.16 100.00
Runoff (in/acre) (%)	15.66 38.99	15.08 37.56	15.43 38.43	15.30 38.09	15.00 37.34
Evapotranspiration (in/acre) (%)	23.60 58.77	21.93 54.61	22.34 55.63	21.87 54.45	22.04 54.88
Lateral Drainage (in/acre) (%)	0.28 0.68	3.11 7.75	0.21 0.53	1.97 4.91	3.09 7.69
Infiltration (in/acre) (%)	0.29 0.71	0.23 0.56	1.94 4.83	1.16 2.89	0.001 0.003
Peak Daily Head maximum (in)	30.00*	9.05	30.00*	7.01	3.15
Note: *Maximum daily head values exceeded the thickness of the barrier protection layer above the PVC or soil barrier liner.					

3.2.2.1.5.2 Slope Stability Analysis

The stability of this capping system was analyzed in the same manner as above. Table 3.2, below, presents the summary of the stability analysis results. These results indicate that the peak daily maximum head will yield a slope stability factor of safety in excess of 1.5 for this capping alternative. Appendix B includes the engineering calculations completed as part of the analysis of the capping system stability.

TABLE 3.2 STABILITY ANALYSIS RESULTS OLD CORTLAND COUNTY FEASIBILITY STUDY					
STABILITY ANALYSIS COMPONENT	PART 360 PVC W/O DRAIN	PART 360 PVC W/DRAIN	PART 360 SOIL W/O DRAIN	PART 360 SOIL W/DRAIN	RCRA COMPOSITE
Peak Daily Head maximum (in)	30.00[1]	9.05	30.00[1]	7.01	3.15
Critical Interface (Location)[2] (°)	PVC/PC 22	PVC/LDS 250	BS/PC 30	BS/LDS 30	BS/PVC 22
Factor of Safety (PDMH)[3]	0.92	1.66	1.29	2.12	1.61

Note: [1] This value represents complete saturation of the barrier protection layer; actual value in excess of 30 inches.

[2] PVC = polyvinyl chloride geomembrane; LDS = lateral drainage soil; PC = protective cover; BS = barrier soil.

[3] PDMH refers to the Peak Daily Maximum Head.

3.2.2.1.6 Capping Cost Analysis and Cap Design Selection

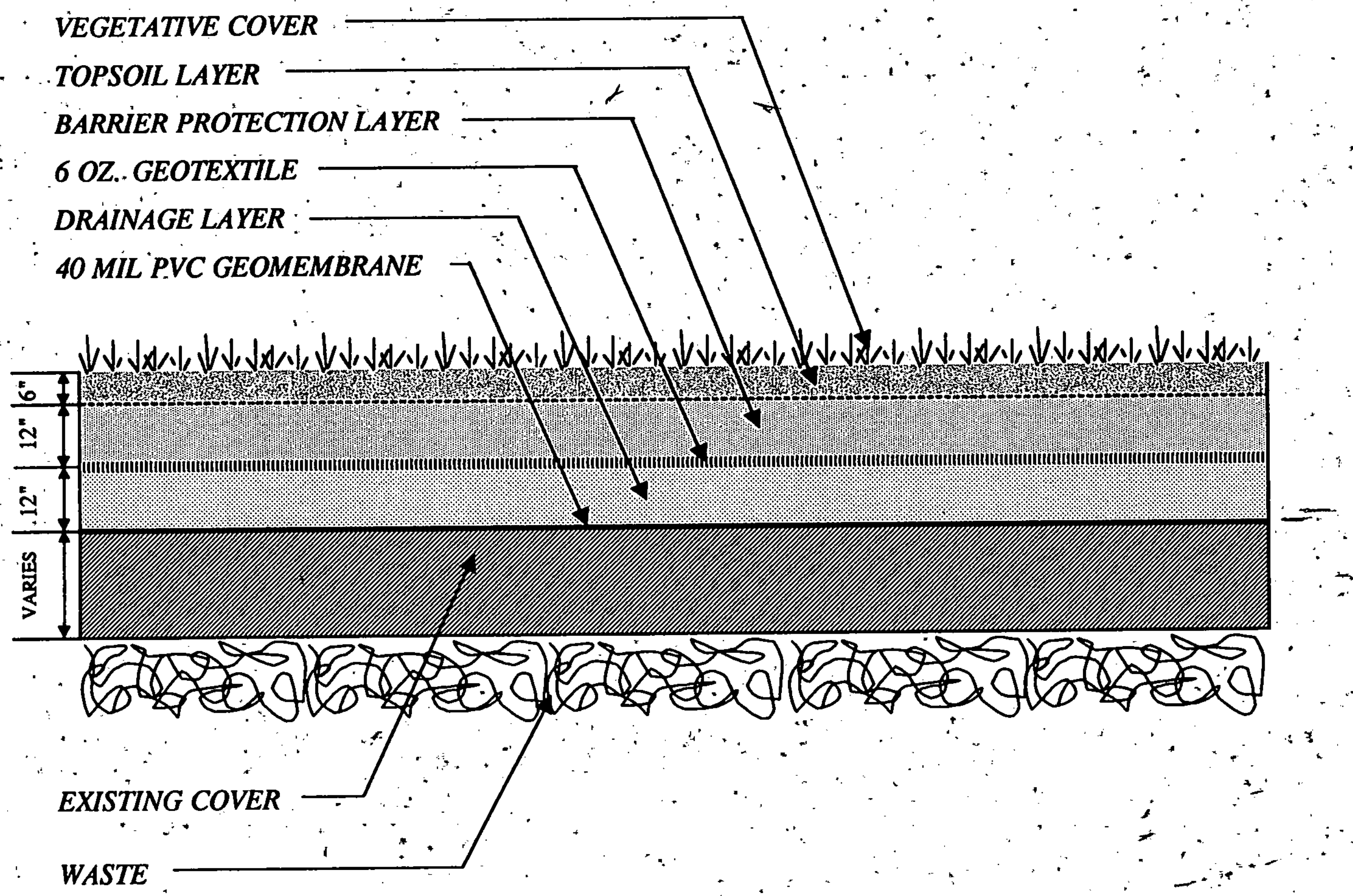
Appendix C includes the cost estimates prepared for each of the three capping options determined to exhibit recommended stability criteria and reasonable performance at limiting infiltration. Table 3.3, presented below, summarizes these costs. It is noted that these cost estimates were generated for the Old Cortland County Landfill limit of waste only. Supplemental cost estimates prepared in later sections during the development of remedial alternatives (i.e., consideration of capping options for Buckbee-Mears Disposal Areas and the Abandoned City of Cortland Landfill) are based on these costs and adjusted accordingly for the additional area(s) to be capped.

TABLE 3.3 SUMMARY OF CAP CONSTRUCTION COSTS OLD CORTLAND COUNTY FEASIBILITY STUDY		
CAPPING ALTERNATIVE	INFILTRATION REDUCTION	ESTIMATED CONSTRUCTION COSTS*
Part 360 PVC Cap w/Drainage	99.44%	$4,157,000
Part 360 Soil Cap w/Drainage	97.11%	$5,283,000
Part 360 RCRA Cap w/Drainage	99.99%	$6,839,000
Note: *Construction costs include 15% for Engineering, Legal & Miscellaneous costs, and 15% for contingency.		

The table above also shows that both the PVC and RCRA caps demonstrate similar levels of performance regarding the reduction of infiltration into the waste. However, since the PVC cap is already very near 100% effective, the minor improvement in infiltration reduction offered by the RCRA cap does not justify a cost in excess of $2½ million more than the PVC cap. Therefore, the most appropriate capping option for the Old Cortland County Landfill is the Part 360 PVC cap with a drainage layer. This cap will be included as a standard element of each remedial alternative developed in the next section. Figure 3.1 presents a schematic drawing of the Part 360 PVC cap.

3.2.2.1.7 Estimated Reduction in Landfill Leachate Generation

The HELP Model (Schroeder et al., 1996) was used to estimate the reduction in leachate generation for the entire site following installation of the Part 360 PVC cap. To perform this evaluation, it was necessary to initially model the volume of leachate generated under existing site conditions.



NOTE: This cap to be installed over the limits of the Old Cortland County Landfill.

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Old Cortland County Landfill
FEASIBILITY STUDY

PART 360 PVC CAP DETAIL

Town of Solon | Cortland County, NY

Figure 3.1

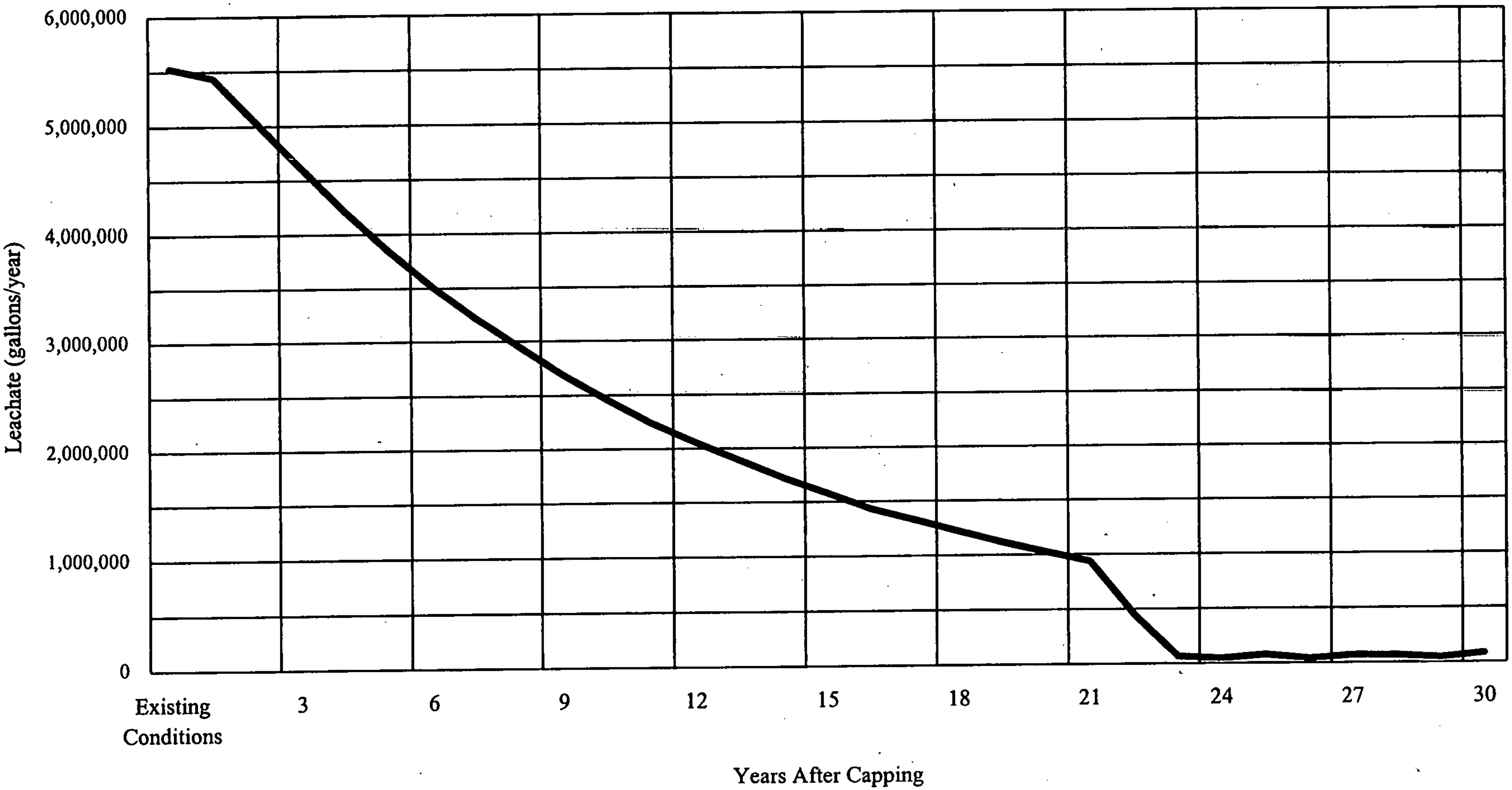
Project No. 331.22

A preliminary model was run for a period of 5 years to simulate the measured water level within the waste (water level recorded at EB-1). This simulation was developed by calibrating the permeability of the material underlying the waste until the computer generated water level within the waste equaled the known values. Calibration of the model yielded a vertical permeability value of the thin till layer underlying the waste of 6.7×10^{-8} cm/sec. This value is reasonable when compared to the test results for samples of on-site soils collected and analyzed during the Remedial Investigation.

The cross-section for the Part 360 PVC cap was then added to the existing conditions model. Six consecutive five-year blocks were run to simulate conditions during the 30-year post-closure monitoring period. Successive runs were initialized with the ending moisture content values from the previous run. Figure 3.2 presents the results of this analysis. It should be noted that the expression "leachate generation" in the context discussed herein does not exclusively refer to new leachate created from the infiltration of precipitation through the geomembrane. Rather, leachate generation in this discussion will refer principally to the volume of leachate which percolates from the bottom of the waste mass through the unloading of excessive moisture existing in the waste prior to capping. Since the PVC cap is expected to reduce infiltration by more than 99% of the existing condition, only a very small amount of the percolation from the waste will constitute new leachate.

As shown in Figure 3.2, the estimated volume of leachate generation under existing conditions is approximately 5-1/2 million gallons per year. Following the installation of the cap, the volume of leachate that will percolate from the bottom of the waste each year begins to rapidly decline. According to this regression, the

FIGURE 3.2
Old Cortland County Landfill Feasibility Study
Estimated Reduction in Leachate Generation



volume will have been reduced by more than 50% over the first 10 years following installation of the cap. During the second 10 year period, it is anticipated that this volume will be reduced by another 50%. Within the final 10-year time frame following capping, there appears to be an initial rapid reduction in the volume of leachate generated, followed by an apparent stabilization of this volume ranging from approximately 50,000 to 90,000 gallons of leachate generated each year.

In summary, the installation of the cap will nearly eliminate the amount of infiltration into the waste. The installation of the cap will result in a 55.5% reduction in leachate generation over the first 10 years; an 81.5% reduction realized after 20 years; and a 98.9% reduction realized at 23 years after capping. Appendix D includes the HELP model results of the estimated reduction in future leachate generation.

It should be noted that the results of this modeling exercise are based on conservative input values and, therefore, likely represent a worst-case scenario. That is, the actual unloading of leachate within the landfill is likely to occur within a shorter time frame.

3.2.2.2 Consideration of Capping the Abandoned City of Cortland Landfill

The Remedial Investigation Report characterized the wastes within the Abandoned City of Cortland Landfill as predominantly ash with scattered debris. The nature of these wastes does not suggest that a significant contaminant contribution to groundwater is possible from the leachate generated within the ash. Nonetheless, it has become necessary to consider capping options for this landfill.

The existing County Maintenance Facility and heavy equipment access areas encompass a portion of the Abandoned City of Cortland Landfill. It is the desire of the County to continue to use this area as part of their daily operations. As a result, it is necessary to consider a modification to the Part 360 PVC cap in order to preserve the use of the County's Maintenance Facility and to accommodate the heavy equipment traffic above the cap. These modifications would affect the soil layers above the PVC geomembrane for the following reasons:

- it will not be possible to, nor will there be a need to, maintain the vegetative cover layer of the cap since the area will be subjected to continuous vehicle traffic;

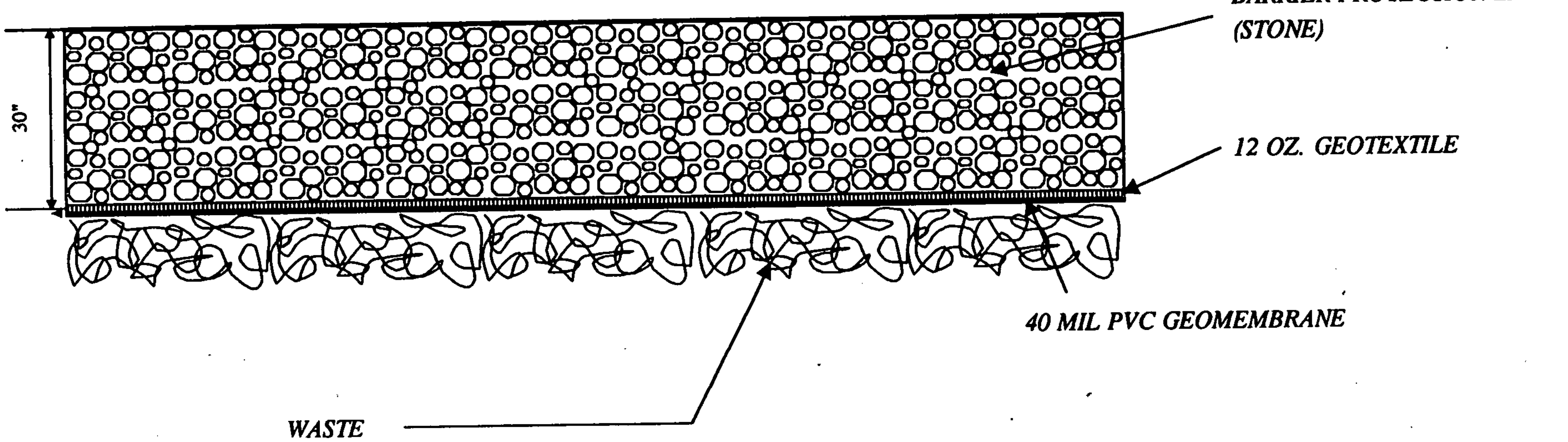
- the barrier protection materials will need to be able to rapidly and evenly distribute the loads of the heavy landfill operating equipment; and

- the protective barrier materials will need to be able to manage surface water quickly due to the shallow slope of the surface in this area.

A puncture resistance analysis was performed to evaluate the factors of safety associated with maintaining the integrity of the PVC geomembrane under typical and worst case loading of landfill equipment. The analysis simulated the distribution of the forces applied through a 2½-foot thick crushed stone layer above the PVC resulting from the impact of a standard landfill compactor. The typical loading case represented the normal distribution of the compactor's weight, while the worst case loading identified all of the compactor's weight brought to a single point source. In both cases, the analysis indicates that the 2½ feet of crushed stone adequately protects the PVC geomembrane against puncture. The puncture resistance analysis is presented as part of Appendix B.

Placement of the crushed stone directly against the PVC during construction is typically not a recommended practice, as this could potentially result in damaging the geomembrane prior to achieving the final 2½-foot thickness. A 12-ounce geotextile will be placed directly above the PVC to provide necessary protection during cap construction. This added protection will also ensure the long-term protection of the PVC in the event that certain landfill operations (e.g., snow removal) results in the "thinning" of the stone layer in areas. Periodic spot surveying within the modified cap area will be required to ensure the thickness of the stone.

Installation of the modified cap within the vicinity of the maintenance facility will require partial removal of the waste ash to a depth of 2½ feet to prepare an appropriate subgrade for the PVC. At this time it is anticipated that the PVC membrane will be placed directly above the waste ash. However, it may be necessary to provide a thin bedding layer in areas that cannot produce a smooth and even surface. In these areas, an additional six inches of waste will be removed to accommodate the bedding layer below the PVC membrane. A line of shallow gas vents will be installed within the Abandoned City of Cortland Landfill waste limits, adjacent to the Old Cortland County Landfill perimeter, to relieve gases potentially migrating to this area of the site. No gas vents will be installed within the high traffic areas. Figure 3.3 presents a schematic drawing of the modified Part 360 cap.



NOTE: This cap to be installed over a portion of the Abandoned City of Cortland Landfill.
If necessary, a thin bedding layer will be placed above the waste for protection of the PVC geomembrane.

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Old Cortland County Landfill
FEASIBILITY STUDY

MODIFIED PART 360
CAP DETAIL

Town of Solon Cortland County, NY

Figure 3.3
Project No. 331.22

3.2.2.3 Additional Capping Considerations

During the limits of waste investigation of the Abandoned City of Cortland Landfill, it was determined that the actual extent of the ash did not continue westward from the County Maintenance Facility for more than 100 feet. Beyond this, the waste consisted mainly of brush and lumber, with scattered tires and glass. The composition of the waste in this area clearly is not representative of hazardous substances and does not merit inclusion as part of a capping program. This area, noted on Plate 1, will not be included as part of the area to be capped during the landfill closure.

3.2.3 Waste Redistribution

3.2.3.1 Waste Removal

Waste removal, as a means of hazardous waste remediation, typically involves a knowledge of specific buried waste locations (drums, hazardous waste cells, etc.). The excavation of these identified wastes serves as a direct source control. Subsequent management of the excavated waste materials is normally accomplished either through on-site treatment and disposal, or transportation to and disposal at a permitted off-site facility.

For facilities where the location of hazardous waste components is unknown, the removal of hazardous wastes will necessarily involve the excavation of the entire waste mass. This is typically not performed at landfill sites having a waste volume in excess of 100,000 yd^3. A rough estimate of the waste volume in the Old Cortland County Landfill suggests a volume greater than 1 million yd^3. In addition, the cache of buried drums reportedly disposed of within the Old County Landfill, was not discovered during the Remedial Investigation. As a result, waste removal technologies will not be considered as a viable remedial alternative for the Old Cortland County Landfill.

3.2.3.2 Waste Relocation

Often it becomes more cost effective to relocate isolated waste areas which would otherwise require capping as an alternative remedial technology. This is especially true for thin and/or odd-shaped waste areas. The average depth of waste (where encountered) at the Buckbee-Mears Sludge Disposal Areas was approximately 10 feet. Additionally, the Isolated Buried Waste Area appears to exhibit waste with associated soil contamination to a depth of approximately 10 feet. The relatively shallow depth of waste and contaminated soils suggests that these areas should be evaluated as possible waste relocation areas. The presence of a few drums buried within the Isolated Buried Waste Area requires their removal. As a result, waste relocation and contaminated soil removal will be considered as the preferred remedial option for this area.

3.2.3.3 Waste Consolidation

Thin and/or odd-shaped waste areas which are contiguous to larger waste masses are often consolidated with these larger waste areas as a means to reduce the overall area to be capped, thereby lowering capping construction costs. At the Abandoned City of Cortland Landfill, many areas exhibited waste thicknesses less than 10 feet, with the adjacent Exposed Scrap Metal Area exhibiting contaminated soils to a depth of approximately 12 feet. The relatively shallow depth of waste and contaminated soils suggests that these areas should be evaluated as possible waste consolidation areas. The presence of both surface and partially buried drums within the Drum Area requires their removal. As a result, waste and contaminated soil consolidation will be considered as the preferred remedial option for this area.

3.2.4 Removal of Sediments

The removal of contaminated sediments at municipal landfill sites is typically implemented when risk evaluations conclusively show that there are associated threats to human health, wildlife or the environment. At the Old Cortland County Landfill, it has been determined that sediment contamination is not associated with risks for any possible exposure scenario to human health, wildlife or the environment. Therefore, the removal of sediments will not be considered further in this study.

3.2.5 Surface Water/Sediment Isolation

Physical isolation of surface waters and sediments is often associated with a need to ensure the elimination of all current and future contact with contaminated media from humans and wildlife. Although some risk to wildlife was shown in the analysis, the risk is not considered substantial and therefore does not warrant the removal of sediments.

3.2.6 Surface Water Containment

Containment of surface water is often utilized to eliminate the transport of contaminants to downstream locations where documented risks exceed acceptable hazard indices. Although some risk to wildlife was shown in the analysis, the risk is not considered significant, and therefore does not warrant the containment of surface water.

3.3 Groundwater Remediation

3.3.1 Groundwater Collection/Aquifer Restoration

Groundwater remediation and related treatment technologies are considered at sites which document unacceptable risks to human health, wildlife or the environment. As previously stated, the only exposure pathway considered as part of the Baseline Human Health Risk Assessment which demonstrated a hazard index greater than 1, was for a future scenario in which residents would routinely ingest groundwater from an area immediately downgradient from the southern perimeter of the Old County Landfill.

Total manganese concentrations in this area, also occurring naturally at background monitoring locations, served as the primary factor in the determination of this risk. The extreme implausibility for this scenario to ever occur renders this risk as unrealistic. As a result, groundwater remediation and related collection and treatment technologies associated with the closure of the Old Cortland County and Abandoned City of Cortland Landfills will not be considered as part of this study.

3.3.2 Treatment Technologies

As stated above, groundwater remediation through active collection and aquifer restoration activities is not necessary at this site. Noteworthy of mention, however, are mechanisms which exist naturally within groundwater, as well as surface water and sediment media, which continue to "treat" contaminants even in the absence of active remediation. These processes are most commonly termed as mechanisms of natural attenuation.

3.3.2.1 Natural Attenuation

The technology behind this option requires little more than allowing contaminant concentrations to decrease through natural means such as biodegradation, cation exchange, chemical precipitation, adsorption, volatilization and/or transformation. The results of the Remedial Investigation suggest that a significant amount of natural attenuation of contaminants occurs within the surface water and groundwater within relatively short distances away from the landfill. In the absence of required active groundwater or surface water remediation, natural attenuation will serve as the mechanism through which landfill related risks are controlled. It will be possible to establish natural attenuation decay constants and curves once a baseline of water quality over time has been documented.

4. DEVELOPMENT AND SCREENING OF ALTERNATIVES

Remedial alternatives were developed on the basis of the preliminary evaluations for remedial technologies presented in Section 3. Each alternative includes a combination of appropriate technologies designed to meet each of the aforementioned remedial objectives. This section concludes with an introduction to the site-specific SCGs which will be used during the detailed analysis of alternatives in Section 5. Table 4.1 presents a summary of those remedial alternatives and their associated costs to be carried through for a detailed suitability analysis with respect to the goals of the remediation program.

4.1 Presentation of Alternatives

4.1.1 ALTERNATIVE I - No Action, Long-Term Monitoring

This alternative assumes that no remedial action would take place at the landfill site. Groundwater and surface water monitoring would continue on a quarterly basis for 30 years.

This alternative does not satisfy 6 NYCRR Part 360 closure requirements for municipal landfills since there is no provision for the construction of a landfill cap or alternative source control measure(s). In addition, a "no-action" remedy also does not address the Remedial Action Objectives set forth for the drum waste in Section 2.1.4. Finally, although some natural attenuation of contaminants is certain, it cannot be determined if SCGs would be met under this alternative. However, in order to develop a baseline cost for comparison with the remaining remedial alternatives, the "no action" alternative will be retained throughout the Feasibility Study.

TABLE 4.1

Summary of Remedial Alternatives and Costs
Feasibility Study
Old Cortland County Landfill, Cortland County, NY

REMEDIAL ALTERNATIVES	DESCRIPTION OF ASSOCIATED ACTIVITIES	CAPITAL COSTS*	ANNUAL O&M COSTS	NET PRESENT VALUE**
ALTERNATIVE I - No Action, Long-Term Monitoring	a - Long-Term Monitoring (equipment, sampling, analysis, reporting, expenses)	$9,000	$14,850	$353,000
ALTERNATIVE II - Waste Containment including Capping Plus Relocation of Exposed Drums and Isolated Buried Waste Area	a - Capping of Old Cortland County Landfill	$4,157,000		
	b - Capping of Abandoned City of Cortland Landfill	$328,000		
	c - Capping of Buckbee-Mears Sludge Disposal Areas	$281,000	$12,000	
	d - Drum Overpack and Disposal	$14,000	NA	
	e - Excavation and Relocation of Empty Drums and Associated Contaminated Soils	$140,000	NA	
	f - Backfilling of Excavated Drum Area and Isolated Buried Waste Area	$86,000	NA	
	g - Institutional Controls	$1,000	NA	
	h - Long-Term Monitoring	$9,000	$14,850	
	TOTALS	$5,016,000	$26,850	$5,638,000
ALTERNATIVE III - Waste Containment including Capping Plus Relocation of Exposed Drums and Isolated Disposal Areas	a - Capping of Old Cortland County Landfill	$4,157,000		
	b - Capping of Abandoned City of Cortland Landfill	$328,000	$10,000	
	c - Excavation of Buckbee-Mears Sludge Disposal Areas	$287,000	NA	
	d - Drum Overpack and Disposal	$14,000	NA	
	e - Excavation and Relocation of Empty Drums and Associated Contaminated Soils	$140,000	NA	
	f - Backfilling of Excavated Drum Area and Isolated Buried Waste Area	$36,000	NA	
	g - Institutional Controls	$1,000	NA	
	h - Long-Term Monitoring	$9,000	$14,850	
	TOTALS	$4,972,000	$24,850	$5,548,000
ALTERNATIVE IV - Waste Containment including Capping Plus Relocation of of Exposed Drums and Isolated Disposal Areas, with Consolidation of Thin Waste Areas	a - Capping of Old Cortland County Landfill	$4,157,000		
	b - Capping of Abandoned City of Cortland Landfill	$208,000	$10,000	
	c - Excavation of Buckbee-Mears Sludge Disposal Areas	$287,000	NA	
	d - Drum Overpack and Disposal	$14,000	NA	
	e - Excavation and Relocation of Empty Drums and Associated Contaminated Soils	$140,000	NA	
	f - Excavation of Thin Waste Areas of City of Cortland LF	$97,000	NA	
	g - Backfilling of Excavated Drum Area and Isolated Buried Waste Area	$36,000	NA	
	h- Institutional Controls	$1,000	NA	
	i - Long-Term Monitoring	$9,000	$14,850	
	TOTALS	$4,949,000	$24,850	$5,525,000

Notes: * Capital costs reflect 1998 dollars and have been adjusted using a 15% factor for both engineering and contingency.
** Net Present Value based on a 6.5% interest rate for the initial investment amount, and a 5% annual inflation rate for O&M costs over a 30-year period for groundwater monitoring and site maintenance.
Capital and Net Present Worth Costs have been rounded to the nearest thousand dollars.

The present array of wells situated around the perimeter of the landfill appears suitable for long-term monitoring purposes. Surface water sampling locations SW-1 and SW-2 are presently included as quarterly monitoring points as part of the closed Pine Tree Landfill environmental monitoring program; and therefore, do not require inclusion in the monitoring program for the Old Cortland County Landfill. SW-4 and SW-5 were included as part of the Remedial Investigation for comparison of background surface water quality with on-site sampling locations. SW-4 and SW-5 are not located within the same surface drainage area as that of the landfill; and therefore, will not be included as part of the long-term monitoring program.

SW-3 is located within the first settlement pond, upstream from surface water sampling locations SW-1 and SW-2. The RI Report suggested that the settlement ponds may be discharge areas for groundwater flowing beneath the landfill. As such, this location will be included as part of the long-term monitoring program for the Old County Landfill. In addition, sediment sample location SED-1 will be sampled annually to monitor (in combination with surface water analytical results from SW-1) the effectiveness of treatment within the settlement ponds. Monitoring cost estimates are included as part of Appendix C.

4.1.2 ALTERNATIVE II - Waste Containment Including Capping Plus Relocation of Exposed Scrap Metal Area and Isolated Buried Waste Area

This alternative has been developed from a combination of the following components:

- **Containment** - A Part 360 PVC cap (as described previously) including a passive gas venting system (four gas vents per acre) will be installed over the entire limits of the Old Cortland County Landfill, the two separate Buckbee-Mears Sludge Disposal Areas and a portion of the Abandoned City of Cortland Landfill. Gas venting will be accomplished through the use of three shallow and one deep vent per acre. Gas monitoring wells will also be installed within areas of the site to detect the potential migration of landfill gas toward site structures (e.g., maintenance facility, existing landfill operations, scale house, office). A variance from 6 NYCRR Part 360 requirements to request substitution of the gas venting layer for four gas vents per acre will be submitted for the Department's approval prior to completion of the Remedial Design. If odors or gas migration becomes a problem following capping, the proposed passive venting system could be easily retrofitted to an active system. Active gas management with the gas flared or converted to energy should eliminate any odor problems or subsurface migration.

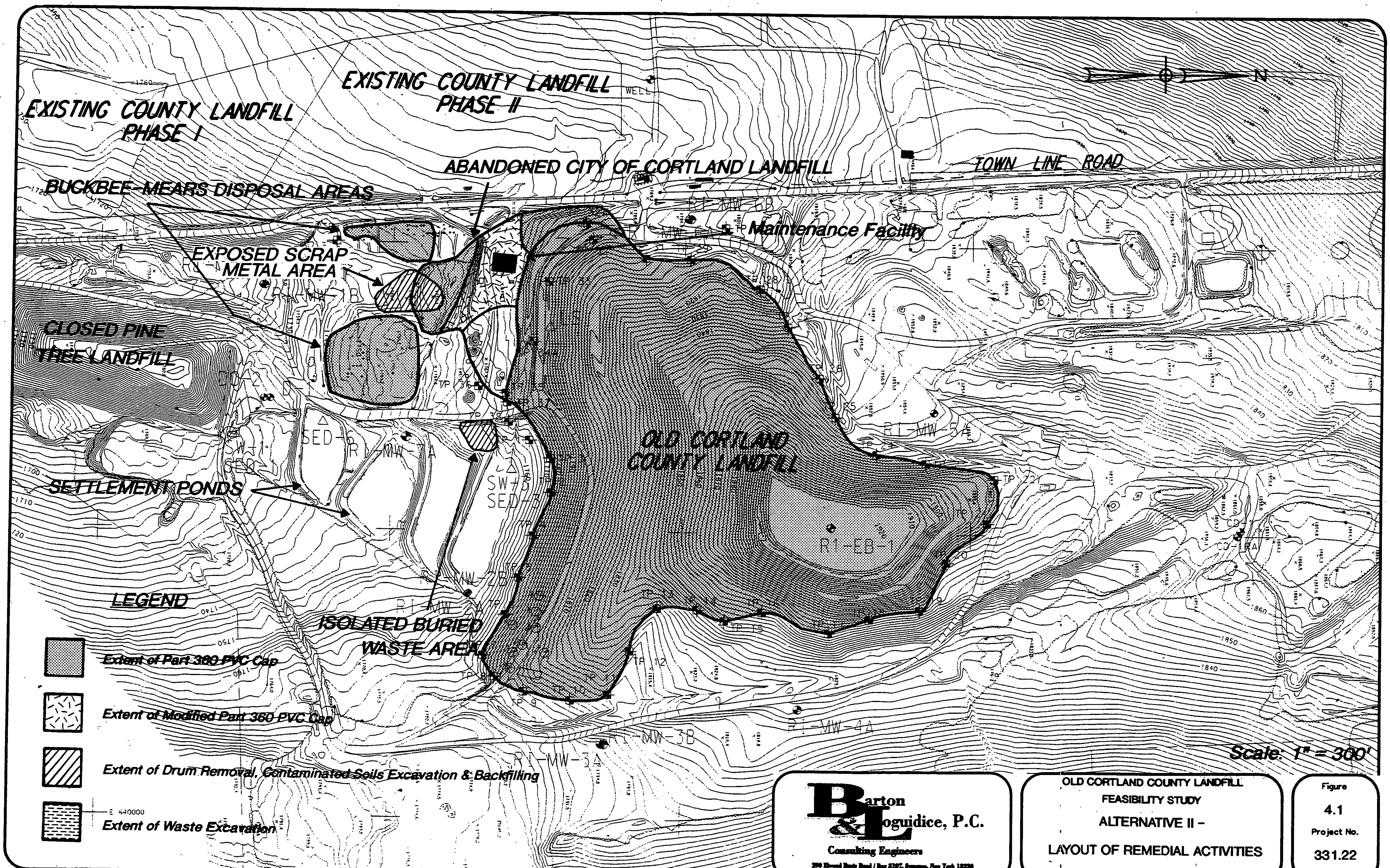
  A modified Part 360 PVC cap will be installed over the areas of the Abandoned City of Cortland Landfill which accommodate vehicle and heavy equipment traffic. Related surface controls include grading, vegetation and protection against potential erosion. Figure 4.1 presents the layout of remediation activities associated with this alternative.

- **Storm Water Management** - The landfill capping system, described above, includes diversion berms, downchutes and perimeter swales to control surface water from the site. As runoff collects within the perimeter drainage swales, it will be diverted via gravity drainage to the southern perimeter of the landfill. The majority of flow will be directed toward the existing ditch along the main site access road (former Town Line Road) and the excavated Buckbee-Mears and Exposed Scrap Metals Areas. This area may serve seasonally as a storm water detention pond. A minor amount of runoff from the lower portion of the southern landfill slope (closest to the ponds) will continue to flow into the settlement ponds.

  The details of the Storm Water Management system, including calculations for sizing the downchutes, perimeter swales and culverts, will be presented as part of the Final Remedial Design. Preliminary costs for storm water management have been included as part of the capping cost estimate.

- **Relocation of Exposed Scrap Metal and Buried Drums** - This alternative will require the sorting and appropriate disposal of drums and scrap metal present at the surface and partially buried within a small area adjacent to the southern limit of the Abandoned City of Cortland Landfill and to the north of the Buckbee-Mears Sludge Disposal Areas. A few drums were also encountered within the Isolated Buried Waste Area during its investigation.

  Excavation and relocation of the wastes and contaminated soils within these areas will include overpacking those drums containing liquid waste residues in preparation of their disposal at a permitted incineration facility. It is anticipated



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Consulting Engineers

OLD CORTLAND COUNTY LANDFILL
FEASIBILITY STUDY
ALTERNATIVE II –
LAYOUT OF REMEDIAL ACTIVITIES
Town of Solon   Cortland County, NY

Figure 4.1
Project No. 331.22

that approximately 13 drums will require this level of disposal. The remaining empty drums, miscellaneous wastes and contaminated soils will be relocated to the Old County Landfill prior to its capping. Both areas will be backfilled to the ground surface using clean materials.

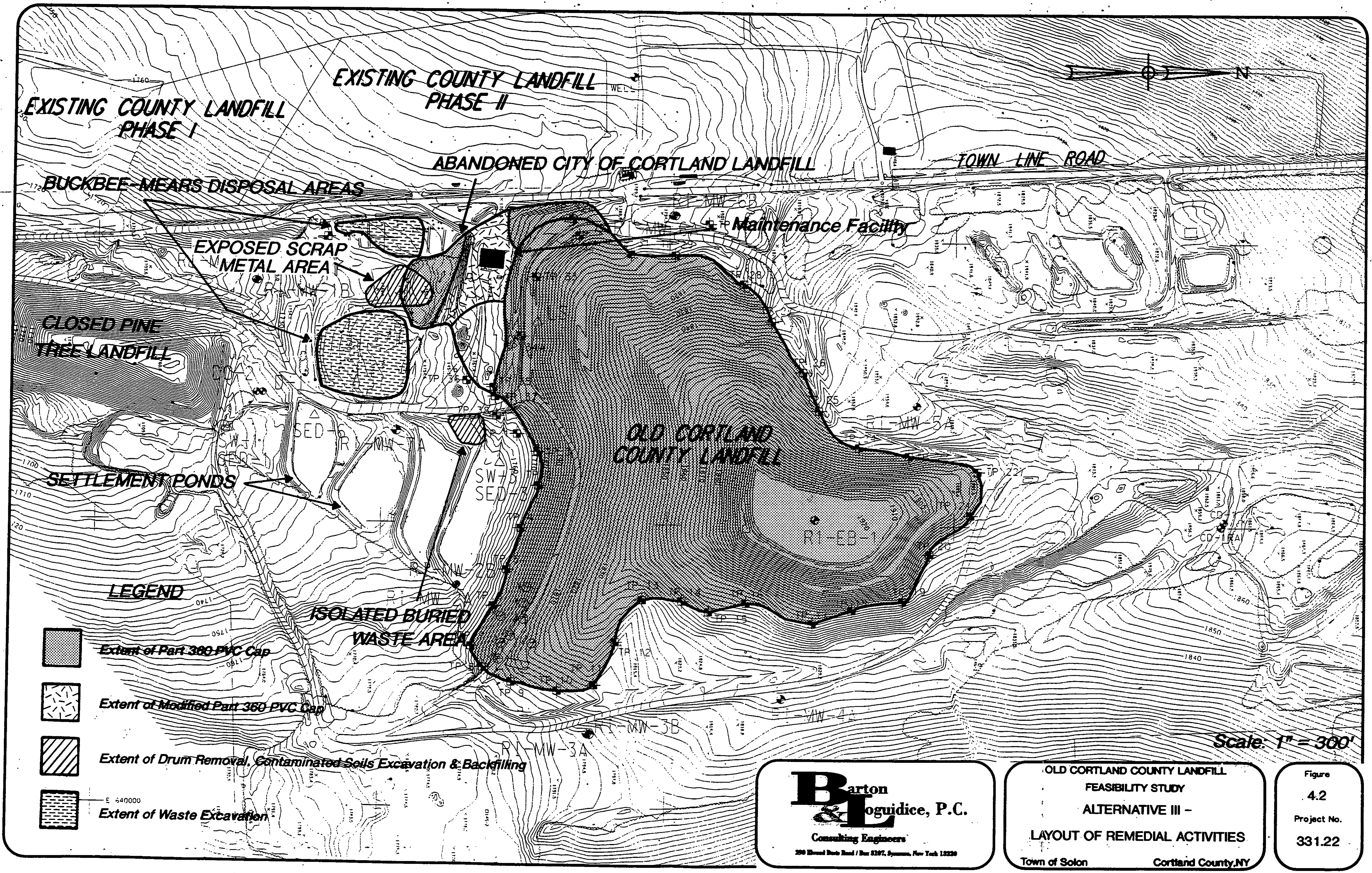
- **Long-Term Monitoring** - Same as Alternative I.

- **Institutional Controls** - In order to prevent the private or commercial usage of contaminated groundwater, deed restrictions will be imposed for the area of the site where landfill leachate impacts to groundwater have been or could be observed. In addition, a sign will be posted at the site entrance indicating the Old Cortland County Landfill and associated waste areas as a closed Inactive Hazardous Waste Disposal Site.

4.1.3 ALTERNATIVE III - Waste Containment Including Capping Plus Relocation of Exposed Scrap Metal and Isolated Disposal Areas

This alternative has been developed from a combination of the following components:

- **Containment** - A Part 360 PVC cap including a passive gas venting system (four gas vents per acre) will be installed over the entire limits of the Old Cortland County and a portion of the Abandoned City of Cortland Landfills. A modified Part 360 PVC cap will be installed over the areas of the Abandoned City of Cortland Landfill which accommodate vehicle and heavy equipment traffic. Related surface controls include grading, vegetation and protection against potential erosion. Figure 4.2 presents the layout of remediation activities associated with this alternative.


EXISTING COUNTY LANDFILL PHASE I
EXISTING COUNTY LANDFILL PHASE II
TOWN LINE ROAD
ABANDONED CITY OF CORTLAND LANDFILL
BUCKBEE-MEARS DISPOSAL AREAS
Maintenance Facility
EXPOSED SCRAP METAL AREA
CLOSED PINE TREE LANDFILL
OLD CORTLAND COUNTY LANDFILL
SETTLEMENT PONDS
ISOLATED BURIED WASTE AREA
N
LEGEND
Extent of Part 360 PVC Cap
Extent of Modified Part 360 PVC Cap
Extent of Drum Removal, Contaminated Soils Excavation & Backfilling
Extent of Waste Excavation
Scale: 1" = 300'
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OLD CORTLAND COUNTY LANDFILL
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- **Relocation of Exposed Scrap Metal and Buried Drums** - Same as Alternative II.

- **Relocation of Isolated Disposal Areas** - This alternative will include the excavation and relocation of wastes buried within the two Buckbee-Mears Sludge Disposal Areas. As previously stated in Section 3, the water content of the sludge meets the NYSDEC Part 360 criteria of a stabilized material; and therefore, will not require special handling during excavation and spreading.

  For implementability purposes, it will be assumed that the limits of the separate Buckbee-Mears disposal areas will be completely excavated to the depth of prior sludge disposal, which was observed to average about 10 feet. Of this, the upper 3 feet consists of topsoil and cover materials. These soils will be scraped off to a depth of 3 feet and stockpiled nearby for replacement. This equates to an approximate waste thickness of 7 feet and a volume of 28,300 yd^3. Materials removed from these areas will be relocated to the Old County Landfill prior to capping.

  Due to their close proximity, the completed excavations associated with the two Buckbee-Mears disposal areas and the Exposed Scrap Metal Area will be combined (as shown on Plate 3) for ease of operation and to provide better drainage upon completion.

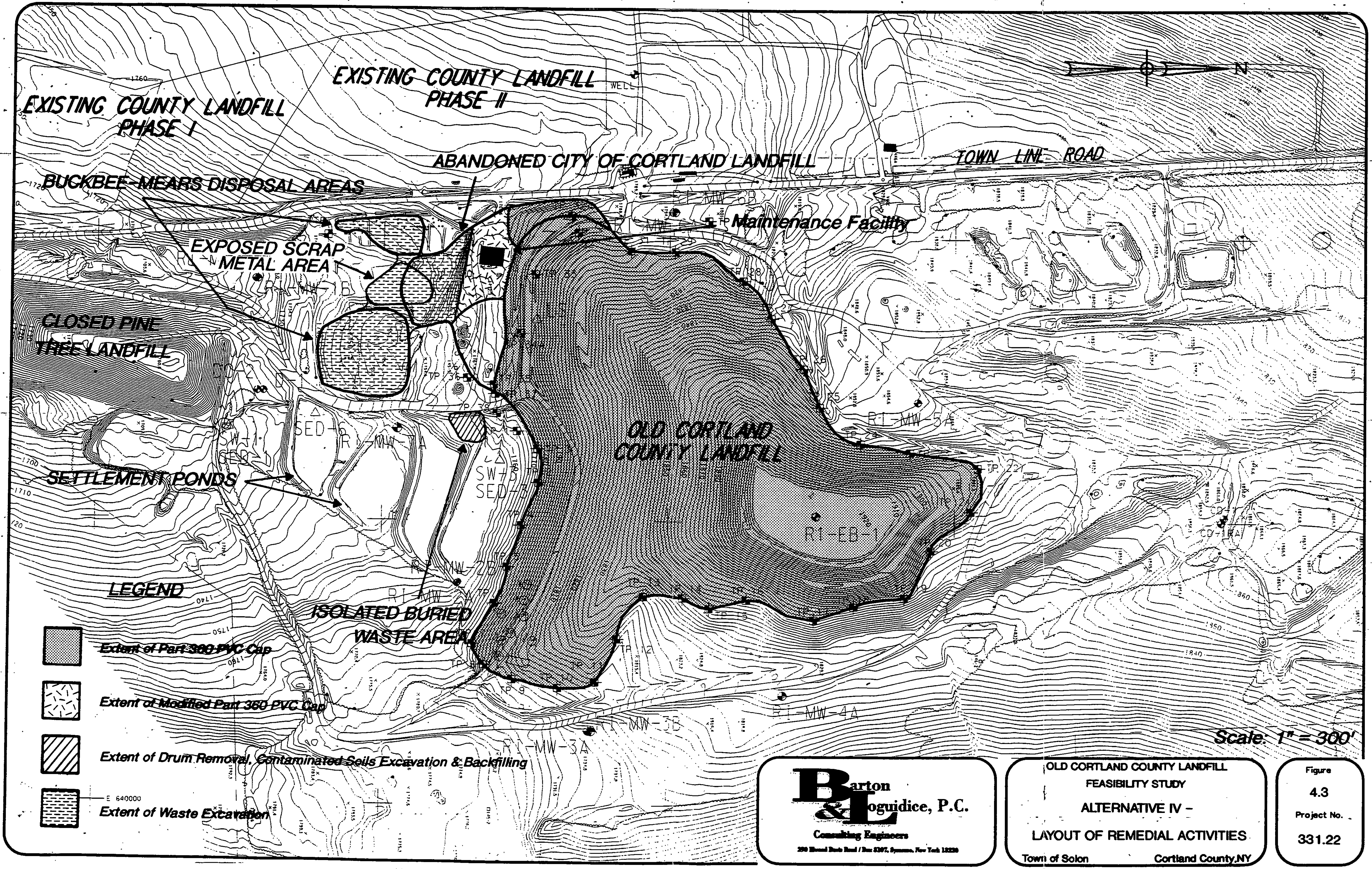
- **Long-Term Monitoring** - Same as Alternative I.

- **Institutional Controls** - Same as Alternative II.

4.1.4 ALTERNATIVE IV - Waste Containment Including Capping Plus Relocation of Exposed Scrap Metal and Isolated Disposal Areas, With Consolidation of Thin Waste Areas

This alternative has been developed from a combination of the following components:

- **Containment** - Same as Alternative II.
- **Relocation of Exposed Scrap Metal** - Same as Alternative II.
- **Relocation of Isolated Disposal Areas** - Same as Alternative III.
- **Consolidation of Thin Waste Areas** - Most of the waste area associated with the Abandoned City of Cortland Landfill is relatively thin (less than 10 feet thick). Although complete excavation and consolidation of this waste area is not possible due to the presence of the County's Maintenance Facility, one area exists beyond the southern limits of the proposed modified Part 360 PVC cap, which will be excavated and consolidated with the Old County Landfill prior to capping. Figure 4.3 presents the layout of remediation activities associated with this alternative.
- **Long-Term Monitoring** - Same as Alternative I.
- **Institutional Controls** - Same as Alternative II.


EXISTING COUNTY LANDFILL PHASE I
EXISTING COUNTY LANDFILL PHASE II
WELL
TOWN LINE ROAD
N
ABANDONED CITY OF CORTLAND LANDFILL
BUCKBEE-MEARS DISPOSAL AREAS
Maintenance Facility
EXPOSED SCRAP METAL AREA
CLOSED PINE TREE LANDFILL
OLD CORTLAND COUNTY LANDFILL
SETTLEMENT PONDS
ISOLATED BURIED WASTE AREA
R1-EB-1
R1-MW-5A
R1-MW-4A
R1-MW-3B
R1-MW-3A
R1-MW-2B
R1-MW-7A
R1-MW-1B
R1-MW-6B
SED-6
SED-3
SW-3
LEGEND
Extent of Part 360 PVC Cap
Extent of Modified Part 360 PVC Cap
Extent of Drum Removal, Contaminated Soils Excavation & Backfilling
Extent of Waste Excavation
E 640000
Scale: 1" = 300'
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OLD CORTLAND COUNTY LANDFILL
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4.2 Action-Specific and Location-Specific SCGs

Each of the remedial alternatives outlined above will be evaluated in Section 5 in accordance with their ability to attain action-specific and location-specific SCGs presented below, and with the chemical-specific SCGs identified in Section 2.

4.2.1 Action-Specific SCGs

Several remedial actions have been identified for each alternative. These actions cannot be implemented unless they conform to action-specific SCGs. The following generalized remedial actions were used in the development of action-specific SCGs:

- **Landfill Closure** - Includes landfill cap construction, implementation of institutional controls and long-term water quality monitoring.

- **Management of Contaminated Media** - Includes drum and waste removal, and waste consolidation.

Action-specific SCG's include:

- **Landfill Cap Construction** - The final cover for all municipal solid waste landfills must meet the general requirements of NYSDEC 6 NYCRR Part 360. Modifications are necessary for portions of the Abandoned City of Cortland Landfill to accommodate access of landfill operations equipment.

- **Health and Safety** - All closure activities must be monitored for compliance with Federal standards established for worker health and safety at CERCLA cleanup sites in The Occupational Safety and Health Standards for Hazardous Response Contractors (OSHA-29 CFR 1926).

4.2.2 Location-Specific SCGs

Typical Location-Specific SCGs include regulations or restrictions placed on activities performed within wetlands, floodplains, coastal areas, right-of-ways or easements. There do not appear to be any Location-Specific SCGs associated with the remedial activities for closure of the Old Cortland County Landfill.

5. DETAILED ANALYSIS OF ALTERNATIVES

The purpose of this section is to evaluate each of the alternatives using criteria presented within NYSDEC's 1990 Revised TAGM - Selection of Remedial Actions at Inactive Hazardous Waste Sites. For each alternative, the following criteria were addressed:

- overall protection of human health and the environment
- overall compliance with chemical-specific, action-specific and location-specific SCGs
- long-term effectiveness and permanence
- reduction of toxicity, mobility or volume
- short-term effectiveness
- implementability
- cost (including an analysis of benefit to the environment and community)

Total estimated costs representing the major work items included within individual alternatives have been presented on Table 4.1 in the preceding section. Derivation of these costs are presented individually in Appendix C.

5.1 ALTERNATIVE I - No Action, Long-Term Monitoring

This alternative does not present a viable option for the closure of this site because it fails to satisfy the 6 NYCRR Part 360 regulation, which requires all municipal solid waste landfills to incorporate a multi-media cap design. However, as stated earlier in this report, this alternative provides a baseline for cost comparison with other alternatives.

5.1.1 Overall Protection of Human Health and the Environment

There were no baseline or future theoretical risks to the environment or wildlife associated with the landfill site. A minimal, but unrealistic, risk was associated with the unlikely ingestion of groundwater at the site by humans in the future.

Although it has been demonstrated that natural attenuation of contaminants occurs at the site under existing conditions, and would be expected to occur in the future under this scenario, the continuous generation of leachate from rainwater infiltration will extend the time for site contaminants to degrade to levels within acceptable SCGs. Without the construction of a final landfill cap, the constant generation of leachate and the subsequent continued contamination of the groundwater and surface water, suggests that the natural decay of contaminants at the site would take a very long time. Hence, it appears that this alternative does not adequately satisfy the criterion for the protection of the environment.

5.1.2 Overall Compliance with Chemical-Specific, Action-Specific and Location-Specific SCGs

This alternative does not satisfy the closure requirements specified in 6 NYCRR Part 360 for municipal solid waste landfills. Hence, "no-action" does not comply with action-specific SCGs.

Although chemical-specific SCGs are exceeded within areas of the site with respect to groundwater, surface water and sediments, there appears to exist a natural tendency for the majority of these constituents to be attenuated a short distance from the source of generation. This appears to be a function of the hydrogeologic conditions at the site, which features groundwater discharge from the bedrock to the overburden. This limits the extent of possible contaminant migration within the bedrock. The subsequent discharge of overburden groundwater to surface water bodies about the site, allows for enhanced attenuation by means of adsorption, dilution, oxidation, volatilization and bioremediation. The occurrence of dry conditions during some of the year also limits the downstream migration of contaminated surface water to off-site locations. Although the no-action alternative would not meet 6 NYCRR Part 360 closure requirements, the continued uncontrolled discharge of contaminated groundwater to surface water suggests that future impacts to off-site properties would be no greater than the "no risk" conditions presently demonstrated by site media.

There are no location-specific SCGs assigned to this alternative.

5.1.3 Long-Term Effectiveness and Permanence

This alternative does not provide the means to limit, reduce or eliminate the continued generation of leachate, and therefore does not provide a permanent remedy, nor does it effectively provide a mechanism through which to decrease contaminant concentrations to levels approaching SCGs for surface water and sediment.

5.1.4 Reduction of Toxicity, Mobility or Volume

This alternative does not incorporate a technology option to reduce toxicity, mobility or volume of contamination. There is no option to limit, reduce or eliminate the volume of leachate generation or the continued uncontrolled discharge of contaminated groundwater to surface water in the area of the leachate contaminated pond.

5.1.5 Short-Term Effectiveness

In addition to evaluating the short-term effects to human health or the environment, this criterion is used to evaluate the short-term protection of the community and workers. Since there is no action under this alternative, this criterion does not apply.

5.1.6 Implementability

The implementability of remedial actions does not apply for this alternative. Long-term water quality monitoring does not impose implementability constraints.

5.1.7 Cost-Benefit Analysis

The cumulative 30-year costs associated with post-closure environmental monitoring will be significant. Since there is no remediation program included with this alternative, the benefit to the host environment and wildlife community is negligible. Therefore, the costs imposed through the implementation of this alternative are not practical with regard to the resulting environmental benefit.

5.2 ALTERNATIVE II - Waste Containment Including Capping Plus Relocation of Exposed Scrap Metal Area and Isolated Buried Waste Area

This alternative incorporates the construction of a Part 360 PVC Cap over the Old Cortland County Landfill and the Buckbee-Mears Sludge Disposal Areas, construction of a modified Part 360 PVC Cap over the Abandoned City of Cortland Landfill, excavation and relocation of wastes and contaminated soils associated with the Exposed Scrap Metal and Isolated Buried Waste Areas (with subsequent backfilling), long-term water quality monitoring and institutional controls.

Construction of the standard Part 360 PVC Cap will be performed in the following manner:

- The existing vegetation and topsoil will be stripped from all areas to be capped. Topsoil will be separated and stockpiled for later replacement as part of the new topsoil layer. During this activity, rocks and debris will be removed from the surface of the remaining soil cover in anticipation of placement of the PVC geomembrane.

- Three shallow gas vents per acre and one deep gas vent per acre will be installed into the waste following removal of the existing topsoil layer. The installation of a greater number of gas vents will account for the omission of the gas venting layer. Each vent will be extended upward with each successive stage of cap construction. On average, it is assumed that the deep gas vents will be approximately 30-35 feet deep. The purpose of the deep vents is to relieve gas buildup within the deeper, and possibly sealed-off, portions of the waste mass as an added measure to control subsurface gas migration beyond the landfill limits.

- A 40 mil. PVC geomembrane will be installed directly over the prepared intermediate cover layer.

- A 12-inch drainage layer will be placed over the PVC cap along the side slopes of the landfill to allow for the release of potential porewater pressure buildup within the overlying barrier protection layer. A buildup of pore water pressure could potentially result in slope instability. Drainage layer materials will be of a sufficiently coarse texture and transmissivity to allow for immediate drainage of water entering this layer. Discharge from this layer will be tied into surface water controls at the toe of the landfill slope. A 6-ounce filter fabric will be placed above the drainage layer to protect fines within the overlying barrier protection layer from migrating into the coarser materials.

- An 18-inch barrier protection layer will be installed over the drainage layer. A series of sideslope diversion berms will be constructed during the placement of this layer in order to facilitate surface water runoff toward downchutes located at each of the four major corners of the landfill. The uppermost 6 inches of this layer will be mulched and seeded to promote the growth of a hearty vegetative layer. Following the placement of the uppermost cap layer, the final extensions to the gas vents will be fitted to complete the cap system.

The proposed modifications to the Part 360 PVC Cap design for a portion of the Abandoned City of Cortland Landfill are due to the desire to continue the use of the County's site maintenance facility and specifically to accommodate heavy landfill equipment which will continue to drive across this area. The following modifications (presented earlier in Section 3) are required to satisfy these conditions:

- Replace barrier protection and drainage layers with 30 inches of stone to provide an appropriate surface for the access of landfill vehicles and to allow surface water to rapidly discharge from this horizon.

- Eliminate topsoil and vegetative cover from design within areas of vehicle access.

Site monitoring will continue for a 30-year period in accordance with the general layout of site monitoring locations discussed previously in Section 4.1.1. The monitoring program and analytical testing requirements have been developed in accordance with 6 NYCRR Part 360 regulations with additional requirements for the presence of particular organics. Appendix C presents the estimated annual costs associated with sampling and testing at each location.

Institutional controls for this alternative are limited to the imposition of deed restrictions regarding the future use of groundwater at the site, and the posting of warning signs along the perimeters of the landfill property alerting potential trespassers to the "closed hazardous waste disposal site" at the facility.

Finally, this alternative will also include the sorting and appropriate handling and disposal of drums exposed at the surface within a wooded area adjacent to the Abandoned City of Cortland Landfill, and the excavation and disposal of contaminated soils associated with this area. A few drums were also identified within the Isolated Buried Waste Area adjacent to the second settlement pond. Any drums found to contain residues of previous liquid wastes will be overpacked and shipped to an appropriate incineration facility.

5.2.1 Overall Protection of Human Health and the Environment

As previously discussed, there were essentially no baseline or future theoretical risks to human health, wildlife or the environment associated with the landfill site. Imposition of deed restrictions and the posting of warning signs at the landfill property boundary will prevent the future development of these properties and the use of surface water and/or groundwater for public water supplies, and alert potential trespassers to the site conditions at the property.

The construction of the landfill cap systems and the relocation of isolated waste areas will serve to reduce the volume of leachate generated at the site, and will allow site contaminants within each medium to naturally degrade at a faster rate as opposed to a situation where leachate generation is continuous.

5.2.2 Overall Compliance with Chemical-Specific, Action-Specific and Location-Specific SCGs

This alternative will satisfy the closure requirements specified in 6 NYCRR Part 360 for municipal solid waste landfills.

Although it is assumed that chemical-specific SCGs for surface water and sediment would be attained after closure, due to a significant reduction in the volume of leachate generation and expected dilution of future leachate migrating to groundwater, it cannot be determined with any precision how long this will take.

5.2.3 Long-Term Effectiveness and Permanence

This alternative would provide the means to reduce the generation of leachate, and therefore, the continued discharge of contaminants to the groundwater and surface water at the site. Once the effects of capping have been realized, contaminant concentrations will begin to decrease in response to natural degradation. Over the long-term, it is believed that this alternative will be effective in providing permanent protection to the environment.

5.2.4 Reduction of Toxicity, Mobility or Volume

The construction of the landfill cap will serve to greatly reduce the volume of leachate generated by infiltration through the waste. The toxicity of the leachate generated is expected to be significantly reduced once fresh recharge from upgradient locations is allowed to dilute groundwater concentrations. Capping the landfill may also result in a general lowering of the water table beneath the landfill, creating lower horizontal hydraulic gradients, and resulting in slower groundwater flow velocities. Slower velocities within the subsurface will enhance the residence time, and the subsequent attenuation effects (e.g., dilution, dispersion, adsorption, biodegradation, transformation, chemical precipitation), on certain organic and inorganic constituents. It is anticipated that there will be a significant long-term reduction in the toxicity, mobility and volume of contaminants through the implementation of this alternative.

5.2.5 Short-Term Effectiveness

This alternative would achieve short-term effectiveness in the immediate removal of exposed drums and contaminated soil areas. In addition, the cap will also immediately shut-off the infiltration of surface water into the waste. Short-term attainment of chemical-specific SCGs is unlikely.

5.2.6 Implementability

Landfill closures have been conducted under similar site conditions by a variety of contractors. There appears to be adequate space along the slopes of the Old County Landfill to accommodate the placement of excavated materials without compromising the stability of the final cap. Manufactured materials such as the PVC geomembrane, filter fabric and the gas vents are readily available, and will be supplied by the construction contractor. Long-term water quality monitoring does not impose implementability constraints.

5.2.7 Cost-Benefit Analysis

The technologies presented within this alternative represent an appropriate level of effort needed to meet 6 NYCRR Part 360 closure requirements for municipal solid waste landfills and to address the isolated disposal areas at the site. However, the capping of the Buckbee-Mears Sludge Disposal Areas and the entire limits of the Abandoned City of Cortland Landfill will increase the area requiring long-term care in the post-closure period. Capping of these areas will also limit the available space at the landfill property which may otherwise be effectively used by the County. Therefore, this alternative has a limited cost-benefit relationship.

5.3 ALTERNATIVE III - Waste Containment Including Capping Plus Relocation of Exposed Scrap Metal and Isolated Disposal Areas

This alternative incorporates most of the options included with the development of Alternative II. The exception applies to the excavation of the Buckbee-Mears Sludge Disposal Areas and relocation to the Old County Landfill, instead of capping in place. This alternative also proposes the combination of the Buckbee-Mears Disposal Areas and the Exposed Scrap Metal Area into one excavation, graded to promote drainage to the south (instead of backfilling). With the exception of cost, the effectiveness and compliance with SGSs of this alternative is identical to that presented under Alternative II. The detailed evaluation of this alternative will therefore only include the cost-benefit analysis.

5.3.1 Cost-Benefit Analysis

The costs associated with capping or excavation of the Buckbee-Mears Disposal Areas are nearly identical. There are clearly greater benefits, however, related to the excavation of these wastes. Specifically, excavation results in the complete removal of wastes from an area, allowing this area to become useful space. In addition, excavation eliminates the need to dedicate resources to actively maintain a cap and gas venting system. Finally, the removal of these wastes will forever eliminate the potential for future releases of contaminants to the environment.

This alternative proposes that the Buckbee-Mears Disposal Areas will be shaped and graded to drain collected surface water through two culverts to be installed at the southern ends of the respective excavation areas. This condition was proposed on the basis of the size of the areas and the greater costs associated with backfilling. Subsequently, this will allow for the excavated Exposed Scrap Metal Area (situated adjacent to the southern perimeter of the Abandoned City of Cortland Landfill) to be tied into the Buckbee-Mears excavations and incorporated into this drainage system. The option to cap the Buckbee-Mears Disposal Areas, as presented in Alternative II, did not present an economical way to grade and drain surface water from the excavated Exposed Scrap Metal Area due to the length of culvert (and associated deeper excavation) required to maintain minimum slope tolerances. As a result, Alternative II required the backfilling of the Exposed Scrap Metal Area, thereby increasing the overall remedial construction costs.

Therefore, in consideration of the similar costs associated with the disposition of the Buckbee-Mears wastes, and the costs savings associated with shaping the resulting excavations associated with the Exposed Scrap Metal Area and the Buckbee-Mears Disposal Areas, it is apparent that this alternative exhibits a greater cost-benefit relationship than Alternative II.

5.4 ALTERNATIVE IV - Waste Containment Including Capping Plus Relocation of Exposed Scrap Metal and Isolated Disposal Areas, With Consolidation of Thin Waste Areas

This alternative incorporates most of the options included with the development of Alternative III. The exception applies to the consolidation of the Abandoned City of Cortland Landfill through the excavation of the apparent thin waste area to the immediate south of the landfill vehicle access areas. As with the evaluation of Alternative III, the effectiveness and compliance with SGSs of this alternative are identical. Therefore, the detailed evaluation of this alternative will only include the cost-benefit analysis.

Construction of the proposed landfill cap, long-term monitoring, and institutional controls are similar to these previously described.

5.4.1 Cost-Benefit Analysis

The costs associated with the consolidation of the thin waste area associated with the Abandoned City of Cortland Landfill are less than those associated with capping this area using the standard Part 360 PVC Cap described earlier in this report. In addition, the location of the thin waste area is adjacent to the Exposed Scrap Metal Area and therefore can be incorporated into the grading and drainage plan described in Alternative III.

Subsequently, there will be considerable cost savings associated with the activities proposed under this alternative, obviously resulting in a greater cost-benefit relationship over Alternatives II & III.

5.5 Summary of Cost-Benefit Analyses: Alternatives I Through IV

The previous discussions identified the probable benefits to the environment and the wildlife communities with the implementation of each remedial alternative. The relationship between the apparent benefit and the estimated capital and O&M costs associated with each alternative provides the basis on which the most appropriate remedy should be selected. The analysis of these relationships leads to the following conclusions:

- Alternative I cannot be considered a viable remedial alternative at this site since it does not comply with Federal and State guidelines for closure of inactive hazardous waste disposal facilities.

- Institutional controls and deed restrictions will provide the best option to eliminate the possibility of contaminated groundwater being utilized for public water supply sources.

- Alternatives II through IV each exhibit acceptable benefits to the environment; as each alternative meets the goals presented earlier in Section 2. However, specific cost savings are made possible through the various configurations of capping and waste excavation and relocation activities. In general, the evaluation of the various closure scenarios indicated that the alternatives which propose greater excavation and waste relocation (rather than capping) result in lower overall construction costs. This trend is shown with the decreasing Net Present Worth costs from Alternative II (least acreage affected by waste excavation/relocation) to Alternative IV (greatest acreage affected by waste excavation/relocation), suggesting that Alternative IV offers the greatest cost-benefit relationship.

5.6 Recommended Remedial Alternative

Based on the detailed analyses of technical feasibility, implementability, environmental effectiveness and cost presented in Sections 3, 4 and 5 of this report, Alternative IV - "Waste Containment Including Capping plus Relocation of Exposed Scrap Metal and Isolated Disposal Areas, With Consolidation of Thin Waste Areas" is the recommended alternative. This alternative will meet all of the remedial objectives set forth for this project by implementing specific institutional controls, and source control measures through both capping and waste excavation/relocation activities.

This alternative includes the reduction of leachate generation through capping of the landfill with a low permeability cap system; the excavation and relocation of isolated and thin waste areas, and; the removal and proper disposal of both the exposed and shallow buried drums.

6. REFERENCES

Barton & Loguidice, P.C., December 1996, Old Cortland County Remedial Investigation/ Feasibility Study Final Work Plan.

Barton & Loguidice, P.C., March 1998, Old Cortland County Landfill Final Remedial Investigation Report, Volumes I (Report), II (Appendices), and III (Data Validation Reports).

Czupyrna, G., A.I. MacLean, R.D. Levy, and H. Gold, 1989, In Situ Immobilization of Heavy-Metal Contaminated Soils, Published by Noyes Data Corporation.

Giroud, J.P. and J.F. Beech, 1990, Factors Influencing the Stability of Liner Systems, Journal of Geotextiles, Geomembranes and Related Products.

Knox, R.C., D.A. Sabatini and L.W. Canter, 1993, Subsurface Transport and Fate Processes, Lewis Publishers.

Loehr, R.C., W.J. Jewell, J.D. Novak, W.W. Clarkson, and G.S. Friedman, 1979, Land Application of Wastes, Volumes I & II, Van Nostrand Reinhold Environmental Engineering Series, Published by Van Nostrand Reinhold Company.

New York State Department of Environmental Conservation, 1989, 6 NYCRR Part 360 - Solid Waste Management Facilities, NYSDEC, Division of Solid Waste, Regulation effective December, 1988.

New York State Department of Environmental Conservation, 1990, Selection of Remedial Actions at Inactive Hazardous Waste Sites, Revised Technical and Administrative Guidance Memorandum (TAGM) HWR-90-4030, Released May 15, 1990.

New York State Department of Environmental Conservation, 1992, Division Technical and Administrative Guidance Memorandum: Accelerated Remedial Actions at Class 2, Non-RCRA Regulated Landfills, Released March, 1992.

New York State Department of Environmental Conservation, 1993a, Local Government Regulatory Relief Initiative, Guidance on Landfill Closure Regulatory Relief, NYSDEC Division of Solid Waste, February, 1993.

New York State Department of Environmental Conservation, 1993b, Technical Guidance for Screening Contaminated Sediments, Guidance document produced in cooperation with the Division of Fish and Wildlife and the Division of Marine Resources.

Schroeder, P.R., T.S. Dozier, P.A. Zappi, B.M. McEnroe, J.W. Sjostrom, and R.L. Peyton, 1996, Hydrologic Evaluation of Landfill Performance - HELP Model: Engineering Documentation for Version 3.05a., EPA/600/R-96/168b, U.S. Environmental Protection Agency Risk Reduction Engineering Laboratory, Cincinatti, OH.

United States Environmental Protection Agency, 1991, Conducting Remedial Investigations/ Feasibility Studies for CERCLA Municipal Landfill Sites, EPA OSWER 9355.3-11, Released February, 1991.

United States Environmental Protection Agency, 1993, Presumptive Remedy for CERCLA Municipal Landfill Sites, EPA OSWER 9355.0-49FS, Released September 1993.

United States Environmental Protection Agency, 1997, Use of Monitored Natural Attenuation at Superfund, RCRA, Corrective Action, and Underground Storage Tank Sites, EPA OSWER 9200.4-17, Released as Draft Interim Final December, 1997.

APPENDIX A

HELP MODEL OUTPUT DATA FOR POTENTIAL CAPPING OPTIONS

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                 HELP MODEL VERSION 3.05a  (5 JUNE 1996)                  **
**                 DEVELOPED BY ENVIRONMENTAL LABORATORY                    **
**                   USAE WATERWAYS EXPERIMENT STATION                      **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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******************************************************************************


PRECIPITATION DATA FILE:     c:\help305\DATA4.D4
TEMPERATURE DATA FILE:       c:\help305\DATA7.D7
SOLAR RADIATION DATA FILE:   c:\help305\DATA13.D13
EVAPOTRANSPIRATION DATA:     c:\help305\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\HELP305\SOILCAP.D10
OUTPUT DATA FILE:            c:\help305\soilcap.OUT


TIME:  11: 3     DATE:   2/12/1998


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

     TITLE:  Old Cortland County LF FS: Part 360 Soil Cap

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


     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   0
          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     =       0.4359 VOL/VOL
          EFFECTIVE SAT. HYD. COND.      =  0.999999975000E-05 CM/SEC


                                    LAYER  2
```

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4570 VOL/VOL
FIELD CAPACITY	=	0.1310 VOL/VOL
WILTING POINT	=	0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1581 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05 CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4170 VOL/VOL
FIELD CAPACITY	=	0.0450 VOL/VOL
WILTING POINT	=	0.0180 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1093 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC
SLOPE	=	25.00 PERCENT
DRAINAGE LENGTH	=	230.0 FEET

LAYER 4

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	18.00 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.	=	0.100000001000E-06 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 5 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 25.% AND A SLOPE LENGTH OF 230. FEET.

SCS RUNOFF CURVE NUMBER	=	67.60	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	20.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	5.178	INCHES

```
UPPER LIMIT OF EVAPORATIVE STORAGE   =        9.060  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE   =        1.080  INCHES
INITIAL SNOW WATER                   =        0.000  INCHES
INITIAL WATER IN LAYER MATERIALS     =       13.510  INCHES
TOTAL INITIAL WATER                  =       13.510  INCHES
TOTAL SUBSURFACE INFLOW              =        0.00   INCHES/YEAR
```

EVAPOTRANSPIRATION AND WEATHER DATA

```
NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
         ITHACA                     NEW YORK

     STATION LATITUDE                             =  42.40 DEGREES
     MAXIMUM LEAF AREA INDEX                      =   2.00
     START OF GROWING SEASON (JULIAN DATE)        =    130
     END OF GROWING SEASON (JULIAN DATE)          =    279
     EVAPORATIVE ZONE DEPTH                       =  20.0  INCHES
     AVERAGE ANNUAL WIND SPEED                    =  10.30 MPH
     AVERAGE 1ST QUARTER RELATIVE HUMIDITY        =  74.00 %
     AVERAGE 2ND QUARTER RELATIVE HUMIDITY        =  69.00 %
     AVERAGE 3RD QUARTER RELATIVE HUMIDITY        =  75.00 %
     AVERAGE 4TH QUARTER RELATIVE HUMIDITY        =  76.00 %


NOTE:  PRECIPITATION DATA FOR     ITHACA                  NEW YORK
         WAS ENTERED FROM THE DEFAULT DATA FILE.


NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    ITHACA                 NEW YORK
```

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
22.20	22.70	32.20	44.50	54.80	64.30
68.80	67.10	60.20	49.60	39.30	27.60

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NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    ITHACA                 NEW YORK
           AND STATION LATITUDE  =   42.40 DEGREES
```

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1974

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.84	2.39	3.14	2.54	3.88	4.92
	1.24	3.21	4.98	2.08	3.72	3.08
RUNOFF	0.699	0.246	3.281	1.294	0.240	1.904
	0.126	1.079	1.365	0.232	0.827	1.223
EVAPOTRANSPIRATION	0.442	0.482	0.368	1.703	3.387	3.511
	4.311	1.117	2.590	1.674	1.020	0.302
LATERAL DRAINAGE COLLECTED	0.3066	0.1367	0.0557	0.1561	0.3774	0.2678
FROM LAYER 3	0.1848	0.2095	0.1546	0.0987	0.0399	0.3593
PERCOLATION/LEAKAGE THROUGH	0.1154	0.0997	0.1073	0.1053	0.1177	0.1108
LAYER 4	0.1115	0.1123	0.1071	0.1087	0.1033	0.1172

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	1.705	0.842	0.310	0.897	2.099	1.539
TOP OF LAYER 4	1.028	1.165	0.888	0.549	0.229	1.999
STD. DEVIATION OF DAILY	0.333	0.187	0.128	0.896	0.127	0.195
HEAD ON TOP OF LAYER 4	0.152	0.088	0.116	0.134	0.061	0.584

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ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.02	134382.578	100.00
RUNOFF	12.518	45438.539	33.81
EVAPOTRANSPIRATION	20.906	75887.664	56.47
DRAINAGE COLLECTED FROM LAYER 3	2.3471	8520.057	6.34
PERC./LEAKAGE THROUGH LAYER 4	1.316162	4777.667	3.56
AVG. HEAD ON TOP OF LAYER 4	1.1042		
CHANGE IN WATER STORAGE	-0.066	-241.290	-0.18
SOIL WATER AT START OF YEAR	14.175	51455.781	
SOIL WATER AT END OF YEAR	14.109	51214.492	
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	-0.065	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1975

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	3.06	2.25	1.24	3.88	4.95
	3.64	4.36	7.75	3.24	1.95	3.22
RUNOFF	0.000	0.049	3.710	0.436	0.631	1.279
	0.904	1.001	4.233	0.999	0.180	0.000
EVAPOTRANSPIRATION	0.507	0.468	0.315	1.204	3.001	4.492
	4.817	2.856	2.635	1.796	0.993	0.447
LATERAL DRAINAGE COLLECTED	0.2812	0.1225	0.0459	0.1611	0.3341	0.2254
FROM LAYER 3	0.1411	0.1782	0.1599	0.1433	0.2193	0.3099
PERCOLATION/LEAKAGE THROUGH	0.1146	0.0992	0.1069	0.1055	0.1163	0.1094
LAYER 4	0.1100	0.1113	0.1073	0.1101	0.1092	0.1155

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	1.564	0.754	0.255	0.926	1.858	1.296
TOP OF LAYER 4	0.785	0.991	0.919	0.797	1.260	1.724
STD. DEVIATION OF DAILY	0.312	0.175	0.120	0.773	0.125	0.148
HEAD ON TOP OF LAYER 4	0.137	0.191	0.048	0.219	0.099	0.232

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ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.98	148757.406	100.00
RUNOFF	13.424	48727.695	32.76

EVAPOTRANSPIRATION	23.530	85412.953	57.42
DRAINAGE COLLECTED FROM LAYER 3	2.3219	8428.415	5.67
PERC./LEAKAGE THROUGH LAYER 4	1.315445	4775.064	3.21
AVG. HEAD ON TOP OF LAYER 4	1.0941		
CHANGE IN WATER STORAGE	0.389	1413.270	0.95
SOIL WATER AT START OF YEAR	14.109	51214.492	
SOIL WATER AT END OF YEAR	12.175	44195.871	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	2.323	8431.890	5.67
ANNUAL WATER BUDGET BALANCE	0.0000	0.013	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1976

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.00	2.27	2.81	3.80	3.32	4.47
	8.44	3.66	3.37	5.91	1.63	1.77
RUNOFF	0.000	0.012	0.702	6.467	0.853	1.121
	4.003	1.060	0.824	3.246	0.011	0.002
EVAPOTRANSPIRATION	0.466	0.531	0.630	1.519	3.524	3.864
	6.176	3.103	2.003	1.590	1.035	0.464
LATERAL DRAINAGE COLLECTED	0.1966	0.0765	0.0137	0.0126	0.3384	0.3013
FROM LAYER 3	0.1931	0.1912	0.1840	0.1240	0.0424	0.0026
PERCOLATION/LEAKAGE THROUGH	0.1119	0.1011	0.0728	0.0302	0.1165	0.1119
LAYER 4	0.1117	0.1117	0.1080	0.1095	0.1034	0.0323

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	1.094	0.455	0.076	0.072	1.882	1.732
TOP OF LAYER 4	1.074	1.063	1.057	0.689	0.244	0.014
STD. DEVIATION OF DAILY	0.243	0.140	0.077	0.149	0.414	0.180

HEAD ON TOP OF LAYER 4	0.178	0.266	0.079	0.146	0.099	0.027

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ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.45	161353.516	100.00
RUNOFF	18.302	66437.180	41.17
EVAPOTRANSPIRATION	24.904	90402.328	56.03
DRAINAGE COLLECTED FROM LAYER 3	1.6762	6084.723	3.77
PERC./LEAKAGE THROUGH LAYER 4	1.120983	4069.168	2.52
AVG. HEAD ON TOP OF LAYER 4	0.7877		
CHANGE IN WATER STORAGE	-1.554	-5639.880	-3.50
SOIL WATER AT START OF YEAR	12.175	44195.871	
SOIL WATER AT END OF YEAR	11.290	40981.793	
SNOW WATER AT START OF YEAR	2.323	8431.890	5.23
SNOW WATER AT END OF YEAR	1.655	6006.088	3.72
ANNUAL WATER BUDGET BALANCE	0.0000	-0.003	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1977

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.36	1.82	3.29	2.32	2.17	3.03
	5.20	4.67	9.13	5.89	3.55	3.87
RUNOFF	0.580	2.209	3.688	1.325	0.525	0.499
	1.100	0.961	4.480	2.457	0.885	2.037
EVAPOTRANSPIRATION	0.402	0.503	0.390	0.668	2.217	2.938
	4.336	3.726	2.790	1.789	1.152	0.447

LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0031	0.0301	0.0050
FROM LAYER 3	0.0209	0.0093	0.0316	0.0294	0.3374	0.4708
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0129	0.1064	0.0890
LAYER 4	0.1061	0.1057	0.1031	0.0744	0.1130	0.1208

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.018	0.168	0.029
TOP OF LAYER 4	0.116	0.051	0.181	0.163	1.939	2.619
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.053	0.046	0.033
HEAD ON TOP OF LAYER 4	0.020	0.025	0.062	0.293	0.656	0.344

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ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.30	168069.031	100.00
RUNOFF	20.746	75308.578	44.81
EVAPOTRANSPIRATION	21.357	77525.055	46.13
DRAINAGE COLLECTED FROM LAYER 3	0.9375	3403.232	2.02
PERC./LEAKAGE THROUGH LAYER 4	0.831469	3018.233	1.80
AVG. HEAD ON TOP OF LAYER 4	0.4404		
CHANGE IN WATER STORAGE	2.428	8813.878	5.24
SOIL WATER AT START OF YEAR	11.290	40981.793	
SOIL WATER AT END OF YEAR	15.107	54837.613	
SNOW WATER AT START OF YEAR	1.655	6006.088	3.57
SNOW WATER AT END OF YEAR	0.266	964.143	0.57
ANNUAL WATER BUDGET BALANCE	0.0000	0.053	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.37	0.91	1.77	1.96	1.91	2.64
	2.33	4.25	1.94	3.62	0.95	3.39
RUNOFF	1.874	0.488	4.476	1.178	0.033	0.287
	0.508	1.360	0.226	0.916	0.000	0.147
EVAPOTRANSPIRATION	0.366	0.394	0.370	0.505	2.471	3.088
	4.479	2.270	1.520	1.418	1.127	0.643
LATERAL DRAINAGE COLLECTED	0.2576	0.1093	0.0368	0.0002	0.4641	0.5004
FROM LAYER 3	0.3657	0.3270	0.2310	0.1631	0.0908	0.0297
PERCOLATION/LEAKAGE THROUGH	0.1138	0.0988	0.1066	0.0095	0.1095	0.1183
LAYER 4	0.1174	0.1161	0.1096	0.1108	0.1050	0.1064

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	1.433	0.673	0.204	0.001	2.581	2.876
TOP OF LAYER 4	2.034	1.819	1.328	0.907	0.522	0.165
STD. DEVIATION OF DAILY	0.293	0.164	0.113	0.005	1.334	0.315
HEAD ON TOP OF LAYER 4	0.194	0.173	0.161	0.117	0.112	0.080

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ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	32.04	116305.187	100.00
RUNOFF	11.492	41716.937	35.87
EVAPOTRANSPIRATION	18.651	67702.102	58.21
DRAINAGE COLLECTED FROM LAYER 3	2.5757	9349.834	8.04
PERC./LEAKAGE THROUGH LAYER 4	1.221877	4435.413	3.81
AVG. HEAD ON TOP OF LAYER 4	1.2120		
CHANGE IN WATER STORAGE	-1.901	-6899.089	-5.93
SOIL WATER AT START OF YEAR	15.107	54837.613	

SOIL WATER AT END OF YEAR	11.566	41983.887	
SNOW WATER AT START OF YEAR	0.266	964.143	0.83
SNOW WATER AT END OF YEAR	1.906	6918.781	5.95
ANNUAL WATER BUDGET BALANCE	0.0000	-0.009	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	2.80	2.09	2.65	2.37	3.03	4.00
	4.17	4.03	5.43	4.15	2.36	3.07
STD. DEVIATIONS	2.10	0.80	0.63	0.94	0.94	1.09
	2.81	0.59	2.99	1.70	1.22	0.78
RUNOFF						
TOTALS	0.631	0.601	3.171	2.140	0.457	1.018
	1.328	1.092	2.226	1.570	0.381	0.682
STD. DEVIATIONS	0.766	0.919	1.447	2.446	0.323	0.646
	1.542	0.157	1.989	1.239	0.440	0.914
EVAPOTRANSPIRATION						
TOTALS	0.437	0.476	0.415	1.120	2.920	3.579
	4.824	2.614	2.308	1.653	1.065	0.461
STD. DEVIATIONS	0.055	0.051	0.123	0.522	0.567	0.627
	0.782	0.987	0.532	0.157	0.070	0.122
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	0.2084	0.0890	0.0304	0.0666	0.3088	0.2600
	0.1811	0.1830	0.1522	0.1117	0.1460	0.2345
STD. DEVIATIONS	0.1234	0.0545	0.0230	0.0841	0.1643	0.1773
	0.1240	0.1137	0.0739	0.0518	0.1294	0.2079
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0911	0.0798	0.0787	0.0527	0.1133	0.1079
	0.1113	0.1114	0.1070	0.1027	0.1068	0.0984
STD. DEVIATIONS	0.0510	0.0446	0.0464	0.0488	0.0050	0.0111

0.0040	0.0037	0.0024	0.0158	0.0042	0.0373

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	1.1591	0.5447	0.1691	0.3829	1.7178	1.4942
	1.0074	1.0181	0.8747	0.6212	0.8389	1.3041
STD. DEVIATIONS	0.6865	0.3366	0.1281	0.4834	0.9139	1.0191
	0.6896	0.6325	0.4246	0.2882	0.7440	1.1563

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

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.16 (5.757)	145773.5	100.00
RUNOFF	15.296 (4.0136)	55525.79	38.090
EVAPOTRANSPIRATION	21.869 (2.4248)	79386.02	54.458
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.97169 (0.66806)	7157.252	4.90984
PERCOLATION/LEAKAGE THROUGH LAYER 4	1.16119 (0.20114)	4215.109	2.89155
AVERAGE HEAD ON TOP OF LAYER 4	0.928 (0.315)		
CHANGE IN WATER STORAGE	-0.141 (1.7305)	-510.62	-0.350

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PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)
PRECIPITATION	3.13	11361.900
RUNOFF	2.556	9277.4287
DRAINAGE COLLECTED FROM LAYER 3	0.02112	76.68034
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.004090	14.84602
AVERAGE HEAD ON TOP OF LAYER 4	3.642	
MAXIMUM HEAD ON TOP OF LAYER 4	7.012	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	7.10	25775.8906
MAXIMUM VEG. SOIL WATER (VOL/VOL)		0.3932
MINIMUM VEG. SOIL WATER (VOL/VOL)		0.0560

*** 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	2.0446	0.3408
2	1.0291	0.0858
3	0.8061	0.0672
4	7.6860	0.4270
SNOW WATER	1.906	

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**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                 HELP MODEL VERSION 3.05a  (5 JUNE 1996)                   **
**                DEVELOPED BY ENVIRONMENTAL LABORATORY                     **
**                  USAE WATERWAYS EXPERIMENT STATION                       **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:     a:\help305\DATA4.D4
TEMPERATURE DATA FILE:       a:\help305\DATA7.D7
SOLAR RADIATION DATA FILE:   a:\help305\DATA13.D13
EVAPOTRANSPIRATION DATA:     a:\help305\DATA11.D11
SOIL AND DESIGN DATA FILE:   a:\help305\SOILCAPD.D10
OUTPUT DATA FILE:            a:\help305\SOILCAPD.OUT


TIME:  13: 4     DATE:   2/13/1998


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

     TITLE:  Old Cortland County LF FS: Part 360 Soil Cap (w/o drainage)

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


     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    0
          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  =       0.4356 VOL/VOL
          EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-05 CM/SEC


                                   LAYER  2
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TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4570 VOL/VOL
FIELD CAPACITY	=	0.1310 VOL/VOL
WILTING POINT	=	0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1431 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05 CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4570 VOL/VOL
FIELD CAPACITY	=	0.1310 VOL/VOL
WILTING POINT	=	0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3137 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05 CM/SEC
SLOPE	=	25.00 PERCENT
DRAINAGE LENGTH	=	230.0 FEET

LAYER 4

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	18.00 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.	=	0.100000001000E-06 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 5 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 25.% AND A SLOPE LENGTH OF 230. FEET.

SCS RUNOFF CURVE NUMBER	=	67.60	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	20.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	4.724	INCHES

```
UPPER LIMIT OF EVAPORATIVE STORAGE   =      9.140  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE   =      1.160  INCHES
INITIAL SNOW WATER                   =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS     =     15.781  INCHES
TOTAL INITIAL WATER                  =     15.781  INCHES
TOTAL SUBSURFACE INFLOW              =      0.00   INCHES/YEAR
```

EVAPOTRANSPIRATION AND WEATHER DATA

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NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
         ITHACA                  NEW YORK

    STATION LATITUDE                            =  42.40 DEGREES
    MAXIMUM LEAF AREA INDEX                     =   2.00
    START OF GROWING SEASON (JULIAN DATE)       =    130
    END OF GROWING SEASON (JULIAN DATE)         =    279
    EVAPORATIVE ZONE DEPTH                      =  20.0  INCHES
    AVERAGE ANNUAL WIND SPEED                   =  10.30 MPH
    AVERAGE 1ST QUARTER RELATIVE HUMIDITY       =  74.00 %
    AVERAGE 2ND QUARTER RELATIVE HUMIDITY       =  69.00 %
    AVERAGE 3RD QUARTER RELATIVE HUMIDITY       =  75.00 %
    AVERAGE 4TH QUARTER RELATIVE HUMIDITY       =  76.00 %


NOTE:  PRECIPITATION DATA FOR    ITHACA                NEW YORK
         WAS ENTERED FROM THE DEFAULT DATA FILE.


NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    ITHACA                NEW YORK
```

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
22.20	22.70	32.20	44.50	54.80	64.30
68.80	67.10	60.20	49.60	39.30	27.60

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NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    ITHACA                NEW YORK
           AND STATION LATITUDE  =   42.40 DEGREES
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MONTHLY TOTALS (IN INCHES) FOR YEAR 1974

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.84	2.39	3.14	2.54	3.88	4.92
	1.24	3.21	4.98	2.08	3.72	3.08
RUNOFF	0.674	0.232	3.220	1.255	0.242	1.875
	0.124	1.094	1.364	0.236	0.827	1.238
EVAPOTRANSPIRATION	0.456	0.482	0.403	1.637	3.317	3.198
	4.291	0.954	3.036	1.439	0.809	0.282
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.0131	0.0111	0.0114	0.0127	0.0173	0.0168
	0.0176	0.0179	0.0174	0.0179	0.0170	0.0196
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.1481	0.1313	0.1427	0.1434	0.1620	0.1569
	0.1627	0.1637	0.1586	0.1638	0.1575	0.1692

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	7.283	6.817	6.362	7.288	9.646	9.677
	9.781	9.946	9.973	9.959	9.788	10.884
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.145	0.128	0.139	1.305	0.176	0.069
	0.145	0.054	0.031	0.044	0.114	1.466

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ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.02	134382.578	100.00
RUNOFF	12.380	44940.781	33.44
EVAPOTRANSPIRATION	20.304	73704.812	54.85
DRAINAGE COLLECTED FROM LAYER 3	0.1898	688.920	0.51
PERC./LEAKAGE THROUGH LAYER 4	1.859938	6751.576	5.02
AVG. HEAD ON TOP OF LAYER 4	8.9503		
CHANGE IN WATER STORAGE	2.286	8296.536	6.17
SOIL WATER AT START OF YEAR	16.174	58713.254	
SOIL WATER AT END OF YEAR	18.460	67009.789	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00

SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.051	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1975

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	3.06	2.25	1.24	3.88	4.95
	3.64	4.36	7.75	3.24	1.95	3.22
RUNOFF	0.000	0.055	3.873	0.484	0.630	1.280
	0.865	0.994	4.220	1.000	0.180	0.000
EVAPOTRANSPIRATION	0.507	0.468	0.335	1.330	3.061	4.385
	4.936	3.300	3.370	1.757	0.964	0.410
LATERAL DRAINAGE COLLECTED	0.0171	0.0146	0.0152	0.0203	0.0277	0.0233
FROM LAYER 3	0.0227	0.0213	0.0182	0.0179	0.0167	0.0176
PERCOLATION/LEAKAGE THROUGH	0.1611	0.1428	0.1551	0.1681	0.1957	0.1779
LAYER 4	0.1795	0.1747	0.1612	0.1639	0.1564	0.1630

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	9.494	8.980	8.477	11.643	15.413	13.380
TOP OF LAYER 4	12.642	11.829	10.436	9.972	9.586	9.816
STD. DEVIATION OF DAILY	0.160	0.142	0.153	3.093	0.359	0.579
HEAD ON TOP OF LAYER 4	0.140	1.141	0.608	0.046	0.141	0.121

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ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.98	148757.406	100.00
RUNOFF	13.580	49296.043	33.14

EVAPOTRANSPIRATION	24.825	90113.547	60.58
DRAINAGE COLLECTED FROM LAYER 3	0.2326	844.160	0.57
PERC./LEAKAGE THROUGH LAYER 4	1.999283	7257.396	4.88
AVG. HEAD ON TOP OF LAYER 4	10.9723		
CHANGE IN WATER STORAGE	0.343	1246.257	0.84
SOIL WATER AT START OF YEAR	18.460	67009.789	
SOIL WATER AT END OF YEAR	16.480	59824.156	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	2.323	8431.890	5.67
ANNUAL WATER BUDGET BALANCE	0.0000	0.007	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1976

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.00	2.27	2.81	3.80	3.32	4.47
	8.44	3.66	3.37	5.91	1.63	1.77
RUNOFF	0.000	0.029	0.952	6.791	0.926	1.062
	4.022	1.053	0.824	3.248	0.006	0.002
EVAPOTRANSPIRATION	0.466	0.531	0.630	1.395	3.362	4.080
	6.199	3.553	2.205	1.386	0.890	0.464
LATERAL DRAINAGE COLLECTED	0.0168	0.0148	0.0150	0.0136	0.0198	0.0216
FROM LAYER 3	0.0214	0.0196	0.0174	0.0178	0.0170	0.0166
PERCOLATION/LEAKAGE THROUGH	0.1602	0.1470	0.1542	0.1464	0.1698	0.1724
LAYER 4	0.1751	0.1691	0.1587	0.1635	0.1574	0.1596

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	9.345	8.826	8.318	7.828	10.990	12.418
TOP OF LAYER 4	11.898	10.874	10.000	9.910	9.762	9.247
STD. DEVIATION OF DAILY	0.159	0.146	0.152	0.126	1.767	0.169

HEAD ON TOP OF LAYER 4	0.159	0.733	0.011	0.090	0.140	0.159

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ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.45	161353.516	100.00
RUNOFF	18.915	68660.305	42.55
EVAPOTRANSPIRATION	25.161	91333.937	56.60
DRAINAGE COLLECTED FROM LAYER 3	0.2114	767.217	0.48
PERC./LEAKAGE THROUGH LAYER 4	1.933620	7019.042	4.35
AVG. HEAD ON TOP OF LAYER 4	9.9513		
CHANGE IN WATER STORAGE	-1.771	-6427.036	-3.98
SOIL WATER AT START OF YEAR	16.480	59824.156	
SOIL WATER AT END OF YEAR	15.378	55822.922	
SNOW WATER AT START OF YEAR	2.323	8431.890	5.23
SNOW WATER AT END OF YEAR	1.655	6006.088	3.72
ANNUAL WATER BUDGET BALANCE	0.0000	0.055	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1977

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.36	1.82	3.29	2.32	2.17	3.03
	5.20	4.67	9.13	5.89	3.55	3.87
RUNOFF	0.580	1.872	3.367	1.143	0.524	0.678
	1.091	0.958	4.472	2.457	0.885	2.122
EVAPOTRANSPIRATION	0.402	0.503	0.390	0.666	2.198	3.228
	4.528	2.845	2.638	1.794	1.137	0.447

LATERAL DRAINAGE COLLECTED	0.0157	0.0133	0.0139	0.0126	0.0128	0.0119
FROM LAYER 3	0.0133	0.0177	0.0172	0.0212	0.0258	0.0218
PERCOLATION/LEAKAGE THROUGH	0.1565	0.1387	0.1507	0.1432	0.1472	0.1409
LAYER 4	0.1487	0.1631	0.1582	0.1745	0.1861	0.1765

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	8.713	8.216	7.730	7.254	7.134	6.852
TOP OF LAYER 4	7.383	9.835	9.904	11.782	14.830	12.131
STD. DEVIATION OF DAILY	0.155	0.137	0.148	0.121	0.091	0.034
HEAD ON TOP OF LAYER 4	0.723	0.265	0.061	1.612	1.692	3.077

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ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.30	168069.031	100.00
RUNOFF	20.150	73143.437	43.52
EVAPOTRANSPIRATION	20.776	75416.953	44.87
DRAINAGE COLLECTED FROM LAYER 3	0.1973	716.038	0.43
PERC./LEAKAGE THROUGH LAYER 4	1.884281	6839.938	4.07
AVG. HEAD ON TOP OF LAYER 4	9.3135		
CHANGE IN WATER STORAGE	3.293	11952.619	7.11
SOIL WATER AT START OF YEAR	15.378	55822.922	
SOIL WATER AT END OF YEAR	20.060	72817.484	
SNOW WATER AT START OF YEAR	1.655	6006.088	3.57
SNOW WATER AT END OF YEAR	0.266	964.143	0.57
ANNUAL WATER BUDGET BALANCE	0.0000	0.038	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.37	0.91	1.77	1.96	1.91	2.64
	2.33	4.25	1.94	3.62	0.95	3.39
RUNOFF	2.021	0.585	4.704	1.356	0.035	0.287
	0.508	1.363	0.222	0.917	0.000	0.146
EVAPOTRANSPIRATION	0.366	0.394	0.371	0.506	2.467	3.088
	5.066	3.031	2.389	1.443	0.949	0.559
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.0168	0.0144	0.0150	0.0137	0.0315	0.0325
	0.0281	0.0202	0.0174	0.0179	0.0172	0.0173
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.1603	0.1421	0.1544	0.1466	0.2080	0.2081
	0.1969	0.1711	0.1588	0.1637	0.1581	0.1617

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	9.371	8.859	8.359	7.853	17.510	18.702
	15.615	11.208	10.013	9.936	9.881	9.595
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.159	0.141	0.152	0.144	4.809	1.041
	1.079	1.095	0.112	0.035	0.044	0.133

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ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	32.04	116305.187	100.00
RUNOFF	12.143	44078.711	37.90
EVAPOTRANSPIRATION	20.628	74880.578	64.38
DRAINAGE COLLECTED FROM LAYER 3	0.2419	878.092	0.75
PERC./LEAKAGE THROUGH LAYER 4	2.029741	7367.961	6.34
AVG. HEAD ON TOP OF LAYER 4	11.4084		
CHANGE IN WATER STORAGE	-3.003	-10900.167	-9.37
SOIL WATER AT START OF YEAR	20.060	72817.484	

SOIL WATER AT END OF YEAR	15.417	55962.680	
SNOW WATER AT START OF YEAR	0.266	964.143	0.83
SNOW WATER AT END OF YEAR	1.906	6918.781	5.95
ANNUAL WATER BUDGET BALANCE	0.0000	0.016	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	2.80	2.09	2.65	2.37	3.03	4.00
	4.17	4.03	5.43	4.15	2.36	3.07
STD. DEVIATIONS	2.10	0.80	0.63	0.94	0.94	1.09
	2.81	0.59	2.99	1.70	1.22	0.78
RUNOFF						
TOTALS	0.655	0.555	3.223	2.206	0.471	1.036
	1.322	1.092	2.221	1.572	0.380	0.702
STD. DEVIATIONS	0.826	0.769	1.396	2.586	0.346	0.603
	1.553	0.160	1.984	1.238	0.441	0.948
EVAPOTRANSPIRATION						
TOTALS	0.439	0.476	0.426	1.107	2.881	3.596
	5.004	2.737	2.728	1.564	0.950	0.432
STD. DEVIATIONS	0.056	0.051	0.117	0.492	0.522	0.594
	0.737	1.032	0.475	0.195	0.121	0.101
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	0.0159	0.0136	0.0141	0.0146	0.0218	0.0212
	0.0206	0.0193	0.0175	0.0185	0.0187	0.0186
STD. DEVIATIONS	0.0017	0.0015	0.0016	0.0032	0.0076	0.0077
	0.0056	0.0015	0.0004	0.0015	0.0040	0.0021
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.1572	0.1404	0.1514	0.1495	0.1766	0.1712
	0.1726	0.1684	0.1591	0.1659	0.1631	0.1660
STD. DEVIATIONS	0.0054	0.0059	0.0052	0.0105	0.0249	0.0251

0.0181	0.0050	0.0012	0.0048	0.0129	0.0069

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	8.8411	8.3395	7.8491	8.3733	12.1385	12.2057
	11.4635	10.7385	10.0651	10.3118	10.7693	10.3345
STD. DEVIATIONS	0.9227	0.9012	0.8801	1.8502	4.2471	4.4352
	3.0941	0.8475	0.2113	0.8220	2.2723	1.1754

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

	INCHES		CU. FEET	PERCENT
PRECIPITATION	40.16	(5.757)	145773.5	100.00
RUNOFF	15.434	(3.8061)	56023.86	38.432
EVAPOTRANSPIRATION	22.339	(2.4316)	81089.96	55.627
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.21457	(0.02233)	778.885	0.53431
PERCOLATION/LEAKAGE THROUGH LAYER 4	1.94137	(0.07265)	7047.183	4.83434
AVERAGE HEAD ON TOP OF LAYER 4	10.119	(1.053)		
CHANGE IN WATER STORAGE	0.230	(2.6491)	833.64	0.572

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PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)
PRECIPITATION	3.13	11361.900
RUNOFF	2.565	9311.9150
DRAINAGE COLLECTED FROM LAYER 3	0.00130	4.70519
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.007625	27.67861
AVERAGE HEAD ON TOP OF LAYER 4	22.349	
MAXIMUM HEAD ON TOP OF LAYER 4	39.050	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	16.5 FEET	
SNOW WATER	7.10	25775.8906

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4447
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0600

*** 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	2.0483	0.3414
2	1.2105	0.1009
3	4.4719	0.3727
4	7.6860	0.4270
SNOW WATER	1.906	

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**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                  HELP MODEL VERSION 3.05a  (5 JUNE 1996)                  **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY             **
**                                                                          **
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PRECIPITATION DATA FILE:     c:\help305\DATA4.D4
TEMPERATURE DATA FILE:       c:\help305\DATA7.D7
SOLAR RADIATION DATA FILE:   c:\help305\DATA13.D13
EVAPOTRANSPIRATION DATA:     c:\help305\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\HELP305\PVCCAP.D10
OUTPUT DATA FILE:            c:\help305\pvccap.OUT


TIME:  11: 4     DATE:   2/12/1998


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     TITLE:  Old Cortland County LF FS: Part 360 PVC Cap

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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   0
          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 =        0.4358 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =    0.999999975000E-05 CM/SEC


                                   LAYER  2
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TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1581	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4170	VOL/VOL
FIELD CAPACITY	=	0.0450	VOL/VOL
WILTING POINT	=	0.0180	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1250	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC
SLOPE	=	25.00	PERCENT
DRAINAGE LENGTH	=	230.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 37

THICKNESS	=	0.04	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.	=	0.199999999000E-10	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 COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 5 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 25.% AND A SLOPE LENGTH OF 230. FEET.

SCS RUNOFF CURVE NUMBER	=	67.60	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT

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AREA PROJECTED ON HORIZONTAL PLANE    =      1.000  ACRES
EVAPORATIVE ZONE DEPTH                =     20.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE     =      5.177  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE    =      9.060  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE    =      1.080  INCHES
INITIAL SNOW WATER                    =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS      =      6.012  INCHES
TOTAL INITIAL WATER                   =      6.012  INCHES
TOTAL SUBSURFACE INFLOW               =      0.00   INCHES/YEAR
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EVAPOTRANSPIRATION AND WEATHER DATA

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NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
         ITHACA                NEW YORK

    STATION LATITUDE                          =  42.40 DEGREES
    MAXIMUM LEAF AREA INDEX                   =   2.00
    START OF GROWING SEASON (JULIAN DATE)     =    130
    END OF GROWING SEASON (JULIAN DATE)       =    279
    EVAPORATIVE ZONE DEPTH                    =  20.0  INCHES
    AVERAGE ANNUAL WIND SPEED                 =  10.30 MPH
    AVERAGE 1ST QUARTER RELATIVE HUMIDITY     =  74.00 %
    AVERAGE 2ND QUARTER RELATIVE HUMIDITY     =  69.00 %
    AVERAGE 3RD QUARTER RELATIVE HUMIDITY     =  75.00 %
    AVERAGE 4TH QUARTER RELATIVE HUMIDITY     =  76.00 %


NOTE:  PRECIPITATION DATA FOR     ITHACA              NEW YORK
         WAS ENTERED FROM THE DEFAULT DATA FILE.


NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    ITHACA              NEW YORK
```

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
22.20	22.70	32.20	44.50	54.80	64.30
68.80	67.10	60.20	49.60	39.30	27.60

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NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    ITHACA              NEW YORK
           AND STATION LATITUDE  =  42.40 DEGREES
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MONTHLY TOTALS (IN INCHES) FOR YEAR 1974

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.84	2.39	3.14	2.54	3.88	4.92
	1.24	3.21	4.98	2.08	3.72	3.08
RUNOFF	0.699	0.246	3.281	1.293	0.243	1.904
	0.126	1.082	1.365	0.233	0.828	1.180
EVAPOTRANSPIRATION	0.443	0.482	0.369	1.699	3.519	3.508
	4.177	1.140	3.365	1.544	1.043	0.304
LATERAL DRAINAGE COLLECTED	0.3971	0.2184	0.1472	0.2451	0.4669	0.3507
FROM LAYER 3	0.2787	0.2898	0.2138	0.1764	0.1649	0.5868
PERCOLATION/LEAKAGE THROUGH	0.0273	0.0167	0.0125	0.0180	0.0312	0.0246
LAYER 4	0.0207	0.0213	0.0167	0.0144	0.0135	0.0374

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	2.209	1.345	0.819	1.409	2.597	2.015
TOP OF LAYER 4	1.550	1.612	1.229	0.981	0.948	3.264
STD. DEVIATION OF DAILY	0.335	0.186	0.126	0.893	0.141	0.172
HEAD ON TOP OF LAYER 4	0.154	0.083	0.145	0.103	0.384	0.457

ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.02	134382.578	100.00
RUNOFF	12.480	45303.152	33.71
EVAPOTRANSPIRATION	21.592	78380.273	58.33
DRAINAGE COLLECTED FROM LAYER 3	3.5359	12835.167	9.55
PERC./LEAKAGE THROUGH LAYER 4	0.254328	923.212	0.69
AVG. HEAD ON TOP OF LAYER 4	1.6648		
CHANGE IN WATER STORAGE	-0.843	-3059.179	-2.28
SOIL WATER AT START OF YEAR	7.128	25873.258	
SOIL WATER AT END OF YEAR	6.285	22814.078	

SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.051	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1975

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	3.06	2.25	1.24	3.88	4.95
	3.64	4.36	7.75	3.24	1.95	3.22
RUNOFF	0.000	0.027	3.451	0.323	0.632	1.280
	0.905	1.000	4.236	0.999	0.180	0.000
EVAPOTRANSPIRATION	0.507	0.468	0.312	1.205	3.029	4.505
	4.828	2.090	2.748	1.843	1.015	0.450
LATERAL DRAINAGE COLLECTED	0.4421	0.2433	0.1642	0.3890	0.5048	0.3552
FROM LAYER 3	0.2557	0.2417	0.2461	0.2015	0.2330	0.3415
PERCOLATION/LEAKAGE THROUGH	0.0298	0.0182	0.0136	0.0262	0.0332	0.0249
LAYER 4	0.0193	0.0185	0.0186	0.0160	0.0178	0.0243

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	2.459	1.498	0.913	2.236	2.808	2.041
TOP OF LAYER 4	1.422	1.345	1.414	1.121	1.339	1.900
STD. DEVIATION OF DAILY	0.372	0.207	0.140	1.104	0.261	0.170
HEAD ON TOP OF LAYER 4	0.187	0.088	0.071	0.109	0.059	0.253

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ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.98	148757.406	100.00

RUNOFF	13.032	47305.703	31.80
EVAPOTRANSPIRATION	23.001	83493.172	56.13
DRAINAGE COLLECTED FROM LAYER 3	3.6181	13133.575	8.83
PERC./LEAKAGE THROUGH LAYER 4	0.260352	945.078	0.64
AVG. HEAD ON TOP OF LAYER 4	1.7080		
CHANGE IN WATER STORAGE	1.069	3879.864	2.61
SOIL WATER AT START OF YEAR	6.285	22814.078	
SOIL WATER AT END OF YEAR	5.031	18262.053	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	2.323	8431.890	5.67
ANNUAL WATER BUDGET BALANCE	0.0000	0.021	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1976

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.00	2.27	2.81	3.80	3.32	4.47
	8.44	3.66	3.37	5.91	1.63	1.77
RUNOFF	0.000	0.012	0.702	6.466	0.853	1.122
	4.003	1.059	0.825	3.246	0.011	0.001
EVAPOTRANSPIRATION	0.466	0.531	0.630	1.524	3.533	3.867
	6.186	2.984	2.081	1.581	1.037	0.464
LATERAL DRAINAGE COLLECTED	0.2508	0.1412	0.0907	0.0663	0.3981	0.3687
FROM LAYER 3	0.2708	0.2779	0.2672	0.2184	0.1303	0.0817
PERCOLATION/LEAKAGE THROUGH	0.0190	0.0119	0.0086	0.0066	0.0274	0.0256
LAYER 4	0.0202	0.0206	0.0199	0.0171	0.0113	0.0079

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	1.395	0.840	0.505	0.381	2.214	2.119

TOP OF LAYER 4	1.506	1.546	1.536	1.215	0.749	0.454
STD. DEVIATION OF DAILY	0.213	0.121	0.078	0.143	0.430	0.166
HEAD ON TOP OF LAYER 4	0.166	0.292	0.066	0.159	0.107	0.071

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ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.45	161353.516	100.00
RUNOFF	18.302	66436.734	41.17
EVAPOTRANSPIRATION	24.883	90325.766	55.98
DRAINAGE COLLECTED FROM LAYER 3	2.5621	9300.422	5.76
PERC./LEAKAGE THROUGH LAYER 4	0.196120	711.916	0.44
AVG. HEAD ON TOP OF LAYER 4	1.2049		
CHANGE IN WATER STORAGE	-1.493	-5421.391	-3.36
SOIL WATER AT START OF YEAR	5.031	18262.053	
SOIL WATER AT END OF YEAR	4.206	15266.464	
SNOW WATER AT START OF YEAR	2.323	8431.890	5.23
SNOW WATER AT END OF YEAR	1.655	6006.088	3.72
ANNUAL WATER BUDGET BALANCE	0.0000	0.066	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1977

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.36	1.82	3.29	2.32	2.17	3.03
	5.20	4.67	9.13	5.89	3.55	3.87
RUNOFF	0.580	2.209	3.686	1.317	0.525	0.498
	1.099	0.961	4.480	2.457	0.885	1.938

EVAPOTRANSPIRATION	0.402	0.503	0.390	0.668	2.217	2.961
	4.301	3.747	2.728	1.785	1.152	0.447
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.0479	0.0258	0.0170	0.0097	0.0361	0.0619
	0.1190	0.1240	0.1464	0.3244	0.7101	0.7251
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0052	0.0032	0.0024	0.0015	0.0041	0.0063
	0.0106	0.0110	0.0124	0.0227	0.0434	0.0445

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.266	0.159	0.095	0.056	0.201	0.356
	0.662	0.690	0.841	1.805	4.081	4.033
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.042	0.023	0.015	0.008	0.089	0.143
	0.023	0.037	0.069	1.111	0.509	0.448

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ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.30	168069.031	100.00
RUNOFF	20.635	74905.297	44.57
EVAPOTRANSPIRATION	21.300	77320.219	46.01
DRAINAGE COLLECTED FROM LAYER 3	2.3474	8521.102	5.07
PERC./LEAKAGE THROUGH LAYER 4	0.167347	607.470	0.36
AVG. HEAD ON TOP OF LAYER 4	1.1037		
CHANGE IN WATER STORAGE	1.850	6714.903	4.00
SOIL WATER AT START OF YEAR	4.206	15266.464	
SOIL WATER AT END OF YEAR	7.444	27023.312	
SNOW WATER AT START OF YEAR	1.655	6006.088	3.57
SNOW WATER AT END OF YEAR	0.266	964.143	0.57
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.37	0.91	1.77	1.96	1.91	2.64
	2.33	4.25	1.94	3.62	0.95	3.39
RUNOFF	1.698	0.392	4.322	1.082	0.033	0.287
	0.508	1.360	0.225	0.916	0.000	0.147
EVAPOTRANSPIRATION	0.366	0.394	0.370	0.505	2.471	3.088
	4.488	2.212	1.770	1.595	1.062	0.554
LATERAL DRAINAGE COLLECTED	0.4488	0.2470	0.1667	0.0960	0.4214	0.4883
FROM LAYER 3	0.3915	0.3633	0.2554	0.2148	0.2261	0.1847
PERCOLATION/LEAKAGE THROUGH	0.0302	0.0184	0.0138	0.0089	0.0281	0.0321
LAYER 4	0.0271	0.0255	0.0192	0.0169	0.0174	0.0150

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	2.496	1.521	0.927	0.552	2.344	2.807
TOP OF LAYER 4	2.177	2.021	1.468	1.195	1.300	1.027
STD. DEVIATION OF DAILY	0.378	0.210	0.142	0.083	1.122	0.239
HEAD ON TOP OF LAYER 4	0.190	0.203	0.120	0.055	0.072	0.063

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ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	32.04	116305.187	100.00
RUNOFF	10.971	39823.559	34.24
EVAPOTRANSPIRATION	18.876	68518.070	58.91
DRAINAGE COLLECTED FROM LAYER 3	3.5040	12719.442	10.94
PERC./LEAKAGE THROUGH LAYER 4	0.252382	916.148	0.79
AVG. HEAD ON TOP OF LAYER 4	1.6528		
CHANGE IN WATER STORAGE	-1.563	-5672.021	-4.88

SOIL WATER AT START OF YEAR	7.444	27023.312	
SOIL WATER AT END OF YEAR	4.242	15396.653	
SNOW WATER AT START OF YEAR	0.266	964.143	0.83
SNOW WATER AT END OF YEAR	1.906	6918.781	5.95
ANNUAL WATER BUDGET BALANCE	0.0000	-0.011	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	2.80	2.09	2.65	2.37	3.03	4.00
	4.17	4.03	5.43	4.15	2.36	3.07
STD. DEVIATIONS	2.10	0.80	0.63	0.94	0.94	1.09
	2.81	0.59	2.99	1.70	1.22	0.78
RUNOFF						
TOTALS	0.595	0.577	3.088	2.096	0.457	1.018
	1.328	1.093	2.226	1.570	0.381	0.653
STD. DEVIATIONS	0.696	0.926	1.391	2.476	0.323	0.646
	1.541	0.157	1.989	1.239	0.440	0.871
EVAPOTRANSPIRATION						
TOTALS	0.437	0.476	0.414	1.120	2.954	3.586
	4.796	2.435	2.538	1.670	1.062	0.444
STD. DEVIATIONS	0.055	0.051	0.124	0.522	0.599	0.626
	0.815	0.984	0.625	0.135	0.053	0.090
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	0.3173	0.1751	0.1172	0.1612	0.3654	0.3250
	0.2631	0.2594	0.2258	0.2271	0.2929	0.3840
STD. DEVIATIONS	0.1705	0.0937	0.0638	0.1542	0.1887	0.1576
	0.0970	0.0876	0.0486	0.0568	0.2371	0.2695
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0223	0.0137	0.0102	0.0123	0.0248	0.0227

	0.0196	0.0194	0.0173	0.0174	0.0207	0.0258
STD. DEVIATIONS	0.0105	0.0064	0.0048	0.0098	0.0118	0.0097
	0.0059	0.0053	0.0030	0.0031	0.0130	0.0152

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	1.7650	1.0724	0.6516	0.9265	2.0326	1.8678
	1.4635	1.4426	1.2977	1.2633	1.6834	2.1356
STD. DEVIATIONS	0.9482	0.5799	0.3550	0.8863	1.0494	0.9058
	0.5394	0.4872	0.2794	0.3161	1.3630	1.4987

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

	INCHES		CU. FEET	PERCENT
PRECIPITATION	40.16	(5.757)	145773.5	100.00
RUNOFF	15.084	(4.1557)	54754.89	37.562
EVAPOTRANSPIRATION	21.930	(2.2197)	79607.50	54.610
LATERAL DRAINAGE COLLECTED FROM LAYER 3	3.11348	(0.60753)	11301.942	7.75308
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.22611	(0.04187)	820.765	0.56304
AVERAGE HEAD ON TOP OF LAYER 4	1.467	(0.288)		
CHANGE IN WATER STORAGE	-0.196	(1.5616)	-711.56	-0.488

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PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)
PRECIPITATION	3.13	11361.900
RUNOFF	2.555	9275.8662
DRAINAGE COLLECTED FROM LAYER 3	0.02749	99.79900
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.001638	5.94622
AVERAGE HEAD ON TOP OF LAYER 4	4.740	
MAXIMUM HEAD ON TOP OF LAYER 4	9.050	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	7.10	25775.8906
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3869	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0540	

*** 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	2.0427	0.3404
2	0.8512	0.0709
3	0.8977	0.0748
4	0.0000	0.0000
SNOW WATER	1.906	

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**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                 HELP MODEL VERSION 3.05a  (5 JUNE 1996)                  **
**                 DEVELOPED BY ENVIRONMENTAL LABORATORY                    **
**                   USAE WATERWAYS EXPERIMENT STATION                      **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY             **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:      a:\help305\DATA4.D4
TEMPERATURE DATA FILE:        a:\help305\DATA7.D7
SOLAR RADIATION DATA FILE:    a:\help305\DATA13.D13
EVAPOTRANSPIRATION DATA:      a:\help305\DATA11.D11
SOIL AND DESIGN DATA FILE:    a:\help305\PVCCAPD.D10
OUTPUT DATA FILE:             a:\help305\pvccapd.OUT


TIME:  13: 3     DATE:   2/13/1998


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     TITLE:  Old Cortland County LF FS: Part 360 PVC Cap (w/o drainage)

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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   0
          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   =       0.4356 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =    0.999999975000E-05 CM/SEC


                                  LAYER  2
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TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1431	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3684	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC
SLOPE	=	25.00	PERCENT
DRAINAGE LENGTH	=	230.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 37

THICKNESS	=	0.04	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.	=	0.199999999000E-10	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 COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 5 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 25.% AND A SLOPE LENGTH OF 230. FEET.

SCS RUNOFF CURVE NUMBER	=	67.60	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT

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AREA PROJECTED ON HORIZONTAL PLANE     =     1.000  ACRES
EVAPORATIVE ZONE DEPTH                 =    20.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE      =     4.724  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE     =     9.140  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE     =     1.160  INCHES
INITIAL SNOW WATER                     =     0.000  INCHES
INITIAL WATER IN LAYER MATERIALS       =     8.751  INCHES
TOTAL INITIAL WATER                    =     8.751  INCHES
TOTAL SUBSURFACE INFLOW                =     0.00   INCHES/YEAR
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EVAPOTRANSPIRATION AND WEATHER DATA

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NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
         ITHACA                NEW YORK

    STATION LATITUDE                            = 42.40 DEGREES
    MAXIMUM LEAF AREA INDEX                     =  2.00
    START OF GROWING SEASON (JULIAN DATE)       =   130
    END OF GROWING SEASON (JULIAN DATE)         =   279
    EVAPORATIVE ZONE DEPTH                      = 20.0  INCHES
    AVERAGE ANNUAL WIND SPEED                   = 10.30 MPH
    AVERAGE 1ST QUARTER RELATIVE HUMIDITY       = 74.00 %
    AVERAGE 2ND QUARTER RELATIVE HUMIDITY       = 69.00 %
    AVERAGE 3RD QUARTER RELATIVE HUMIDITY       = 75.00 %
    AVERAGE 4TH QUARTER RELATIVE HUMIDITY       = 76.00 %


NOTE:  PRECIPITATION DATA FOR     ITHACA                NEW YORK
         WAS ENTERED FROM THE DEFAULT DATA FILE.


NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    ITHACA                NEW YORK
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NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
22.20	22.70	32.20	44.50	54.80	64.30
68.80	67.10	60.20	49.60	39.30	27.60

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NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    ITHACA                NEW YORK
           AND STATION LATITUDE  =  42.40 DEGREES
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MONTHLY TOTALS (IN INCHES) FOR YEAR 1974

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.84	2.39	3.14	2.54	3.88	4.92
	1.24	3.21	4.98	2.08	3.72	3.08
RUNOFF	0.674	0.232	3.220	1.255	0.239	1.929
	0.124	1.072	1.366	0.237	0.829	1.246
EVAPOTRANSPIRATION	0.456	0.482	0.403	1.666	3.465	3.075
	4.720	2.085	2.834	1.561	0.945	0.295
LATERAL DRAINAGE COLLECTED	0.0171	0.0152	0.0167	0.0167	0.0219	0.0219
FROM LAYER 3	0.0228	0.0196	0.0174	0.0179	0.0174	0.0214
PERCOLATION/LEAKAGE THROUGH	0.0196	0.0176	0.0193	0.0191	0.0231	0.0229
LAYER 4	0.0238	0.0215	0.0196	0.0202	0.0196	0.0227

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	9.485	9.378	9.273	9.611	12.164	12.559
TOP OF LAYER 4	12.706	10.916	9.995	9.977	9.974	11.890
STD. DEVIATION OF DAILY	0.034	0.030	0.032	0.388	0.751	0.039
HEAD ON TOP OF LAYER 4	0.259	0.703	0.009	0.015	0.019	1.612

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ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.02	134382.578	100.00
RUNOFF	12.423	45096.605	33.56
EVAPOTRANSPIRATION	21.987	79813.930	59.39
DRAINAGE COLLECTED FROM LAYER 3	0.2259	820.107	0.61
PERC./LEAKAGE THROUGH LAYER 4	0.249061	904.090	0.67
AVG. HEAD ON TOP OF LAYER 4	10.6606		
CHANGE IN WATER STORAGE	2.134	7747.859	5.77
SOIL WATER AT START OF YEAR	10.454	37948.824	
SOIL WATER AT END OF YEAR	12.589	45696.684	

SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.018	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1975

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	3.06	2.25	1.24	3.88	4.95
	3.64	4.36	7.75	3.24	1.95	3.22
RUNOFF	0.000	0.062	4.005	0.519	0.631	1.280
	0.902	1.001	4.232	1.000	0.180	0.000
EVAPOTRANSPIRATION	0.507	0.468	0.322	1.341	2.966	4.457
	4.831	3.338	3.500	1.780	0.986	0.446
LATERAL DRAINAGE COLLECTED	0.0178	0.0159	0.0174	0.0308	0.0370	0.0354
FROM LAYER 3	0.0332	0.0279	0.0244	0.0239	0.0230	0.0212
PERCOLATION/LEAKAGE THROUGH	0.0201	0.0181	0.0198	0.0295	0.0344	0.0330
LAYER 4	0.0315	0.0276	0.0247	0.0246	0.0237	0.0226

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	9.893	9.782	9.673	17.677	20.582	20.351
TOP OF LAYER 4	18.450	15.533	14.022	13.278	13.204	11.771
STD. DEVIATION OF DAILY	0.034	0.031	0.034	5.302	0.913	0.996
HEAD ON TOP OF LAYER 4	1.167	1.044	0.684	0.049	0.000	1.612

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ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.98	148757.406	100.00

RUNOFF	13.811	50134.312	33.70
EVAPOTRANSPIRATION	24.943	90542.789	60.87
DRAINAGE COLLECTED FROM LAYER 3	0.3077	1117.088	0.75
PERC./LEAKAGE THROUGH LAYER 4	0.309544	1123.646	0.76
AVG. HEAD ON TOP OF LAYER 4	14.5180		
CHANGE IN WATER STORAGE	1.609	5839.517	3.93
SOIL WATER AT START OF YEAR	12.589	45696.684	
SOIL WATER AT END OF YEAR	11.874	43104.312	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	2.323	8431.890	5.67
ANNUAL WATER BUDGET BALANCE	0.0000	0.059	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1976

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.00	2.27	2.81	3.80	3.32	4.47
	8.44	3.66	3.37	5.91	1.63	1.77
RUNOFF	0.000	0.042	1.141	7.142	0.853	1.120
	4.004	1.060	0.824	3.247	0.011	0.005
EVAPOTRANSPIRATION	0.466	0.531	0.630	1.517	3.522	3.869
	6.225	3.528	2.622	1.788	1.035	0.464
LATERAL DRAINAGE COLLECTED	0.0178	0.0164	0.0174	0.0213	0.0417	0.0341
FROM LAYER 3	0.0307	0.0288	0.0258	0.0245	0.0232	0.0193
PERCOLATION/LEAKAGE THROUGH	0.0201	0.0187	0.0198	0.0225	0.0380	0.0319
LAYER 4	0.0296	0.0282	0.0257	0.0251	0.0238	0.0212

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	9.889	9.777	9.666	12.252	23.199	19.574

TOP OF LAYER 4	17.053	16.021	14.804	13.639	13.320	10.731
STD. DEVIATION OF DAILY	0.034	0.032	0.033	4.801	1.865	0.298
HEAD ON TOP OF LAYER 4	0.936	0.156	0.641	0.367	0.059	1.406

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ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.45	161353.516	100.00
RUNOFF	19.449	70600.664	43.76
EVAPOTRANSPIRATION	26.197	95094.172	58.94
DRAINAGE COLLECTED FROM LAYER 3	0.3009	1092.265	0.68
PERC./LEAKAGE THROUGH LAYER 4	0.304771	1106.318	0.69
AVG. HEAD ON TOP OF LAYER 4	14.1605		
CHANGE IN WATER STORAGE	-1.802	-6539.951	-4.05
SOIL WATER AT START OF YEAR	11.874	43104.312	
SOIL WATER AT END OF YEAR	10.741	38990.164	
SNOW WATER AT START OF YEAR	2.323	8431.890	5.23
SNOW WATER AT END OF YEAR	1.655	6006.088	3.72
ANNUAL WATER BUDGET BALANCE	0.0000	0.050	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1977

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.36	1.82	3.29	2.32	2.17	3.03
	5.20	4.67	9.13	5.89	3.55	3.87
RUNOFF	0.580	1.888	3.407	1.315	0.525	0.497
	1.088	0.934	4.451	2.457	0.886	2.172

EVAPOTRANSPIRATION	0.402	0.503	0.390	0.668	2.217	3.286
	5.838	4.234	2.771	1.747	1.109	0.447
LATERAL DRAINAGE COLLECTED	0.0177	0.0158	0.0173	0.0172	0.0225	0.0214
FROM LAYER 3	0.0221	0.0185	0.0177	0.0211	0.0236	0.0219
PERCOLATION/LEAKAGE THROUGH	0.0201	0.0180	0.0198	0.0195	0.0235	0.0225
LAYER 4	0.0232	0.0206	0.0199	0.0226	0.0241	0.0232

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	9.851	9.742	9.633	9.900	12.490	12.309
TOP OF LAYER 4	12.267	10.271	10.195	11.763	13.557	12.190
STD. DEVIATION OF DAILY	0.033	0.031	0.033	0.994	0.090	0.023
HEAD ON TOP OF LAYER 4	0.390	0.485	0.335	1.189	0.761	2.959

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ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.30	168069.031	100.00
RUNOFF	20.201	73329.055	43.63
EVAPOTRANSPIRATION	23.611	85708.578	51.00
DRAINAGE COLLECTED FROM LAYER 3	0.2369	859.810	0.51
PERC./LEAKAGE THROUGH LAYER 4	0.257049	933.087	0.56
AVG. HEAD ON TOP OF LAYER 4	11.1807		
CHANGE IN WATER STORAGE	1.994	7238.406	4.31
SOIL WATER AT START OF YEAR	10.741	38990.164	
SOIL WATER AT END OF YEAR	14.124	51270.512	
SNOW WATER AT START OF YEAR	1.655	6006.088	3.57
SNOW WATER AT END OF YEAR	0.266	964.143	0.57
ANNUAL WATER BUDGET BALANCE	0.0000	0.084	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.37	0.91	1.77	1.96	1.91	2.64
	2.33	4.25	1.94	3.62	0.95	3.39
RUNOFF	2.102	0.637	4.773	1.389	0.071	0.286
	0.508	1.363	0.222	0.917	0.000	0.147
EVAPOTRANSPIRATION	0.366	0.394	0.372	0.508	2.461	3.085
	5.087	3.027	2.370	1.763	1.184	0.657
LATERAL DRAINAGE COLLECTED	0.0177	0.0158	0.0173	0.0166	0.0440	0.0411
FROM LAYER 3	0.0349	0.0259	0.0233	0.0235	0.0218	0.0220
PERCOLATION/LEAKAGE THROUGH	0.0201	0.0180	0.0198	0.0190	0.0398	0.0373
LAYER 4	0.0328	0.0260	0.0239	0.0243	0.0228	0.0232

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	9.866	9.756	9.647	9.536	24.456	23.631
TOP OF LAYER 4	19.434	14.379	13.369	13.054	12.547	12.229
STD. DEVIATION OF DAILY	0.034	0.030	0.033	0.033	5.707	1.043
HEAD ON TOP OF LAYER 4	1.947	0.879	0.085	0.228	0.103	0.931

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ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	32.04	116305.187	100.00
RUNOFF	12.417	45072.070	38.75
EVAPOTRANSPIRATION	21.275	77229.016	66.40
DRAINAGE COLLECTED FROM LAYER 3	0.3039	1103.318	0.95
PERC./LEAKAGE THROUGH LAYER 4	0.307143	1114.931	0.96
AVG. HEAD ON TOP OF LAYER 4	14.3254		
CHANGE IN WATER STORAGE	-2.263	-8214.169	-7.06

SOIL WATER AT START OF YEAR	14.124	51270.512	
SOIL WATER AT END OF YEAR	10.221	37101.707	
SNOW WATER AT START OF YEAR	0.266	964.143	0.83
SNOW WATER AT END OF YEAR	1.906	6918.781	5.95
ANNUAL WATER BUDGET BALANCE	0.0000	0.020	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	2.80	2.09	2.65	2.37	3.03	4.00
	4.17	4.03	5.43	4.15	2.36	3.07
STD. DEVIATIONS	2.10	0.80	0.63	0.94	0.94	1.09
	2.81	0.59	2.99	1.70	1.22	0.78
RUNOFF						
TOTALS	0.671	0.572	3.309	2.324	0.464	1.023
	1.325	1.086	2.219	1.572	0.381	0.714
STD. DEVIATIONS	0.860	0.773	1.355	2.716	0.311	0.655
	1.543	0.164	1.981	1.238	0.441	0.968
EVAPOTRANSPIRATION						
TOTALS	0.439	0.476	0.423	1.140	2.926	3.555
	5.340	3.242	2.820	1.728	1.052	0.462
STD. DEVIATIONS	0.056	0.051	0.119	0.520	0.585	0.599
	0.659	0.784	0.420	0.095	0.096	0.129
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	0.0176	0.0158	0.0172	0.0205	0.0334	0.0308
	0.0287	0.0241	0.0217	0.0222	0.0218	0.0211
STD. DEVIATIONS	0.0003	0.0004	0.0003	0.0060	0.0106	0.0088
	0.0059	0.0048	0.0039	0.0027	0.0026	0.0011
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0200	0.0181	0.0197	0.0219	0.0318	0.0295

	0.0282	0.0248	0.0228	0.0233	0.0228	0.0226
STD. DEVIATIONS	0.0002	0.0004	0.0002	0.0045	0.0079	0.0065
	0.0044	0.0035	0.0028	0.0020	0.0019	0.0008

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	9.7968	9.6871	9.5784	11.7953	18.5782	17.6847
	15.9820	13.4240	12.4772	12.3422	12.5205	11.7621
STD. DEVIATIONS	0.1753	0.1734	0.1716	3.4738	5.8761	5.0301
	3.3049	2.6616	2.2341	1.4997	1.4720	0.6083

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

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.16 (5.757)	145773.5	100.00
RUNOFF	15.660 (3.8533)	56846.54	38.996
EVAPOTRANSPIRATION	23.603 (2.0342)	85677.70	58.775
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.27507 (0.04013)	998.518	0.68498
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.28551 (0.02981)	1036.414	0.71098
AVERAGE HEAD ON TOP OF LAYER 4	12.969 (1.883)		
CHANGE IN WATER STORAGE	0.335 (2.1752)	1214.33	0.833

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PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)
PRECIPITATION	3.13	11361.900
RUNOFF	2.556	9277.7412
DRAINAGE COLLECTED FROM LAYER 3	0.00174	6.30075
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.001528	5.54783
AVERAGE HEAD ON TOP OF LAYER 4	29.928	
MAXIMUM HEAD ON TOP OF LAYER 4	50.894	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	22.2 FEET	
SNOW WATER	7.10	25775.8906
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4570	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0815	

*** 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	2.0435	0.3406
2	1.4047	0.1171
3	5.4627	0.4552
4	0.0000	0.0000
SNOW WATER	1.906	

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**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                  HELP MODEL VERSION 3.05a  (5 JUNE 1996)                 **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:     A:\HELP305\DATA4.D4
TEMPERATURE DATA FILE:       A:\HELP305\DATA7.D7
SOLAR RADIATION DATA FILE:   A:\HELP305\DATA13.D13
EVAPOTRANSPIRATION DATA:     A:\HELP305\DATA11.D11
SOIL AND DESIGN DATA FILE:   A:\HELP305\RCRAPVC.D10
OUTPUT DATA FILE:            A:\HELP305\RCRAPVC.OUT


TIME:  16:15     DATE:   3/ 9/1998


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

     TITLE:  Old Cortland County LF FS: RCRA Composite (PVC) Cap

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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   0
           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   =        0.4362 VOL/VOL
           EFFECTIVE SAT. HYD. COND.    =    0.999999975000E-05 CM/SEC


                                   LAYER  2
```

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4570 VOL/VOL
FIELD CAPACITY	=	0.1310 VOL/VOL
WILTING POINT	=	0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1527 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05 CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4170 VOL/VOL
FIELD CAPACITY	=	0.0450 VOL/VOL
WILTING POINT	=	0.0180 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0417 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999978000E-02 CM/SEC
SLOPE	=	25.00 PERCENT
DRAINAGE LENGTH	=	230.0 FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 37

THICKNESS	=	0.04 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.	=	0.199999999000E-10 CM/SEC
FML PINHOLE DENSITY	=	1.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	1.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD

LAYER 5

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

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.	=	0.100000001000E-06 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 5 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 25.% AND A SLOPE LENGTH OF 230. FEET.

SCS RUNOFF CURVE NUMBER	=	67.60	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	20.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	5.018	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	9.060	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.080	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	15.198	INCHES
TOTAL INITIAL WATER	=	15.198	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM ITHACA NEW YORK

STATION LATITUDE	=	42.40	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	130	
END OF GROWING SEASON (JULIAN DATE)	=	279	
EVAPORATIVE ZONE DEPTH	=	20.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	69.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	75.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00	%

NOTE: PRECIPITATION DATA FOR ITHACA NEW YORK WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR ITHACA NEW YORK

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
22.20	22.70	32.20	44.50	54.80	64.30

68.80	67.10	60.20	49.60	39.30	27.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ITHACA NEW YORK
AND STATION LATITUDE = 42.40 DEGREES

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ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.02	134382.578	100.00
RUNOFF	12.476	45289.117	33.70
EVAPOTRANSPIRATION	21.091	76559.039	56.97
DRAINAGE COLLECTED FROM LAYER 3	3.4523	12531.892	9.33
PERC./LEAKAGE THROUGH LAYER 5	0.001156	4.196	0.00
AVG. HEAD ON TOP OF LAYER 4	0.1618		
CHANGE IN WATER STORAGE	0.000	-1.610	0.00
SOIL WATER AT START OF YEAR	15.766	57231.000	
SOIL WATER AT END OF YEAR	15.766	57229.391	
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	-0.060	0.00

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ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.98	148757.406	100.00
RUNOFF	13.387	48596.297	32.67
EVAPOTRANSPIRATION	23.685	85975.320	57.80
DRAINAGE COLLECTED FROM LAYER 3	3.3118	12021.734	8.08

PERC./LEAKAGE THROUGH LAYER 5	0.001069	3.880	0.00
AVG. HEAD ON TOP OF LAYER 4	0.1558		
CHANGE IN WATER STORAGE	0.595	2160.141	1.45
SOIL WATER AT START OF YEAR	15.766	57229.391	
SOIL WATER AT END OF YEAR	14.038	50957.645	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	2.323	8431.890	5.67
ANNUAL WATER BUDGET BALANCE	0.0000	0.039	0.00

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ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.45	161353.516	100.00
RUNOFF	18.263	66296.430	41.09
EVAPOTRANSPIRATION	24.781	89956.125	55.75
DRAINAGE COLLECTED FROM LAYER 3	1.9702	7151.654	4.43
PERC./LEAKAGE THROUGH LAYER 5	0.000696	2.528	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0920		
CHANGE IN WATER STORAGE	-0.566	-2053.260	-1.27
SOIL WATER AT START OF YEAR	14.038	50957.645	
SOIL WATER AT END OF YEAR	14.141	51330.184	
SNOW WATER AT START OF YEAR	2.323	8431.890	5.23
SNOW WATER AT END OF YEAR	1.655	6006.088	3.72
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

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ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.30	168069.031	100.00
RUNOFF	19.923	72321.578	43.03
EVAPOTRANSPIRATION	21.662	78633.703	46.79
DRAINAGE COLLECTED FROM LAYER 3	4.3174	15672.297	9.32
PERC./LEAKAGE THROUGH LAYER 5	0.001365	4.957	0.00
AVG. HEAD ON TOP OF LAYER 4	0.2024		
CHANGE IN WATER STORAGE	0.396	1436.431	0.85
SOIL WATER AT START OF YEAR	14.141	51330.184	
SOIL WATER AT END OF YEAR	15.925	57808.562	
SNOW WATER AT START OF YEAR	1.655	6006.088	3.57
SNOW WATER AT END OF YEAR	0.266	964.143	0.57
ANNUAL WATER BUDGET BALANCE	0.0000	0.056	0.00

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ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	32.04	116305.187	100.00
RUNOFF	10.931	39680.797	34.12
EVAPOTRANSPIRATION	18.973	68872.187	59.22
DRAINAGE COLLECTED FROM LAYER 3	2.3871	8665.191	7.45
PERC./LEAKAGE THROUGH LAYER 5	0.000814	2.955	0.00
AVG. HEAD ON TOP OF LAYER 4	0.1113		
CHANGE IN WATER STORAGE	-0.252	-915.944	-0.79
SOIL WATER AT START OF YEAR	15.925	57808.562	
SOIL WATER AT END OF YEAR	14.033	50937.980	
SNOW WATER AT START OF YEAR	0.266	964.143	0.83
SNOW WATER AT END OF YEAR	1.906	6918.781	5.95
ANNUAL WATER BUDGET BALANCE	0.0000	0.002	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	2.80	2.09	2.65	2.37	3.03	4.00
	4.17	4.03	5.43	4.15	2.36	3.07
STD. DEVIATIONS	2.10	0.80	0.63	0.94	0.94	1.09
	2.81	0.59	2.99	1.70	1.22	0.78
RUNOFF						
TOTALS	0.592	0.513	3.066	2.080	0.455	1.048
	1.324	1.086	2.220	1.570	0.381	0.661
STD. DEVIATIONS	0.692	0.777	1.387	2.460	0.323	0.619
	1.542	0.164	1.981	1.238	0.441	0.876
EVAPOTRANSPIRATION						
TOTALS	0.437	0.476	0.415	1.110	2.921	3.635
	4.987	2.472	2.466	1.636	1.031	0.452
STD. DEVIATIONS	0.055	0.051	0.123	0.532	0.564	0.564
	0.734	0.806	0.413	0.146	0.048	0.106
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	0.0255	0.0002	0.0000	0.3483	0.7344	0.1889
	0.1698	0.2287	0.0723	0.4397	0.3820	0.4979
STD. DEVIATIONS	0.0236	0.0002	0.0000	0.4246	0.4616	0.0806
	0.1008	0.1259	0.0639	0.7945	0.5539	0.5478
PERCOLATION/LEAKAGE THROUGH LAYER 5						
TOTALS	0.0000	0.0000	0.0000	0.0001	0.0002	0.0001
	0.0001	0.0001	0.0000	0.0001	0.0001	0.0002
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000
	0.0000	0.0000	0.0000	0.0002	0.0002	0.0002

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.0142	0.0001	0.0000	0.2002	0.4085	0.1086
	0.0945	0.1272	0.0416	0.2446	0.2196	0.2769
STD. DEVIATIONS	0.0131	0.0001	0.0000	0.2441	0.2567	0.0463
	0.0561	0.0700	0.0367	0.4419	0.3184	0.3047

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

	INCHES		CU. FEET	PERCENT
PRECIPITATION	40.16	(5.757)	145773.5	100.00
RUNOFF	14.996	(3.8863)	54436.84	37.343
EVAPOTRANSPIRATION	22.038	(2.2732)	79999.27	54.879
LATERAL DRAINAGE COLLECTED FROM LAYER 3	3.08776	(0.92671)	11208.553	7.68902
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.00102	(0.00027)	3.703	0.00254
AVERAGE HEAD ON TOP OF LAYER 4	0.145	(0.044)		
CHANGE IN WATER STORAGE	0.034	(0.4713)	125.15	0.086

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PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)
PRECIPITATION	3.13	11361.900
RUNOFF	2.556	9277.1064
DRAINAGE COLLECTED FROM LAYER 3	0.09311	337.97220
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000029	0.10427
AVERAGE HEAD ON TOP OF LAYER 4	1.605	
MAXIMUM HEAD ON TOP OF LAYER 4	3.145	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	7.10	25775.8906
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3770	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0561	

*** 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	2.0462	0.3410
2	0.9893	0.0824
3	0.7491	0.0624
4	0.0000	0.0000
5	10.2480	0.4270
SNOW WATER	1.906	

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APPENDIX B

ENGINEERING CALCULATIONS

B.1 - Slope Stability Analysis

B.2 - Puncture Resistance Analysis

APPENDIX B - Engineering Calculations

OLD CORTLAND COUNTY LANDFILL FEASIBILITY STUDY

Summary of HELP Model Data & Slope Stability Calculations

Capping Alternatives	HELP MODEL Version 3.05a - AVERAGE ANNUAL TOTALS (s=25%; L=230 ft)									
	Precipitation		Runoff		Evapotranspiration		Lateral Drainage		Percolation	
	(in/ac)	(%)	(in/ac)	(%)	(in/ac)	(%)	(in/ac)	(%)	(in/ac)	(%)
Part 360 Soil (w/ drainage)	40.16	100.00	15.296	38.09	21.869	54.45	1.97169	4.91	1.16119	2.891
Part 360 Soil (w/o drainage)	40.16	100.00	15.434	38.43	22.339	55.63	0.21457	0.53	1.94137	4.834
Part 360 PVC (w/drainage)	40.16	100.00	15.084	37.56	21.930	54.61	3.11348	7.75	0.22611	0.563
Part 360 PVC (w/o drainage)	40.16	100.00	15.660	38.99	23.603	58.77	0.27507	0.68	0.28551	0.711
RCRA Comp. (PVC)(w/drainage)	40.16	100.00	14.996	37.34	22.038	54.88	3.08776	7.69	0.00102	0.003

Capping Alternatives	PEAK DAILY MAX. HEAD	CRITICAL INTERFACE		FACTOR OF SAFETY (FS)	CONSTRUCTION COST
		LOCATION*	(°)	Hmax	(Based on 39.3 acres)
Part 360 Soil (w/ drainage)	7.012	BS/LDS	30	2.12	$5,282,000
Part 360 Soil (w/o drainage)	30	BS/PC	30	1.29	NA
Part 360 PVC (w/drainage)	9.050	PVC/LDS	25	1.66	$4,157,000
Part 360 PVC (w/o drainage)	30	PVC/PC	22	0.92	NA
RCRA Comp. (PVC)(w/drainage)	3.145	BS/PVC	22	1.61	$6,839,000

NOTES: * PVC = polyvinyl chloride geomembrane; LDS = lateral drainage soil; PC = protective cover; BS = barrier soil.

job: Old Cortland County Landfill FS
calculated by: MDR date: 3/25/98
checked by: JTR date: 4/22/98
job#: 331.22 page: ____

VENEER STABILITY ANALYSES

Giroud & Beech (1990)

Factor of Safety (FS) = (Sum of Resistive Forces)/(Sum of Driving Forces) = [{Fr(a) + Fr(Sc)} + {Fb(c) + Fb(Ø) - EQf}]/[{Fd(soil) + Fd(water)}]

FS = [{(aH/sinB)+(EQi*G'T²tanSc/(2sinB)*(2HcosB/T-1))}+{(cTcosØ/(sinB*cos(Ø+B)))+(G'T²sinØ/(sin2B*cos(Ø+B)))-EQf}]
/ [{(EQd*G'T(H-T/(2cosB)))+ (GwsinBhLh)}]

where:

- Fr(a) = Resistive force due to interface adhesion
- Fr(Sc) = Resistive force due to interface friction
- Fb(c) = Buttress force due to soil cohesion
- Fb(Ø) = Buttress force due to soil internal friction
- Fd(soil) = Driving force due to soil weight
- Fd(water) = Driving force due to water above interface
- EQf = Reduction in buttress force due to earthquake loading = (ksG'T²)/(sin2B*(cosB-sinB*tanØ))
- EQd = additional driving force due to earthquake loading = 1+ks/tanB
- EQi = interface reduction factor due to earthquake loading = 1-ks*tanB
- G' = soil unit weight accounting for buoyancy = G-Gw(h/T)

CASE: Part 360 Soil (w/drainage) — **CRITICAL INTERFACE: Barrier Soil/Lateral Drainage Sand**

SOIL PARAMETERS		
G = moist unit weight =	125	pcf
c = internal cohesion =	0	psf
Ø = internal friction angle =	32	°
T = cover thickness =	2.5	ft

DESIGN PARAMETERS		
H = height of slope =	57	ft
B = slope angle =	13.92	°
Slope run factor (H:V)	4.04	H:1V
Lh = Horizontal slope length =	230.0	ft

INTERFACE PARAMETERS		
Sc = interface friction angle =	30	°
a = interface adhesion =	0	psf

EFFECTS OF WATER		
h = head of water above interface =	0.584333	ft
Gw = unit weight of water =	62.4	pcf
G' = buoyant soil unit weight =	110.4	pcf

EARTHQUAKE PARAMETERS		
ks = pseudostatic seismic coefficient =	0	g

RESISTIVE FORCES

	STATIC (lbs/ft)	SEISMIC (lbs/ft)
Fr(a) =	0	0
Fr(Sc) =	35,824	35,824
Fb(c) =	0	0
Fb(Ø) =	1,126	1,126
EQf =	0	0
TOTAL =	36,950	36,950

DRIVING FORCES

	STATIC (lbs/ft)	SEISMIC (lbs/ft)
Fd(soil) =	15,379	15,379
Fd(water)=	2,017	2,017
TOTAL =	17,396	17,396

FS(static) =	**2.12**	---->	Tensile reinforcement req'd for (FS=1.5) =	0 lbs/ft
FS(seismic) =	**2.12**	---->	Tensile reinforcement req'd for (FS=1.0) =	0 lbs/ft

job: Old Cortland County Landfill FS
calculated by: MDR date: 3/25/98
checked by: JFB date: 3/22/98
job#: 331.22 page:

VENEER STABILITY ANALYSES
Giroud & Beech (1990)

Factor of Safety (FS) = (Sum of Resistive Forces)/(Sum of Driving Forces) = [{Fr(a) + Fr(Sc)} + {Fb(c) + Fb(Ø) - EQf}]/[{Fd(soil) + Fd(water)}]

FS [{(aH/sinB)+(EQi*G'T²tanSc/(2sinB)*(2HcosB/T-1))}+{(cTcosØ/(sinB*cos(Ø+B)))+(G'T²sinØ/(sin2B*cos(Ø+B)))-EQf}]
[{(EQd*G'T(H-T/(2cosB)))+ (GwsinBhLh)}]

where:
- Fr(a) = Resistive force due to interface adhesion
- Fr(Sc) = Resistive force due to interface friction
- Fb(c) = Buttress force due to soil cohesion
- Fb(Ø) = Buttress force due to soil internal friction
- Fd(soil) = Driving force due to soil weight
- Fd(water) = Driving force due to water above interface
- EQf = Reduction in buttress force due to earthquake loading = (ksG'T²)/(sin2B*(cosB-sinB*tanØ))
- EQd = additional driving force due to earthquake loading = 1+ks/tanB
- EQi = interface reduction factor due to earthquake loading = 1-ks*tanB
- G' = soil unit weight accounting for buoyancy = G-Gw(h/T)

CASE: Part 360 Soil (w/o drainage) **CRITICAL INTERFACE: Barrier Soil/Protective Cover**

SOIL PARAMETERS

G = moist unit weight =	135	pcf
c = internal cohesion =	0	psf
Ø = internal friction angle =	30	°
T = cover thickness =	2.5	ft

DESIGN PARAMETERS

H = height of slope =	57	ft
B = slope angle =	13.92	°
Slope run factor (H:V)	4.04	H:1V
Lh = Horizontal slope length =	230.0	ft

INTERFACE PARAMETERS

Sc = interface friction angle =	30	°
a = interface adhesion =	0	psf

EFFECTS OF WATER

h = head of water above interface =	2.5	ft
Gw = unit weight of water =	62.4	pcf
G' = buoyant soil unit weight =	72.6	pcf

EARTHQUAKE PARAMETERS

ks = pseudostatic seismic coefficient =	0	g

RESISTIVE FORCES

	STATIC (lbs/ft)	SEISMIC (lbs/ft)
Fr(a) =	0	0
Fr(Sc) =	23,555	23,555
Fb(c) =	0	0
Fb(Ø) =	674	674
EQf =	0	0
TOTAL =	24,230	24,230

DRIVING FORCES

	STATIC (lbs/ft)	SEISMIC (lbs/ft)
Fd(soil) =	10,112	10,112
Fd(water)=	8,632	8,632
TOTAL =	18,743	18,743

FS(static) =	**1.29**	----->	Tensile reinforcement req'd for (FS=1.5) =	3,885	lbs/ft
FS(seismic) =	**1.29**	----->	Tensile reinforcement req'd for (FS=1.0) =	0	lbs/ft

job: Old Cortland County Landfill FS
calculated by: MDR date: 3/25/98
checked by: JFB date: 4/22/98
job#: 331.22 page: ____

VENEER STABILITY ANALYSES

Giroud & Beech (1990)

Factor of Safety (FS) = (Sum of Resistive Forces)/(Sum of Driving Forces) = [{Fr(a) + Fr(Sc)} + {Fb(c) + Fb(Ø) - EQf}]/[{Fd(soil) + Fd(water)}]

FS = [((aH/sinB)+(EQi*G'T²tanSc/(2sinB)*(2HcosB/T-1)))+((cTcosØ/(sinB*cos(Ø+B)))+(G'T²sinØ/(sin2B*cos(Ø+B)))-EQf)] / [((EQd*G'T(H-T/(2cosB)))+ (GwsinBhLh))]

where:
- Fr(a) = Resistive force due to interface adhesion
- Fr(Sc) = Resistive force due to interface friction
- Fb(c) = Buttress force due to soil cohesion
- Fb(Ø) = Buttress force due to soil internal friction
- Fd(soil) = Driving force due to soil weight
- Fd(water) = Driving force due to water above interface
- EQf = Reduction in buttress force due to earthquake loading = (ksG'T²)/(sin2B*(cosB-sinB*tanØ))
- EQd = additional driving force due to earthquake loading = 1+ks/tanB
- EQi = interface reduction factor due to earthquake loading = 1-ks*tanB
- G' = soil unit weight accounting for buoyancy = G-Gw(h/T)

CASE: Part 360 PVC (w/drainage) — **CRITICAL INTERFACE: PVC/Lateral Drainage Sand**

SOIL PARAMETERS		
G = moist unit weight =	125	pcf
c = internal cohesion =	0	psf
Ø = internal friction angle =	32	°
T = cover thickness =	2.5	ft

DESIGN PARAMETERS		
H = height of slope =	57	ft
B = slope angle =	13.92	°
Slope run factor (H:V)	4.04	H:1V
Lh = Horizontal slope length =	230.0	ft

INTERFACE PARAMETERS		
Sc = interface friction angle =	25	°
a = interface adhesion =	0	psf

EFFECTS OF WATER		
h = head of water above interface =	0.754167	ft
Gw = unit weight of water =	62.4	pcf
G' = buoyant soil unit weight =	106.2	pcf

EARTHQUAKE PARAMETERS		
ks = pseudostatic seismic coefficient =	0	g

RESISTIVE FORCES	STATIC (lbs/ft)	SEISMIC (lbs/ft)
Fr(a) =	0	0
Fr(Sc) =	27,823	27,823
Fb(c) =	0	0
Fb(Ø) =	1,082	1,082
EQf =	0	0
TOTAL =	28,906	28,906

DRIVING FORCES	STATIC (lbs/ft)	SEISMIC (lbs/ft)
Fd(soil) =	14,788	14,788
Fd(water)=	2,604	2,604
TOTAL =	17,392	17,392

FS(static) =	**1.66**	----->	Tensile reinforcement req'd for (FS=1.5) =	0 lbs/ft
FS(seismic) =	**1.66**	----->	Tensile reinforcement req'd for (FS=1.0) =	0 lbs/ft

Job: Old Cortland County Landfill FS
calculated by: MDR date: 3/25/98
checked by: JFC date: 4/22/98
Job#: 331.22 page:

VENEER STABILITY ANALYSES
Giroud & Beech (1990)

Factor of Safety (FS) = (Sum of Resistive Forces)/(Sum of Driving Forces) = [{Fr(a) + Fr(Sc)} + {Fb(c) + Fb(Ø) - EQf}]/[{Fd(soil) + Fd(water)}]

FS = [{(aH/sinB)+(EQi*G'T²tanSc/(2sinB)*(2HcosB/T-1))}+{(cTcosØ/(sinB*cos(Ø+B)))+(G'T²sinØ/(sin2B*cos(Ø+B)))-EQf}] / [{(EQd*G'T(H-T/(2cosB)))+ (GwsinBhLh)}]

where:
- Fr(a) = Resistive force due to interface adhesion
- Fr(Sc) = Resistive force due to interface friction
- Fb(c) = Buttress force due to soil cohesion
- Fb(Ø) = Buttress force due to soil internal friction
- Fd(soil) = Driving force due to soil weight
- Fd(water) = Driving force due to water above interface
- EQf = Reduction in buttress force due to earthquake loading = (ksG'T²)/(sin2B*(cosB-sinB*tanØ))
- EQd = additional driving force due to earthquake loading = 1+ks/tanB
- EQi = interface reduction factor due to earthquake loading = 1-ks*tanB
- G' = soil unit weight accounting for buoyancy = G-Gw(h/T)

CASE: Part 360 PVC (w/o drainage) — **CRITICAL INTERFACE: PVC/Protective Cover**

SOIL PARAMETERS		
G = moist unit weight =	135	pcf
c = internal cohesion =	0	psf
Ø = internal friction angle =	30	°
T = cover thickness =	2.5	ft
DESIGN PARAMETERS		
H = height of slope =	57	ft
B = slope angle =	13.92	°
Slope run factor (H:V)	4.04	H:1V
Lh = Horizontal slope length =	230.0	ft

INTERFACE PARAMETERS		
Sc = interface friction angle =	22	°
a = interface adhesion =	0	psf
EFFECTS OF WATER		
h = head of water above interface =	2.5	ft
Gw = unit weight of water =	62.4	pcf
G' = buoyant soil unit weight =	72.6	pcf
EARTHQUAKE PARAMETERS		
ks = pseudostatic seismic coefficient =	0	g

RESISTIVE FORCES

	STATIC (lbs/ft)	SEISMIC (lbs/ft)
Fr(a) =	0	0
Fr(Sc) =	16,484	16,484
Fb(c) =	0	0
Fb(Ø) =	674	674
EQf =	0	0
TOTAL =	17,158	17,158

DRIVING FORCES

	STATIC (lbs/ft)	SEISMIC (lbs/ft)
Fd(soil) =	10,112	10,112
Fd(water)=	8,632	8,632
TOTAL =	18,743	18,743

FS(static) =	**0.92**	----->	Tensile reinforcement req'd for (FS=1.5) =	10,957 lbs/ft
FS(seismic) =	**0.92**	----->	Tensile reinforcement req'd for (FS=1.0) =	1,585 lbs/ft

job: Old Cortland County Landfill FS
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VENEER STABILITY ANALYSES

Giroud & Beech (1990)

Factor of Safety (FS) = (Sum of Resistive Forces)/(Sum of Driving Forces) = [{Fr(a) + Fr(Sc)} + {Fb(c) + Fb(Ø) - EQf}]/[{Fd(soil) + Fd(water)}]

FS = [{(aH/sinB)+(EQi*G'T²tanSc/(2sinB)*(2HcosB/T-1))}+{(cTcosØ/(sinB*cos(Ø+B)))+(G'T²sinØ/(sin2B*cos(Ø+B)))-EQf}] / [{(EQd*G'T(H-T/(2cosB)))+ (GwsinBhLh)}]

where:

- Fr(a) = Resistive force due to interface adhesion
- Fr(Sc) = Resistive force due to interface friction
- Fb(c) = Buttress force due to soil cohesion
- Fb(Ø) = Buttress force due to soil internal friction
- Fd(soil) = Driving force due to soil weight
- Fd(water) = Driving force due to water above interface
- EQf = Reduction in buttress force due to earthquake loading = (ksG'T²)/(sin2B*(cosB-sinB*tanØ))
- EQd = additional driving force due to earthquake loading = 1+ks/tanB
- EQi = interface reduction factor due to earthquake loading = 1-ks*tanB
- G' = soil unit weight accounting for buoyancy = G-Gw(h/T)

CASE: RCRA (PVC) (w/drainage) | **CRITICAL INTERFACE: Barrier Soil/PVC**

SOIL PARAMETERS			INTERFACE PARAMETERS		
G = moist unit weight =	125	pcf	Sc = interface friction angle =	22	°
c = internal cohesion =	0	psf	a = interface adhesion =	0	psf
Ø = internal friction angle =	32	°			
T = cover thickness =	2.5	ft	**EFFECTS OF WATER**		
			h = head of water above interface =	0.2620833	ft
DESIGN PARAMETERS			Gw = unit weight of water =	62.4	pcf
H = height of slope =	57	ft	G' = buoyant soil unit weight =	118.5	pcf
B = slope angle =	13.92	°			
Slope run factor (H:V)	4.04	H:1V	**EARTHQUAKE PARAMETERS**		
Lh = Horizontal slope length =	230.0	ft	ks = pseudostatic seismic coefficient =	0	g

RESISTIVE FORCES

	STATIC (lbs/ft)	SEISMIC (lbs/ft)
Fr(a) =	0	0
Fr(Sc) =	26,896	26,896
Fb(c) =	0	0
Fb(Ø) =	1,208	1,208
EQf =	0	0
TOTAL =	28,103	28,103

DRIVING FORCES

	STATIC (lbs/ft)	SEISMIC (lbs/ft)
Fd(soil) =	16,499	16,499
Fd(water)=	905	905
TOTAL =	17,404	17,404

FS(static) =	**1.61**	----->	Tensile reinforcement req'd for (FS=1.5) =	0 lbs/ft
FS(seismic) =	**1.61**	----->	Tensile reinforcement req'd for (FS=1.0) =	0 lbs/ft

job: Old Cortland County Landfill FS
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PVC PUNCTURE RESISTANCE

(From Koerner, Designing with Geosynthetics, third edition, 1994, pg. 165-167)

INTRODUCTION

The analysis performed below will determine if the 2.5 foot thick gravel protective cover layer is thick enough to protect the underlying PVC geomembrane from puncturing under the loads which will be induced by landfill operating equipment in the area surrounding the Maintenance building.

The analysis consists of first calculating the landfill equipment loads which may occur in this area of the site; these loads are then used to calculate the increase in stress on the PVC geomembrane. The force required for the PVC to resist puncture is then calculated using the calculated stress acting through a stone of specified dimension and other factors which related the ASTM puncture method to the actual field conditions. The factor of safety is then calculated by dividing the required force by the puncture strength of the PVC as tested by ASTM test method D4833.

The calculations analyze two scenarios; a typical scenario whereby the load of a landfill compactor is evenly distributed through each wheel as individual point loads; and a worst case scenario whereby the load of a full articulated dump truck is distributed through one point load.

CALCULATE TOTAL LOAD (Q) APPLIED TO GROUND SURFACE

CASE 1: typical load of a CAT 826C landfill compactor

operating weight = 69,733 lbs. (Caterpillar performance handbook, edition 20, 1989)
assume weight evenly distributed through each wheel as individual point loads
include factor of safety(F.S)=1.5

Q_1= 69733(1.5)/4= 26150 [lbs.]

CASE 2: worst case load of a fully loaded CAT D300B articulated dump truck

operating weight=43,520 lbs. (Caterpillar performance handbook, edition 20, 1989)
fully loaded weight (+20,000 lbs.)=83,520 lbs.
assume weight distributed through one tire as a point load

Q_2= 83,520*1.5= 125280 [lbs.]

CALCULATE LOAD INDUCED ON PVC GEOMEMBRANE

using Boussinesq method (Bowles, Foundation Analysis and Design, Fourth Edition, pg. 243)

$$q = \frac{3Q}{2\pi r^2} \frac{1}{(1+(r/z)^2)^{5/2}}$$

where:

q= pressure acting on the stone to cause puncture of the PVC geomembrane [psf]
Q=total load applied to ground surface [lbs.]
z=soil thickness = 2.5 [ft]
r=horizontal distance from source load to point to be analyzed [ft],assume a worst case scenario whereby the point to be analyzed is directly below the applied load (I.e. r=0)

$q = \frac{3Q}{2\pi z^2}$

CASE 1: q= 1998 [psf]

CASE 2: q= 9571 [psf]

CALCULATE FORCE REQUIRED TO RESIST PVC PUNCTURE

$F_{req'd} = qd^2 s_1 s_2 s_3$

where:

q (defined above) [psi]

d=average diameter of puncturing aggregate, assume= 1 [in]

s_1=protusion factor (h/d), where h=protrusion height
assume worst case= 1

s_2=scale factor to adjust ASTM D4833 test value using .31 inch
diameter puncture probe to actual puncturing object (.31/d) = 0.31

s_3=shape factor to adjust flat puncture probe of ASTM D4833 to
actual shape of puncturing object $(1-A_p/A_c)$
where A_p/A_c ranges from 0.8 for Ottawa sand to 0.3 for shot rock
assume worst case= 0.7

CASE 1: $F_{req'd}$= 3.0 [lbs.]

CASE 2: $F_{req'd}$= 14.4 [lbs.]

CALCULATE FACTOR OF SAFETY AGAINST PVC PUNCTURE

$F.S. = \frac{F_{allow}}{F_{req'd}}$

where: $F_{allow} = \frac{F_{ault}}{F.S._p}$

F_{ault}= ultimate puncture strength as determined by test method ASTM 4833
PVC ranges from 10 to 100 lbs. Assume= 50 [lbs.]

$F.S._p$= cumulative factor of safety. Assume= 2

CASE 1: F.S. = 8.3

CASE 2: F.S. = 1.7

job: Old Cortland County Landfill, FS
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CONCLUSIONS AND RECOMMENDATIONS

The analysis performed above, indicates that the 2.5 feet of stone to be placed above the PVC will offer adequate protection against the PVC puncturing from typical and extreme worst case loading conditions. However, during the winter months this area is plowed and it is likely that some of the gravel will be scraped off. If the gravel is scraped off such that only 0.85 feet of material remains, then typical compactor loading will most likely result in a puncture. If enough gravel is scraped off such that 1.9 feet of gravel remains, then the worst case loading scenario will most likely result in a puncture. Therefor, the thickness of the gravel protection layer should be monitored closely to ensure that the PVC is not punctured. In addition to the 2.5 feet of protective cover, a 12 oz/yd geotextile will be placed on top of the PVC geomembrane to protect the geomembrane from puncture during the installation of the stone layer.

APPENDIX C

COST ESTIMATES FOR REMEDIAL ALTERNATIVE COMPONENTS

C.1 - Cap Construction Estimates for Old Cortland County Landfill
  a. NYSDEC Part 360 PVC Cap
  b. NYSDEC Part 360 Soil Cap
  c. RCRA Composite Cap

C.2 - Modified Cap Construction Estimate for Abandoned City of Cortland Landfill
  a. Alternatives II & III: Cap Entire Limits of Ash Waste With Modified Part 360 PVC Cap Within Landfill Vehicle Access Area/Maintenance Facility
  b. Alternative IV: Modified Part 360 PVC Cap Installed Within Landfill Vehicle Access Area/Maintenance Facility With Consolidation of Thin Waste Areas

C.3 - NYSDEC Part 360 Cap Construction Estimate for Buckbee-Mears Sludge Disposal Areas

C.4 - Drum Handling and Disposal Cost Estimate

C.5 - Cost Estimate for Excavation of Contaminated Soils and Sludge Disposal Areas
  a. Alternative II: Excavation of Contaminated Soils Areas
  b. Alternatives III & IV: Excavation of Contaminated Soils and Sludge Disposal Areas

C.6 - Cost Estimate for Long-Term Environmental Monitoring Program

job: Old Cortland County Landfill FS
calculated by: MJC date: 4/24/98
checked by: [signature] date: 4/24/98
job#: 331.22 page: 1/1

TABLE C-1a

COST ESTIMATE: NYSDEC Part 360 PVC Cap w/Drainage

Feasibility Study

Old Cortland County Landfill, Cortland County, NY

Landfill Cap Item	Quantity	Units	Unit Cost	Total Item Cost
1. Strip existing topsoil	39.3	acres	$2,500	$98,250
2. Remove rocks & grade existing soil	39.3	acres	$1,000	$39,300
3. Purchase, delivery & placement of 40 mil PVC geomembrane	1,712,000	sf	$0.40	$684,800
4. Purchase, delivery & placement sand drainage layer (12 in, 1E-3 cm/s)	64,000	cy	$12	$768,000
5. Purchase, delivery & placement of 6 oz/sy geotextile	1,712,000	sf	$0.12	$205,440
6. Purchase, delivery & placement of protective cover soil (18 in)	96,000	cy	$8	$768,000
7. Purchase & placement of gas vents				
A. Shallow Gas Vents (3/acre)	117	each	$1,000	$117,000
B. Deep Gas Vents (1/acre)	39	each	$2,600	$101,400
8. Seeding & mulching	39.3	acres	$1,400	$55,020
9. Purchase, delivery & placement of riprap for down chutes (~3,000 LF)	5,000	cy	$20	$100,000
10. Purchase, delivery & placement of stone for landfill perimeter trenches and toe drain (~6,000 LF)	4,000	cy	$18	$72,000
11. Side slope diversion berm construction (~8,000 LF)	2,000	cy	$8	$16,000
12. Materials testing	39.3	acres	$3,000	$118,000
			TOTAL CONSTRUCTION COSTS:	$3,143,210
			Engineering, Legal & Miscellaneous Fees (15%):	$471,482
			SUBTOTAL:	$3,614,692
			Contingency (15%):	$542,204
			OVERALL PROJECT COSTS:	$4,156,895
			ROUNDED ESTIMATED COST:	$4,157,000

job: Old Cortland County Landfill FS
calculated by: MJC date: 4/24/98
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job#: 331.22 page: 1/1

TABLE C-1b

COST ESTIMATE: NYSDEC Part 360 Soil Cap w/Drainage

Feasibility Study

Old Cortland County Landfill, Cortland County, NY

Landfill Cap Item	Quantity	Units	Unit Cost	Total Item Cost
1. Strip existing topsoil	39.3	acres	$2,500	$98,250
2. Remove rocks & grade existing soil	39.3	acres	$1,000	$39,300
3. Purchase, delivery & placement of barrier soil (18 in, 1E-7 cm/s)	96,000	cy	$16	$1,536,000
4. Purchase, delivery & placement of sand drainage layer (12 in, 1E-3 cm/s)	64,000	cy	$12	$768,000
5. Purchase, delivery & placement of 6 oz/sy geotextile	1,712,000	sf	$0.12	$205,440
6. Purchase, delivery & placement of protective cover soil (18 in)	96,000	cy	$8	$768,000
7. Purchase & placement of gas vents				
A. Shallow Gas Vents (3/acre)	117	each	$1,000	$117,000
B. Deep Gas Vents (1/acre)	39	each	$2,600	$101,400
8. Seeding & mulching	39.3	acres	$1,400	$55,020
9. Purchase, delivery & placement of riprap for down chutes (~3,000 LF)	5,000	cy	$20	$100,000
10. Purchase, delivery & placement of stone for landfill perimeter trenches and toe drain (~6,000 LF)	4,000	cy	$18	$72,000
11. Side slope diversion berm construction (~8,000 LF)	2,000	cy	$8	$16,000
12. Materials testing	39.3	acres	$3,000	$117,900
			TOTAL CONSTRUCTION COSTS:	$3,994,310
			Engineering, Legal & Miscellaneous Fees (15%):	$599,147
			SUBTOTAL:	$4,593,457
			Contingency (15%):	$689,018
			OVERALL PROJECT COSTS:	$5,282,475
			ROUNDED ESTIMATED COST:	$5,282,000

job: Old Cortland County Landfill FS
calculated by: MJC date: 4/24/96
checked by: [signature] date: 4/24/98
job#: 331.22 page: 1/1

TABLE C-1c

COST ESTIMATE: RCRA Composite Cap

Feasibility Study

Old Cortland County Landfill, Cortland County, NY

Landfill Cap Item	Quantity	Units	Unit Cost	Total Item Cost
1. Strip existing topsoil	39.3	acres	$2,500	$98,250
2. Remove rocks & grade existing soil	39.3	acres	$1,000	$39,300
3. Purchase, delivery & placement of barrier soil (24 in, 1E-7 cm/s)	127,000	cy	$16	$2,032,000
4. Purchase, delivery & placement of 20 mil PVC geomembrane	1,712,000	sf	$0.30	$513,600
5. Purchase, delivery & placement of sand drainage layer (12 in, 1E-2 cm/s)	64,000	cy	$14	$896,000
6. Purchase, delivery & placement of 6 oz/sy geotextile	1,712,000	sf	$0.12	$205,440
7. Purchase, delivery & placement of protective cover soil (18 in)	96,000	cy	$8	$768,000
8. Purchase & placement of gas vents				
A. Shallow Gas Vents (3/acre)	117	each	$1,000	$117,000
B. Deep Gas Vents (1/acre)	39	each	$2,600	$101,400
9. Seeding & mulching	39.3	acres	$1,400	$55,020
10. Purchase, delivery & placement of riprap for down chutes (~3,000 LF)	5,000	cy	$20	$100,000
11. Purchase, delivery & placement of stone for landfill perimeter trenches and toe drain (~6,000 LF)	4,000	cy	$18	$72,000
12. Side slope diversion berm construction (~8,000 LF)	2,000	cy	$8	$16,000
13. Materials testing	39.3	acres	$4,000	$157,200

TOTAL CONSTRUCTION COSTS:	$5,171,210
Engineering, Legal & Miscellaneous Fees (15%):	$775,682
SUBTOTAL:	$5,946,892
Contingency (15%):	$892,034
OVERALL PROJECT COSTS:	$6,838,925

ROUNDED ESTIMATED COST: **$6,839,000**

job: Old Cortland County Landfill FS
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TABLE C-2a

COST ESTIMATE: Capping Abandoned City of Cortland Landfill with Modified NYSDEC Part 360 Cap

Feasibility Study

Old Cortland County Landfill, Cortland County, NY

Landfill Cap Item	Quantity	Units	Unit Cost	Total Item Cost
Modified Part 360 PVC Cap[1]				
1. Strip existing topsoil	1.40	acres	$2,500	$3,500
2. Excavate, haul & spread existing cover soil and waste to 2 1/2' below grade (haul road and adjacent to maint. fac.)	5,700	cy	$5	$28,500
3. Remove rocks & grade subgrade	1.40	acres	$1,000	$1,400
4. Purchase, delivery & placement of 40 mil PVC geomembrane	61,000	sf	$0.40	$24,400
5. Purchase, delivery & placement of 12 oz/sy geotextile	61,000	sf	$0.16	$9,760
6. Purchase, delivery & placement of stone protective cover soil (30 in)	5,700	cy	$10	$57,000
7. Purchase & placement of gas vents A. Shallow Gas Vents (4/acre)	6	each	$1,000	$6,000
8. Purchase, delivery & placement of stone for landfill perimeter trenches and toe drain (~570 LF)	380	cy	$18	$6,840
9. Materials testing	1.40	acres	$2,500	$3,500
Standard Part 360 PVC Cap[2]				
1. Clearing & grubbing	0.88	acres	$5,000	$4,400
2. Capping (per-acre cap cost from Table C-1a: Part 360 PVC Cap)	1.28	acres	$79,980	$102,374
			TOTAL CONSTRUCTION COSTS:	$247,674
			Engineering, Legal & Miscellaneous Fees (15%):	$37,151
			SUBTOTAL:	$284,826
			Contingency (15%):	$42,724
			OVERALL PROJECT COSTS:	$327,549
			ROUNDED ESTIMATED COST:	$328,000

NOTES: This estimate applies to Alternatives II & III and is included in the total costs for these remedial alternatives.

[1] Modified Part 360 PVC Cap installed over landfill vehicle access areas and adjacent to the County Maintenance Facility.

[2] Standard Part 360 Cap installed over remaining City of Cortland Landfill area.

job: Old Cortland County Landfill FS
calculated by: MJC date: 4/24/98
checked by: [signature] date: 4/24/98
job#: 331.22 page: 1/1

TABLE C-2b

COST ESTIMATE: Capping Abandoned City of Cortland Landfill with Modified NYSDEC Part 360 Cap; Excavation of Thin Waste Areas Beyond Modified Cap Area

Feasibility Study

Old Cortland County Landfill, Cortland County, NY

Landfill Cap Item	Quantity	Units	Unit Cost	Total Item Cost
Modified Part 360 PVC Cap[1]				
1. Strip existing topsoil	1.14	acres	$2,500	$2,850
2. Excavate, haul & spread existing cover soil and waste to 2 1/2' below grade (haul road and adjacent to maint. fac.)	4,800	cy	$5	$24,000
3. Remove rocks & grade existing surface	1.14	acres	$1,000	$1,140
4. Purchase, delivery & placement of 40 mil PVC geomembrane	50,000	sf	$0.40	$20,000
5. Purchase, delivery & placement of 12 oz/sy geotextile	50,000	sf	$0.16	$8,000
6. Purchase, delivery & placement of stone protective cover soil (30 in)	4,800	cy	$10	$48,000
7. Purchase & placement of gas vents				
A. Shallow Gas Vents (4/acre)	5	each	$1,000	$5,000
8. Purchase, delivery & placement of stone for landfill perimeter trenches and toe drain (~570 LF)	380	cy	$18	$6,840
9. Materials testing	1.14	acres	$2,500	$2,850
Standard Part 360 PVC Cap[2]				
1. Capping (per-acre cap cost from Table C-1a: Part 360 PVC Cap with Drainage)	0.48	acres	$79,980	$38,390
Waste Relocation[3]				
1. Clearing & grubbing	0.88	acres	$5,000	$4,400
2. Strip existing topsoil and stockpile (~1')	1.06	acres	$2,500	$2,650
3. Excavate, haul & spread waste to approx. 8' below grade	12,000	cy	$5	$60,000
4. Replace topsoil within graded excavation	1,700	cy	$3	$5,100
5. Seeding & mulching	1.06	acres	$1,400	$1,484
			TOTAL CONSTRUCTION COSTS:	$230,704
			Engineering, Legal & Miscellaneous Fees (15%):	$34,606
			SUBTOTAL:	$265,310
			Contingency (15%):	$39,797
			OVERALL PROJECT COSTS[4]:	$305,107
			ROUNDED ESTIMATED COST:	$305,000

NOTES: This estimate applies to Alternative IV and is included in the total costs for this remedial alternative.

[1] Modified Part 360 PVC Cap installed over landfill vehicle access areas and adjacent to the County Maintenance Facility.

[2] Standard Part 360 Cap installed over narrow waste area at southwest corner of Old Cortland County Landfill

[3] Thin waste area to south of maintenance facility to be excavated.

[4] Value of capping = $207,000; value of waste relocation = $97,000.

job: Old Cortland County Landfill FS
calculated by: MJC date: 4/24/98
checked by: [signature] date: 4/24/98
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TABLE C-3

COST ESTIMATE: Capping of Buckbee-Mears Sludge Disposal Areas with NYSDEC Part 360 PVC Cap

Feasibility Study

Old Cortland County Landfill, Cortland County, NY

Landfill Cap Item	Quantity	Units	Unit Cost	Total Item Cost
1. Clearing & grubbing	2.5	acres	$5,000	$12,500
2. Capping (per-acre cap cost from Table C-1a: Part 360 PVC Cap with Drainage)	2.5	acres	$79,980	$199,950
			TOTAL CONSTRUCTION COSTS:	$212,450
			Engineering, Legal & Miscellaneous Fees (15%):	$31,868
			SUBTOTAL:	$244,318
			Contingency (15%):	$36,648
			OVERALL PROJECT COSTS:	$280,965
			ROUNDED ESTIMATED COST:	$281,000

job: Old Cortland County Landfill FS
calculated by: MJC date: 4/24/98
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job#: 331.22 page: 1/1

TABLE C-4

COST ESTIMATE: Drum Handling & Disposal

Feasibility Study

Old Cortland County Landfill, Cortland County, NY

Item	Quantity	Units	Unit Cost	Total Item Cost
1. Clearing & grubbing	1.05	acres	$2,500	$2,625
2. Isolate, Overpack, Ship & Dispose of Drums Containing Liquid Wastes (Drum Area & Isolated Buried Waste Area)	13	drums	$600	$7,800
			TOTAL CONSTRUCTION COSTS:	$10,425
			Engineering, Legal & Miscellaneous Fees (15%):	$1,564
			SUBTOTAL:	$11,989
			Contingency (15%):	$1,798
			OVERALL PROJECT COSTS:	$13,787
			ROUNDED ESTIMATED COST:	$14,000

job: Old Cortland County Landfill FS
calculated by: MJC date: 7/14/98
checked by: MCC date: 7/16/98
job#: 381.22 page: 1/1

TABLE C-5a

COST ESTIMATE: Excavation of Contaminated Soil Areas

Feasibility Study

Old Cortland County Landfill, Cortland County, NY

Item	Quantity	Units	Unit Cost	Total Item Cost
Exposed Scrap Metal Area - Contaminated Soils[1]				
1. Excavate, haul & spread contaminated soils and scrap metal to a depth of 10 ft.	17,000	cy	$5	$85,000
2. Load, haul & backfill on-site materials	17,000	cy	$3	$51,000
3. Seeding & mulching	1.05	acres	$1,400	$1,470
SUBTOTAL				$137,470
Isolated Buried Waste Area - Contaminated Soils[1]				
1. Excavate, haul & spread contaminated soils and buried wastes to a depth of 10 ft.	4,100	cy	$5	$20,500
2. Load, haul & backfill on-site materials	4,100	cy	$3	$12,300
3. Seeding & mulching	0.25	acres	$1,400	$350
SUBTOTAL				$33,150

TOTAL CONSTRUCTION COSTS:	$170,620
Engineering, Legal & Miscellaneous Fees (15%):	$25,593
SUBTOTAL:	$196,213
Contingency (15%):	$29,432
OVERALL PROJECT COSTS:	$225,645
ROUNDED ESTIMATED COST:	$226,000

NOTES: This estimate applies to Alternative II and is included in the total cost estimate for this remedial alternative.

[1] Value of excavation and disposal = $140,000; value of backfilling = $86,000.

job: Old Cortland County Landfill FS
calculated by: MJC date: 7/14/98
checked by: MK date: 7/16/98
job#: 331.22 page: 1/1

TABLE C-5b

COST ESTIMATE: Excavation of Contaminated Soils and Sludge Disposal Areas

Feasibility Study

Old Cortland County Landfill, Cortland County, NY

Item	Quantity	Units	Unit Cost	Total Item Cost
Buckbee-Mears Sludge Disposal Areas[1]				
1. Clearing & grubbing	2.50	acres	$5,000	$12,500
2. Strip existing topsoil to 3 ft. below grade; replace topsoil along slopes and bottom of excavation	12,100	cy	$4	$48,400
3. Excavate, haul & spread sludge waste & soil to a depth of 10 ft.	28,300	cy	$5	$141,500
4. Seeding & mulching	2.50	acres	$1,400	$3,500
5. Purchase, delivery & placement of drainage culverts in each of the excavations	220	ft	$50	$11,000
SUBTOTAL				$216,900
Exposed Scrap Metal Area - Contaminated Soils[2]				
1. Excavate, haul & spread contaminated soils and scrap metal to a depth of 10 ft.	17,000	cy	$5	$85,000
2. Purchase, delivery & placement of topsoil	1,700	cy	$8	$13,600
3. Seeding & mulching	1.05	acres	$1,400	$1,470
SUBTOTAL				$100,070
Isolated Buried Waste Area - Contaminated Soils[2]				
1. Excavate, haul & spread contaminated soils and buried wastes to a depth of 10 ft.	4,100	cy	$5	$20,500
2. Purchase, delivery & placement of topsoil	4,100	cy	$3	$12,300
3. Seeding & mulching	0.25	acres	$1,400	$350
SUBTOTAL				$33,150

TOTAL CONSTRUCTION COSTS:	$350,120
Engineering, Legal & Miscellaneous Fees (15%):	$52,518
SUBTOTAL:	$402,638
Contingency (15%):	$60,396
OVERALL PROJECT COSTS:	$463,034
ROUNDED ESTIMATED COST:	$463,000

NOTES: This estimate applies to Alternatives III & IV and is included in the total cost estimate for these remedial alternatives.

[1] Value of excavation and grading within Buckbee-Mears Disposal Areas = $287,000.

[2] Value of excavation of Exposed Scrap Metal Area and Isolated Buried Waste Area = $140,000; value of backfilling within these areas = $36,000.

job: Old Cortland County Landfill FS
calculated by: MJC date: 7/14/98
checked by: MJC date: 7/16/98
job#: 331.22 page: 1/1

TABLE C-6

COST ESTIMATE: Long-Term Monitoring
Feasibility Study
Old Cortland County Landfill, Cortland County, NY

Location	ANNUAL ANALYTICAL REQUIREMENTS [1] Baseline (# of Samples/yr.)	Analytical Costs per Sample	Routine (# of Samples/yr.)	Analytical Costs per Sample	Total Annual Cost per Location
Groundwater Monitoring Wells					
MW-1A	1	$412	3	$135	$817
MW-1B	1	$412	3	$135	$817
MW-2A	1	$412	3	$135	$817
MW-2B	1	$412	3	$135	$817
MW-3A	1	$412	3	$135	$817
MW-3B	1	$412	3	$135	$817
MW-4A	1	$412	3	$135	$817
MW-5A	1	$412	3	$135	$817
MW-6A	1	$412	3	$135	$817
MW-6B	1	$412	3	$135	$817
MW-7A	1	$412	3	$135	$817
CD-1	1	$412	3	$135	$817
CD-1RA	1	$412	3	$135	$817
Sediment Sampling Location					
SED-1	1	$412	0	$0	$412
Surface Water Sampling Location					
SW-3	1	$412	3	$135	$817

Subtotal - Analytical Services:	$11,850
Annual Sampling Costs: [2]	$1,060
Subtotal Annual Analytical & Sampling Costs:	$12,910
Contingency (15% of annual costs):	$1,937
Total Annual & Sampling Costs:	$14,847
Net Present Value - 30 Yr. Monitoring Program: [3]	$344,000

NOTES:
[1] In accordance with 1988 NYSEC 6NYCRR Part 360 municipal landfill closure requirements. Baseline analysis substitutes EPA method 8260 for EPA method 601/602 tests for Volatile Organic Compounds.
[2] Based on sampling cost of $20 per location per quarter.
[3] Based on total investment at 6.5% return, and an annual inflation rate of 5%.

APPENDIX D

HELP MODEL ANALYSIS OF POST-CLOSURE REDUCTION IN LEACHATE GENERATION

OLD CORTLAND COUNTY LANDFILL FEASIBILITY STUDY

SUMMARY OF LEACHATE REDUCTION FOLLOWING CAPPING

HELP MODEL VERSION 3.05a

Year	Precipitation (in/acre/yr)	Precipitation (gal/yr)	Runoff (in/acre/yr)	Runoff (gal/yr)	Evapotranspiration (in/acre/yr)	Evapotranspiration (gal/yr)	Lat. Drain. above PVC (in/acre/yr)	Lat. Drain. above PVC (gal/yr)	Perc. thru PVC (in/acre/yr)	Perc. thru PVC (gal/yr)	Perc. from Waste (in/acre/yr)	Perc. from Waste (gal/yr)
Existing Conditions	40.16	41,709,345	10.285	10,681,788	23.839	24,758,692					5.322900	5,528,264
Yr 1 After Capping	37.02	38,448,206	14.218	14,766,520	20.082	20,856,750	0.4409	457,910	0.009869	10,250	5.237173	5,439,219
Yr 2 After Capping	40.98	42,560,980	13.424	13,941,889	23.593	24,503,201	2.8185	2,927,236	0.059991	62,305	4.840398	5,027,137
Yr 3 After Capping	44.45	46,164,850	18.725	19,447,397	24.853	25,811,811	2.6353	2,736,968	0.056245	58,415	4.449633	4,621,297
Yr 4 After Capping	46.30	48,086,222	20.649	21,445,624	21.027	21,838,207	2.1365	2,218,925	0.045816	47,584	4.053833	4,210,227
Yr 5 After Capping	32.04	33,276,081	10.970	11,393,215	18.565	19,281,225	3.9319	4,083,590	0.082605	85,792	3.705824	3,848,792
Yr 6 After Capping	37.02	38,448,206	13.628	14,153,759	20.779	21,580,639	2.2320	2,318,109	0.047996	49,848	3.383552	3,514,087
Yr 7 After Capping	40.98	42,560,980	13.423	13,940,850	23.429	24,332,874	3.3603	3,489,938	0.071024	73,764	3.096410	3,215,867
Yr 8 After Capping	44.45	46,164,850	18.302	19,008,078	24.900	25,860,625	3.1371	3,258,127	0.066489	69,054	2.839382	2,948,923
Yr 9 After Capping	46.30	48,086,222	20.599	21,393,695	20.704	21,502,746	2.3296	2,419,474	0.049776	51,696	2.588238	2,688,090
Yr 10 After Cappin	32.04	33,276,081	10.972	11,395,292	18.631	19,349,771	4.1250	4,284,140	0.086513	89,851	2.368752	2,460,137
Yr 11 After Cappin	37.02	38,448,206	13.810	14,342,780	21.325	22,147,704	1.9125	1,986,283	0.041431	43,029	2.157732	2,240,976
Yr 12 After Cappin	40.98	42,560,980	13.334	13,848,416	23.592	24,502,163	2.8085	2,916,850	0.059785	62,091	1.983107	2,059,614
Yr 13 After Cappin	44.45	46,164,850	18.905	19,634,342	24.857	25,815,966	2.5632	2,662,086	0.054748	56,860	1.819446	1,889,639
Yr 14 After Cappin	46.30	48,086,222	20.778	21,579,601	20.767	21,568,176	2.2562	2,343,243	0.048296	50,159	1.659812	1,723,846
Yr 15 After Cappin	32.04	33,276,081	10.971	11,394,254	18.722	19,444,282	3.9453	4,097,507	0.082874	86,071	1.521198	1,579,885
Yr 16 After Cappin	37.02	38,448,206	13.832	14,365,629	20.894	21,700,076	1.9625	2,038,212	0.042450	44,088	1.376797	1,429,913
Yr 17 After Cappin	40.98	42,560,980	13.424	13,941,889	23.663	24,575,902	3.1433	3,264,566	0.066614	69,184	1.277634	1,326,924
Yr 18 After Cappin	44.45	46,164,850	18.303	19,009,117	24.904	25,864,779	2.9649	3,079,284	0.062982	65,412	1.174833	1,220,157
Yr 19 After Cappin	46.30	48,086,222	19.864	20,630,339	21.672	22,508,091	1.8153	1,885,333	0.039248	40,762	1.073163	1,114,565
Yr 20 After Cappin	32.04	33,276,081	11.492	11,935,353	18.727	19,449,475	3.8486	3,997,076	0.080907	84,028	0.984968	1,022,967
Yr 21 After Cappin	37.02	38,448,206	13.716	14,245,154	21.369	22,193,401	2.1166	2,198,257	0.045601	47,360	0.902636	937,459
Yr 22 After Cappin	40.98	42,560,980	12.999	13,500,492	23.685	24,598,751	3.1002	3,219,804	0.065742	68,278	0.436271	453,102
Yr 23 After Cappin	44.45	46,164,850	18.298	19,003,924	24.614	25,563,591	2.9585	3,072,637	0.062854	65,279	0.062870	65,295
Yr 24 After Cappin	46.30	48,086,222	20.053	20,826,631	21.853	22,696,073	1.9792	2,055,556	0.042713	44,361	0.042693	44,340
Yr 25 After Cappin	32.04	33,276,081	11.492	11,935,353	19.103	19,839,980	3.4900	3,624,642	0.073624	76,464	0.073644	76,485
Yr 26 After Cappin	37.02	38,448,206	13.750	14,280,465	20.787	21,588,948	1.7595	1,827,380	0.038243	39,718	0.038260	39,736
Yr 27 After Cappin	40.98	42,560,980	13.422	13,939,811	23.633	24,544,745	3.2008	3,324,285	0.067784	70,399	0.067784	70,399
Yr 28 After Cappin	44.45	46,164,850	18.302	19,008,078	24.810	25,767,152	3.0167	3,133,082	0.064038	66,509	0.064038	66,509
Yr 29 After Cappin	46.30	48,086,222	20.757	21,557,791	20.745	21,545,328	1.9406	2,015,467	0.041872	43,487	0.041872	43,487
Yr 30 After Cappin	32.04	33,276,081	11.491	11,934,315	18.738	19,460,899	3.8159	3,963,115	0.080247	83,343	0.080247	83,343

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**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                  HELP MODEL VERSION 3.05a  (5 JUNE 1996)                 **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY             **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:      c:\help305\DATA4.D4
TEMPERATURE DATA FILE:        c:\help305\DATA7.D7
SOLAR RADIATION DATA FILE:    c:\help305\DATA13.D13
EVAPOTRANSPIRATION DATA:      c:\help305\DATA11.D11
SOIL AND DESIGN DATA FILE:    c:\help305\EXSTCON.D10
OUTPUT DATA FILE:             c:\help305\exstcon.OUT


TIME:   8:44     DATE:   2/19/1998


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

     TITLE:  Old Cortland County LF FS: Existing Conditions Model

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


                                  LAYER  1
                                  --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                    =     24.00   INCHES
          POROSITY                     =      0.5010 VOL/VOL
          FIELD CAPACITY               =      0.2840 VOL/VOL
          WILTING POINT                =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2840 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.999999975000E-05 CM/SEC


                                  LAYER  2
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TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	408.00 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

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	132.00 INCHES
POROSITY	=	0.6710 VOL/VOL
FIELD CAPACITY	=	0.2920 VOL/VOL
WILTING POINT	=	0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.6710 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 4

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4710 VOL/VOL
FIELD CAPACITY	=	0.3420 VOL/VOL
WILTING POINT	=	0.2100 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4710 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.670000020000E-07 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 9 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 18.% AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	82.20	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	20.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	5.680	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	10.020	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	2.700	INCHES

INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	225.828	INCHES
TOTAL INITIAL WATER	=	225.828	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
ITHACA NEW YORK

STATION LATITUDE	=	42.40	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	130	
END OF GROWING SEASON (JULIAN DATE)	=	279	
EVAPORATIVE ZONE DEPTH	=	20.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	69.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	75.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00	%

NOTE: PRECIPITATION DATA FOR ITHACA NEW YORK
WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ITHACA NEW YORK

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
22.20	22.70	32.20	44.50	54.80	64.30
68.80	67.10	60.20	49.60	39.30	27.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ITHACA NEW YORK
AND STATION LATITUDE = 42.40 DEGREES

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ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.02	134382.578	100.00
RUNOFF	6.839	24826.613	18.47

EVAPOTRANSPIRATION	23.327	84677.531	63.01
PERC./LEAKAGE THROUGH LAYER 4	5.223144	18960.014	14.11
AVG. HEAD ON TOP OF LAYER 4	126.7148		
CHANGE IN WATER STORAGE	1.630	5918.469	4.40
SOIL WATER AT START OF YEAR	225.828	819755.437	
SOIL WATER AT END OF YEAR	227.458	825673.875	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.055	0.00

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ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.98	148757.406	100.00
RUNOFF	8.507	30878.645	20.76
EVAPOTRANSPIRATION	25.113	91158.383	61.28
PERC./LEAKAGE THROUGH LAYER 4	5.194410	18855.709	12.68
AVG. HEAD ON TOP OF LAYER 4	125.8596		
CHANGE IN WATER STORAGE	2.167	7864.647	5.29
SOIL WATER AT START OF YEAR	227.458	825673.875	
SOIL WATER AT END OF YEAR	227.302	825106.625	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	2.323	8431.890	5.67
ANNUAL WATER BUDGET BALANCE	0.0000	0.024	0.00

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ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.45	161353.516	100.00
RUNOFF	12.930	46934.352	29.09
EVAPOTRANSPIRATION	26.151	94929.062	58.83
PERC./LEAKAGE THROUGH LAYER 4	5.310610	19277.516	11.95
AVG. HEAD ON TOP OF LAYER 4	128.7943		
CHANGE IN WATER STORAGE	0.059	212.506	0.13
SOIL WATER AT START OF YEAR	227.302	825106.625	
SOIL WATER AT END OF YEAR	228.029	827744.937	
SNOW WATER AT START OF YEAR	2.323	8431.890	5.23
SNOW WATER AT END OF YEAR	1.655	6006.088	3.72
ANNUAL WATER BUDGET BALANCE	0.0000	0.085	0.00

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ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.30	168069.031	100.00
RUNOFF	14.140	51329.242	30.54
EVAPOTRANSPIRATION	24.120	87553.906	52.09
PERC./LEAKAGE THROUGH LAYER 4	5.318691	19306.850	11.49
AVG. HEAD ON TOP OF LAYER 4	129.4599		
CHANGE IN WATER STORAGE	2.721	9879.020	5.88
SOIL WATER AT START OF YEAR	228.029	827744.937	
SOIL WATER AT END OF YEAR	232.139	842665.937	
SNOW WATER AT START OF YEAR	1.655	6006.088	3.57
SNOW WATER AT END OF YEAR	0.266	964.143	0.57
ANNUAL WATER BUDGET BALANCE	0.0000	0.007	0.00

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ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	32.04	116305.187	100.00
RUNOFF	9.008	32698.463	28.11
EVAPOTRANSPIRATION	20.486	74363.437	63.94
PERC./LEAKAGE THROUGH LAYER 4	5.567645	20210.551	17.38
AVG. HEAD ON TOP OF LAYER 4	136.6513		
CHANGE IN WATER STORAGE	-3.021	-10967.323	-9.43
SOIL WATER AT START OF YEAR	232.139	842665.937	
SOIL WATER AT END OF YEAR	227.478	825743.937	
SNOW WATER AT START OF YEAR	0.266	964.143	0.83
SNOW WATER AT END OF YEAR	1.906	6918.781	5.95
ANNUAL WATER BUDGET BALANCE	0.0000	0.061	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	2.80	2.09	2.65	2.37	3.03	4.00
	4.17	4.03	5.43	4.15	2.36	3.07
STD. DEVIATIONS	2.10	0.80	0.63	0.94	0.94	1.09
	2.81	0.59	2.99	1.70	1.22	0.78
RUNOFF						
TOTALS	0.650	0.617	3.650	2.514	0.051	0.166
	0.510	0.041	0.887	0.525	0.077	0.597
STD. DEVIATIONS	0.900	0.741	1.300	2.723	0.029	0.191
	1.068	0.031	1.133	0.635	0.124	1.002

EVAPOTRANSPIRATION

TOTALS	0.435	0.476	0.412	1.126	2.980	3.596
	5.297	3.213	3.021	1.762	1.073	0.449
STD. DEVIATIONS	0.055	0.051	0.126	0.529	0.624	0.603
	0.660	0.832	0.535	0.077	0.101	0.094

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.4578	0.4144	0.4525	0.4349	0.4497	0.4381
	0.4519	0.4516	0.4354	0.4482	0.4347	0.4538
STD. DEVIATIONS	0.0149	0.0134	0.0154	0.0147	0.0130	0.0140
	0.0140	0.0135	0.0130	0.0125	0.0108	0.0123

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	131.5092	130.7782	129.7172	128.6505	128.7639	129.7861
	129.5038	129.4134	128.8236	128.2655	128.5867	130.1535
STD. DEVIATIONS	5.0451	5.2818	5.2423	5.1459	4.4049	4.9048
	4.7497	4.6025	4.5685	4.2578	3.7932	4.1865

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

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.16 (5.757)	145773.5	100.00
RUNOFF	10.285 (3.1034)	37333.46	25.611
EVAPOTRANSPIRATION	23.839 (2.1537)	86536.46	59.364
PERCOLATION/LEAKAGE THROUGH LAYER 4	5.32290 (0.14708)	19322.127	13.25489
AVERAGE HEAD ON TOP OF LAYER 4	129.496 (4.262)		
CHANGE IN WATER STORAGE	0.711 (2.3109)	2581.46	1.771

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PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)
PRECIPITATION	3.13	11361.900
RUNOFF	2.200	7986.9487
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.015586	56.57553
AVERAGE HEAD ON TOP OF LAYER 4	140.129	
SNOW WATER	7.10	25775.8906
MAXIMUM VEG. SOIL WATER (VOL/VOL)		0.4784
MINIMUM VEG. SOIL WATER (VOL/VOL)		0.1424

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FINAL WATER STORAGE AT END OF YEAR 1978

LAYER	(INCHES)	(VOL/VOL)
1	8.4594	0.3525
2	119.1423	0.2920
3	88.5720	0.6710
4	11.3040	0.4710
SNOW WATER	1.906	

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**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.05a  (5 JUNE 1996)                    **
**                DEVELOPED BY ENVIRONMENTAL LABORATORY                     **
**                  USAE WATERWAYS EXPERIMENT STATION                       **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY             **
**                                                                          **
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PRECIPITATION DATA FILE:     c:\help305\DATA4.D4
TEMPERATURE DATA FILE:       c:\help305\DATA7.D7
SOLAR RADIATION DATA FILE:   c:\help305\DATA13.D13
EVAPOTRANSPIRATION DATA:     c:\help305\DATA11.D11
SOIL AND DESIGN DATA FILE:   c:\help305\RED1-5.D10
OUTPUT DATA FILE:            c:\help305\red1-5.OUT
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TIME:    8:56     DATE:    2/19/1998
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     TITLE:  Old Cortland County LF FS: Léachate Reduction (yrs 1-5)

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.
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                                 LAYER  1
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                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
          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 =       0.1310 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =   0.999999975000E-05 CM/SEC
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                                 LAYER  2
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TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1310	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4170	VOL/VOL
FIELD CAPACITY	=	0.0450	VOL/VOL
WILTING POINT	=	0.0180	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0450	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC
SLOPE	=	18.00	PERCENT
DRAINAGE LENGTH	=	500.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 37

THICKNESS	=	0.04	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.	=	0.199999999000E-10	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	1.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	24.00	INCHES
POROSITY	=	0.5010	VOL/VOL
FIELD CAPACITY	=	0.2840	VOL/VOL
WILTING POINT	=	0.1350	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3525	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	408.00	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

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	132.00	INCHES
POROSITY	=	0.6710	VOL/VOL
FIELD CAPACITY	=	0.2920	VOL/VOL
WILTING POINT	=	0.0770	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.6710	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 8

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4710	VOL/VOL
FIELD CAPACITY	=	0.3420	VOL/VOL
WILTING POINT	=	0.2100	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4710	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.670000020000E-07	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 5 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 18.% AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	65.50	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT

AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	20.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.448	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	9.060	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.080	INCHES
INITIAL SNOW WATER	=	1.906	INCHES
INITIAL WATER IN LAYER MATERIALS	=	230.370	INCHES
TOTAL INITIAL WATER	=	232.276	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
ITHACA NEW YORK

STATION LATITUDE	=	42.40	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	130	
END OF GROWING SEASON (JULIAN DATE)	=	279	
EVAPORATIVE ZONE DEPTH	=	20.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	69.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	75.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00	%

NOTE: PRECIPITATION DATA FOR ITHACA NEW YORK
WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ITHACA NEW YORK

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
22.20	22.70	32.20	44.50	54.80	64.30
68.80	67.10	60.20	49.60	39.30	27.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ITHACA NEW YORK
AND STATION LATITUDE = 42.40 DEGREES

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ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.02	134382.578	100.00
RUNOFF	14.218	51611.059	38.41
EVAPOTRANSPIRATION	20.082	72897.883	54.25
DRAINAGE COLLECTED FROM LAYER 3	0.4409	1600.523	1.19
PERC./LEAKAGE THROUGH LAYER 4	0.009869	35.823	0.03
AVG. HEAD ON TOP OF LAYER 4	0.6049		
PERC./LEAKAGE THROUGH LAYER 8	5.237173	19010.937	14.15
AVG. HEAD ON TOP OF LAYER 8	127.1233		
CHANGE IN WATER STORAGE	-2.958	-10737.770	-7.99
SOIL WATER AT START OF YEAR	234.600	851597.937	
SOIL WATER AT END OF YEAR	233.548	847779.000	
SNOW WATER AT START OF YEAR	1.906	6918.780	5.15
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.061	0.00

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ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.98	148757.406	100.00
RUNOFF	13.424	48729.926	32.76
EVAPOTRANSPIRATION	23.593	85644.227	57.57
DRAINAGE COLLECTED FROM LAYER 3	2.8185	10231.160	6.88
PERC./LEAKAGE THROUGH LAYER 4	0.059991	217.769	0.15
AVG. HEAD ON TOP OF LAYER 4	3.9018		
PERC./LEAKAGE THROUGH LAYER 8	4.840398	17570.646	11.81
AVG. HEAD ON TOP OF LAYER 8	115.6789		
CHANGE IN WATER STORAGE	-3.697	-13418.565	-9.02
SOIL WATER AT START OF YEAR	233.548	847779.000	

SOIL WATER AT END OF YEAR	227.529	825928.500	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	2.323	8431.890	5.67
ANNUAL WATER BUDGET BALANCE	0.0000	0.019	0.00

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ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.45	161353.516	100.00
RUNOFF	18.725	67972.320	42.13
EVAPOTRANSPIRATION	24.853	90217.695	55.91
DRAINAGE COLLECTED FROM LAYER 3	2.6353	9566.216	5.93
PERC./LEAKAGE THROUGH LAYER 4	0.056245	204.168	0.13
AVG. HEAD ON TOP OF LAYER 4	3.6389		
PERC./LEAKAGE THROUGH LAYER 8	4.449633	16152.168	10.01
AVG. HEAD ON TOP OF LAYER 8	104.0415		
CHANGE IN WATER STORAGE	-6.213	-22554.922	-13.98
SOIL WATER AT START OF YEAR	227.529	825928.500	
SOIL WATER AT END OF YEAR	221.983	805799.375	
SNOW WATER AT START OF YEAR	2.323	8431.890	5.23
SNOW WATER AT END OF YEAR	1.655	6006.088	3.72
ANNUAL WATER BUDGET BALANCE	0.0000	0.040	0.00

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ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.30	168069.031	100.00

RUNOFF	20.649	74954.133	44.60
EVAPOTRANSPIRATION	21.027	76328.547	45.41
DRAINAGE COLLECTED FROM LAYER 3	2.1365	7755.657	4.61
PERC./LEAKAGE THROUGH LAYER 4	0.045816	166.312	0.10
AVG. HEAD ON TOP OF LAYER 4	2.9551		
PERC./LEAKAGE THROUGH LAYER 8	4.053833	14715.414	8.76
AVG. HEAD ON TOP OF LAYER 8	92.9828		
CHANGE IN WATER STORAGE	-1.566	-5684.794	-3.38
SOIL WATER AT START OF YEAR	221.983	805799.375	
SOIL WATER AT END OF YEAR	221.806	805156.562	
SNOW WATER AT START OF YEAR	1.655	6006.088	3.57
SNOW WATER AT END OF YEAR	0.266	964.143	0.57
ANNUAL WATER BUDGET BALANCE	0.0000	0.071	0.00

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ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	32.04	116305.187	100.00
RUNOFF	10.970	39821.289	34.24
EVAPOTRANSPIRATION	18.565	67389.250	57.94
DRAINAGE COLLECTED FROM LAYER 3	3.9319	14272.737	12.27
PERC./LEAKAGE THROUGH LAYER 4	0.082605	299.856	0.26
AVG. HEAD ON TOP OF LAYER 4	5.4488		
PERC./LEAKAGE THROUGH LAYER 8	3.705824	13452.141	11.57
AVG. HEAD ON TOP OF LAYER 8	82.9399		
CHANGE IN WATER STORAGE	-5.132	-18630.227	-16.02
SOIL WATER AT START OF YEAR	221.806	805156.562	
SOIL WATER AT END OF YEAR	215.034	780571.687	

SNOW WATER AT START OF YEAR	0.266	964.143	0.83
SNOW WATER AT END OF YEAR	1.906	6918.781	5.95
ANNUAL WATER BUDGET BALANCE	0.0000	0.001	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	2.80	2.09	2.65	2.37	3.03	4.00
	4.17	4.03	5.43	4.15	2.36	3.07
STD. DEVIATIONS	2.10	0.80	0.63	0.94	0.94	1.09
	2.81	0.59	2.99	1.70	1.22	0.78
RUNOFF						
TOTALS	1.070	0.537	3.207	2.048	0.457	1.019
	1.329	1.093	2.226	1.570	0.381	0.662
STD. DEVIATIONS	1.317	0.948	1.335	2.617	0.323	0.647
	1.541	0.157	1.988	1.239	0.440	0.878
EVAPOTRANSPIRATION						
TOTALS	0.425	0.476	0.414	1.123	2.926	3.584
	4.669	2.553	2.387	1.630	0.992	0.445
STD. DEVIATIONS	0.060	0.051	0.124	0.526	0.575	0.625
	0.981	0.937	0.354	0.192	0.131	0.093
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	0.1995	0.1546	0.1447	0.1328	0.2024	0.2061
	0.2011	0.2111	0.2007	0.2191	0.2445	0.2761
STD. DEVIATIONS	0.1471	0.1133	0.1068	0.0936	0.1439	0.1547
	0.1409	0.1331	0.1167	0.0919	0.1259	0.1167
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0042	0.0033	0.0031	0.0029	0.0043	0.0044
	0.0043	0.0045	0.0043	0.0047	0.0052	0.0058
STD. DEVIATIONS	0.0031	0.0024	0.0023	0.0020	0.0030	0.0032
	0.0029	0.0027	0.0024	0.0019	0.0026	0.0024

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.3928	0.3550	0.3878	0.3727	0.3825	0.3676
	0.3772	0.3745	0.3598	0.3691	0.3546	0.3638
STD. DEVIATIONS	0.0519	0.0473	0.0522	0.0505	0.0521	0.0504
	0.0519	0.0517	0.0498	0.0513	0.0494	0.0508

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	3.2562	2.7720	2.3607	2.2388	3.3022	3.4752
	3.2809	3.4441	3.3843	3.5751	4.1230	4.5060
STD. DEVIATIONS	2.4011	2.0452	1.7428	1.5782	2.3476	2.6077
	2.2986	2.1712	1.9670	1.5000	2.1227	1.9045

DAILY AVERAGE HEAD ON TOP OF LAYER 8

AVERAGES	109.4233	108.5749	107.7274	106.8420	105.9433	105.0384
	104.1300	103.2055	102.2961	101.3884	100.4847	99.5858
STD. DEVIATIONS	17.6456	17.6831	17.7173	17.7258	17.7109	17.6744
	17.6236	17.5613	17.4915	17.4150	17.3319	17.2444

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

	INCHES		CU. FEET	PERCENT
PRECIPITATION	40.16	(5.757)	145773.5	100.00
RUNOFF	15.597	(3.9792)	56617.75	38.840
EVAPOTRANSPIRATION	21.624	(2.5691)	78495.52	53.848
LATERAL DRAINAGE COLLECTED FROM LAYER 3	2.39263	(1.27322)	8685.259	5.95805
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.05091	(0.02658)	184.785	0.12676
AVERAGE HEAD ON TOP OF LAYER 4	3.310	(1.766)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	4.45737	(0.60880)	16180.261	11.09959
AVERAGE HEAD ON TOP OF LAYER 8	104.553	(17.567)		

CHANGE IN WATER STORAGE	-3.913	(1.8197)	-14205.25	-9.745

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PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)
PRECIPITATION	3.13	11361.900
RUNOFF	2.556	9277.0352
DRAINAGE COLLECTED FROM LAYER 3	0.01600	58.07543
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000332	1.20497
AVERAGE HEAD ON TOP OF LAYER 4	8.093	
MAXIMUM HEAD ON TOP OF LAYER 4	15.399	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	8.9 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.014812	53.76845
AVERAGE HEAD ON TOP OF LAYER 8	131.986	
SNOW WATER	7.10	25775.8906
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3869	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0540	

*** 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	2.0482	0.3414
2	1.0299	0.0858
3	2.2858	0.1905
4	0.0000	0.0000
5	6.8160	0.2840
6	119.1360	0.2920
7	68.1837	0.5165
8	11.3040	0.4710
SNOW WATER	1.906	

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**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                 HELP MODEL VERSION 3.05a  (5 JUNE 1996)                  **
**                 DEVELOPED BY ENVIRONMENTAL LABORATORY                    **
**                   USAE WATERWAYS EXPERIMENT STATION                      **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:     c:\help305\DATA4.D4
TEMPERATURE DATA FILE:       c:\help305\DATA7.D7
SOLAR RADIATION DATA FILE:   c:\help305\DATA13.D13
EVAPOTRANSPIRATION DATA:     c:\help305\DATA11.D11
SOIL AND DESIGN DATA FILE:   c:\help305\RED6-10.D10
OUTPUT DATA FILE:            c:\help305\red6-10.OUT


TIME:   9: 0     DATE:   2/19/1998


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     TITLE:  Old Cortland County LF FS: Leachate Reduction (yrs 6-10)

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


                                  LAYER  1
                                  --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
          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   =       0.3414 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =   0.999999975000E-05 CM/SEC


                                  LAYER  2
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TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4570 VOL/VOL
FIELD CAPACITY	=	0.1310 VOL/VOL
WILTING POINT	=	0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0858 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05 CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4170 VOL/VOL
FIELD CAPACITY	=	0.0450 VOL/VOL
WILTING POINT	=	0.0180 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1905 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC
SLOPE	=	18.00 PERCENT
DRAINAGE LENGTH	=	500.0 FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 37

THICKNESS	=	0.04 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.	=	0.199999999000E-10 CM/SEC
FML PINHOLE DENSITY	=	1.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	1.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	24.00 INCHES
POROSITY	=	0.5010 VOL/VOL
FIELD CAPACITY	=	0.2840 VOL/VOL
WILTING POINT	=	0.1350 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2840 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05 CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	408.00 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

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	132.00 INCHES
POROSITY	=	0.6710 VOL/VOL
FIELD CAPACITY	=	0.2920 VOL/VOL
WILTING POINT	=	0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.5165 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 8

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4710 VOL/VOL
FIELD CAPACITY	=	0.3420 VOL/VOL
WILTING POINT	=	0.2100 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4710 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.670000020000E-07 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 5 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 18.% AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	65.50
FRACTION OF AREA ALLOWING RUNOFF	=	100.0 PERCENT

AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	20.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.459	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	9.060	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.080	INCHES
INITIAL SNOW WATER	=	1.906	INCHES
INITIAL WATER IN LAYER MATERIALS	=	210.798	INCHES
TOTAL INITIAL WATER	=	212.704	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
ITHACA NEW YORK

STATION LATITUDE	=	42.40	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	130	
END OF GROWING SEASON (JULIAN DATE)	=	279	
EVAPORATIVE ZONE DEPTH	=	20.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	69.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	75.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00	%

NOTE: PRECIPITATION DATA FOR ITHACA NEW YORK
WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ITHACA NEW YORK

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
22.20	22.70	32.20	44.50	54.80	64.30
68.80	67.10	60.20	49.60	39.30	27.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ITHACA NEW YORK
AND STATION LATITUDE = 42.40 DEGREES

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ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.02	134382.578	100.00
RUNOFF	13.628	49468.805	36.81
EVAPOTRANSPIRATION	20.779	75428.141	56.13
DRAINAGE COLLECTED FROM LAYER 3	2.2320	8102.155	6.03
PERC./LEAKAGE THROUGH LAYER 4	0.047996	174.225	0.13
AVG. HEAD ON TOP OF LAYER 4	3.0896		
PERC./LEAKAGE THROUGH LAYER 8	3.383552	12282.295	9.14
AVG. HEAD ON TOP OF LAYER 8	73.6422		
CHANGE IN WATER STORAGE	-3.002	-10898.786	-8.11
SOIL WATER AT START OF YEAR	214.206	777567.562	
SOIL WATER AT END OF YEAR	213.110	773587.562	
SNOW WATER AT START OF YEAR	1.906	6918.780	5.15
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.035	0.00

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ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.98	148757.406	100.00
RUNOFF	13.423	48724.902	32.75
EVAPOTRANSPIRATION	23.429	85048.062	57.17
DRAINAGE COLLECTED FROM LAYER 3	3.3603	12197.974	8.20
PERC./LEAKAGE THROUGH LAYER 4	0.071024	257.816	0.17
AVG. HEAD ON TOP OF LAYER 4	4.6533		
PERC./LEAKAGE THROUGH LAYER 8	3.096410	11239.967	7.56
AVG. HEAD ON TOP OF LAYER 8	65.3539		
CHANGE IN WATER STORAGE	-2.329	-8453.459	-5.68
SOIL WATER AT START OF YEAR	213.110	773587.562	

SOIL WATER AT END OF YEAR	208.458	756702.250	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	2.323	8431.890	5.67
ANNUAL WATER BUDGET BALANCE	0.0000	-0.035	0.00

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ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.45	161353.516	100.00
RUNOFF	18.302	66435.703	41.17
EVAPOTRANSPIRATION	24.900	90387.773	56.02
DRAINAGE COLLECTED FROM LAYER 3	3.1371	11387.662	7.06
PERC./LEAKAGE THROUGH LAYER 4	0.066489	241.355	0.15
AVG. HEAD ON TOP OF LAYER 4	4.3346		
PERC./LEAKAGE THROUGH LAYER 8	2.839382	10306.958	6.39
AVG. HEAD ON TOP OF LAYER 8	57.7054		
CHANGE IN WATER STORAGE	-4.729	-17164.701	-10.64
SOIL WATER AT START OF YEAR	208.458	756702.250	
SOIL WATER AT END OF YEAR	204.398	741963.312	
SNOW WATER AT START OF YEAR	2.323	8431.890	5.23
SNOW WATER AT END OF YEAR	1.655	6006.088	3.72
ANNUAL WATER BUDGET BALANCE	0.0000	0.117	0.00

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ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.30	168069.031	100.00

RUNOFF	20.599	74773.906	44.49
EVAPOTRANSPIRATION	20.704	75154.687	44.72
DRAINAGE COLLECTED FROM LAYER 3	2.3296	8456.532	5.03
PERC./LEAKAGE THROUGH LAYER 4	0.049776	180.687	0.11
AVG. HEAD ON TOP OF LAYER 4	3.2221		
PERC./LEAKAGE THROUGH LAYER 8	2.588238	9395.304	5.59
AVG. HEAD ON TOP OF LAYER 8	50.6895		
CHANGE IN WATER STORAGE	0.079	288.566	0.17
SOIL WATER AT START OF YEAR	204.398	741963.312	
SOIL WATER AT END OF YEAR	205.866	747293.875	
SNOW WATER AT START OF YEAR	1.655	6006.088	3.57
SNOW WATER AT END OF YEAR	0.266	964.143	0.57
ANNUAL WATER BUDGET BALANCE	0.0000	0.023	0.00

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ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	32.04	116305.187	100.00
RUNOFF	10.972	39826.754	34.24
EVAPOTRANSPIRATION	18.631	67630.227	58.15
DRAINAGE COLLECTED FROM LAYER 3	4.1250	14973.804	12.87
PERC./LEAKAGE THROUGH LAYER 4	0.086513	314.041	0.27
AVG. HEAD ON TOP OF LAYER 4	5.7174		
PERC./LEAKAGE THROUGH LAYER 8	2.368752	8598.569	7.39
AVG. HEAD ON TOP OF LAYER 8	44.3555		
CHANGE IN WATER STORAGE	-4.056	-14724.165	-12.66
SOIL WATER AT START OF YEAR	205.866	747293.875	
SOIL WATER AT END OF YEAR	200.169	726615.062	

SNOW WATER AT START OF YEAR	0.266	964.143	0.83
SNOW WATER AT END OF YEAR	1.906	6918.781	5.95
ANNUAL WATER BUDGET BALANCE	0.0000	0.001	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	2.80	2.09	2.65	2.37	3.03	4.00
	4.17	4.03	5.43	4.15	2.36	3.07
STD. DEVIATIONS	2.10	0.80	0.63	0.94	0.94	1.09
	2.81	0.59	2.99	1.70	1.22	0.78
RUNOFF						
TOTALS	1.030	0.548	2.999	2.071	0.457	1.019
	1.330	1.092	2.226	1.571	0.381	0.662
STD. DEVIATIONS	1.240	0.941	1.430	2.478	0.324	0.646
	1.541	0.157	1.988	1.238	0.440	0.878
EVAPOTRANSPIRATION						
TOTALS	0.425	0.476	0.414	1.121	2.923	3.581
	4.837	2.434	2.307	1.642	1.069	0.461
STD. DEVIATIONS	0.060	0.051	0.123	0.524	0.569	0.624
	0.787	0.879	0.507	0.163	0.071	0.122
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	0.2883	0.2234	0.2090	0.1863	0.2568	0.2571
	0.2476	0.2579	0.2437	0.2636	0.2815	0.3216
STD. DEVIATIONS	0.1021	0.0791	0.0741	0.0674	0.1079	0.1178
	0.1046	0.1045	0.0907	0.0549	0.1095	0.1181
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0061	0.0047	0.0045	0.0040	0.0054	0.0054
	0.0053	0.0055	0.0052	0.0056	0.0059	0.0068
STD. DEVIATIONS	0.0021	0.0016	0.0015	0.0014	0.0022	0.0024
	0.0021	0.0021	0.0019	0.0011	0.0022	0.0024

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.2518	0.2280	0.2489	0.2390	0.2451	0.2355
	0.2415	0.2397	0.2302	0.2361	0.2268	0.2326
STD. DEVIATIONS	0.0345	0.0321	0.0352	0.0338	0.0346	0.0333
	0.0341	0.0338	0.0325	0.0333	0.0320	0.0328

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	4.7043	4.0048	3.4106	3.1413	4.1901	4.3353
	4.0409	4.2085	4.1098	4.3007	4.7458	5.2485
STD. DEVIATIONS	1.6667	1.4192	1.2090	1.1365	1.7604	1.9869
	1.7071	1.7060	1.5290	0.8956	1.8468	1.9279

DAILY AVERAGE HEAD ON TOP OF LAYER 8

AVERAGES	61.5212	61.1533	60.5362	59.9036	59.2770	58.6577
	58.0424	57.4216	56.8158	56.2145	55.6191	55.0293
STD. DEVIATIONS	11.7217	12.0393	11.9489	11.8564	11.7654	11.6738
	11.5828	11.4911	11.4021	11.3134	11.2241	11.1365

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

	INCHES		CU. FEET	PERCENT
PRECIPITATION	40.16	(5.757)	145773.5	100.00
RUNOFF	15.385	(3.9405)	55846.02	38.310
EVAPOTRANSPIRATION	21.689	(2.4744)	78729.78	54.008
LATERAL DRAINAGE COLLECTED FROM LAYER 3	3.03681	(0.78210)	11023.625	7.56216
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.06436	(0.01597)	233.625	0.16027
AVERAGE HEAD ON TOP OF LAYER 4	4.203	(1.086)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	2.85527	(0.40171)	10364.618	7.11008
AVERAGE HEAD ON TOP OF LAYER 8	58.349	(11.596)		

CHANGE IN WATER STORAGE	-2.807	(1.8609)	-10190.51	-6.991

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PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)
PRECIPITATION	3.13	11361.900
RUNOFF	2.555	9276.2568
DRAINAGE COLLECTED FROM LAYER 3	0.01709	62.03127
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000354	1.28483
AVERAGE HEAD ON TOP OF LAYER 4	8.644	
MAXIMUM HEAD ON TOP OF LAYER 4	16.408	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	10.1 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.009692	35.18179
AVERAGE HEAD ON TOP OF LAYER 8	78.064	
SNOW WATER	7.10	25775.8906
MAXIMUM VEG. SOIL WATER (VOL/VOL)		0.3869
MINIMUM VEG. SOIL WATER (VOL/VOL)		0.0560

*** 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	2.0445	0.3407
2	1.0266	0.0855
3	2.2109	0.1842
4	0.0000	0.0000
5	6.8160	0.2840
6	119.1360	0.2920
7	54.2235	0.4108
8	11.3040	0.4710
SNOW WATER	1.906	

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**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                 HELP MODEL VERSION 3.05a  (5 JUNE 1996)                  **
**                 DEVELOPED BY ENVIRONMENTAL LABORATORY                    **
**                   USAE WATERWAYS EXPERIMENT STATION                      **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:     c:\help305\DATA4.D4
TEMPERATURE DATA FILE:       c:\help305\DATA7.D7
SOLAR RADIATION DATA FILE:   c:\help305\DATA13.D13
EVAPOTRANSPIRATION DATA:     c:\help305\DATA11.D11
SOIL AND DESIGN DATA FILE:   c:\help305\RED11-15.D10
OUTPUT DATA FILE:            c:\help305\red11-15.OUT


TIME:   9: 4     DATE:   2/19/1998


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     TITLE:  Old Cortland County LF FS: Leachate Reduction (yrs 11-15)

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


                                  LAYER  1
                                  --------

                       TYPE 1 - VERTICAL PERCOLATION LAYER
                           MATERIAL TEXTURE NUMBER   0
           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  =       0.3407 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =   0.999999975000E-05 CM/SEC


                                  LAYER  2
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TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0855	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4170	VOL/VOL
FIELD CAPACITY	=	0.0450	VOL/VOL
WILTING POINT	=	0.0180	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1842	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC
SLOPE	=	18.00	PERCENT
DRAINAGE LENGTH	=	500.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 37

THICKNESS	=	0.04	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.	=	0.199999999000E-10	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	1.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	24.00	INCHES
POROSITY	=	0.5010	VOL/VOL
FIELD CAPACITY	=	0.2840	VOL/VOL
WILTING POINT	=	0.1350	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2840	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	408.00	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

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	132.00	INCHES
POROSITY	=	0.6710	VOL/VOL
FIELD CAPACITY	=	0.2920	VOL/VOL
WILTING POINT	=	0.0770	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4108	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 8

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4710	VOL/VOL
FIELD CAPACITY	=	0.3420	VOL/VOL
WILTING POINT	=	0.2100	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4710	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.670000020000E-07	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 5 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 18.% AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	65.50	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT

AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	20.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.439	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	9.060	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.080	INCHES
INITIAL SNOW WATER	=	1.906	INCHES
INITIAL WATER IN LAYER MATERIALS	=	196.762	INCHES
TOTAL INITIAL WATER	=	198.668	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
ITHACA NEW YORK

STATION LATITUDE	=	42.40	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	130	
END OF GROWING SEASON (JULIAN DATE)	=	279	
EVAPORATIVE ZONE DEPTH	=	20.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	69.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	75.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00	%

NOTE: PRECIPITATION DATA FOR ITHACA NEW YORK
WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ITHACA NEW YORK

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
22.20	22.70	32.20	44.50	54.80	64.30
68.80	67.10	60.20	49.60	39.30	27.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ITHACA NEW YORK
AND STATION LATITUDE = 42.40 DEGREES

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ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.02	134382.578	100.00
RUNOFF	13.810	50132.027	37.31
EVAPOTRANSPIRATION	21.325	77410.992	57.60
DRAINAGE COLLECTED FROM LAYER 3	1.9125	6942.321	5.17
PERC./LEAKAGE THROUGH LAYER 4	0.041431	150.394	0.11
AVG. HEAD ON TOP OF LAYER 4	2.6501		
PERC./LEAKAGE THROUGH LAYER 8	2.157732	7832.566	5.83
AVG. HEAD ON TOP OF LAYER 8	38.2721		
CHANGE IN WATER STORAGE	-2.186	-7935.287	-5.90
SOIL WATER AT START OF YEAR	200.170	726617.625	
SOIL WATER AT END OF YEAR	199.890	725601.125	
SNOW WATER AT START OF YEAR	1.906	6918.780	5.15
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.048	0.00

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ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.98	148757.406	100.00
RUNOFF	13.334	48402.523	32.54
EVAPOTRANSPIRATION	23.592	85640.516	57.57
DRAINAGE COLLECTED FROM LAYER 3	2.8085	10194.784	6.85
PERC./LEAKAGE THROUGH LAYER 4	0.059785	217.020	0.15
AVG. HEAD ON TOP OF LAYER 4	3.8877		
PERC./LEAKAGE THROUGH LAYER 8	1.983107	7198.679	4.84
AVG. HEAD ON TOP OF LAYER 8	33.2269		
CHANGE IN WATER STORAGE	-0.738	-2679.114	-1.80
SOIL WATER AT START OF YEAR	199.890	725601.125	

SOIL WATER AT END OF YEAR	196.829	714490.125	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	2.323	8431.890	5.67
ANNUAL WATER BUDGET BALANCE	0.0000	0.026	0.00

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ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.45	161353.516	100.00
RUNOFF	18.905	68624.219	42.53
EVAPOTRANSPIRATION	24.857	90232.227	55.92
DRAINAGE COLLECTED FROM LAYER 3	2.5632	9304.476	5.77
PERC./LEAKAGE THROUGH LAYER 4	0.054748	198.734	0.12
AVG. HEAD ON TOP OF LAYER 4	3.5380		
PERC./LEAKAGE THROUGH LAYER 8	1.819446	6604.590	4.09
AVG. HEAD ON TOP OF LAYER 8	28.3559		
CHANGE IN WATER STORAGE	-3.695	-13412.014	-8.31
SOIL WATER AT START OF YEAR	196.829	714490.125	
SOIL WATER AT END OF YEAR	193.803	703503.937	
SNOW WATER AT START OF YEAR	2.323	8431.890	5.23
SNOW WATER AT END OF YEAR	1.655	6006.088	3.72
ANNUAL WATER BUDGET BALANCE	0.0000	0.020	0.00

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ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.30	168069.031	100.00

RUNOFF	20.778	75424.617	44.88
EVAPOTRANSPIRATION	20.767	75384.242	44.85
DRAINAGE COLLECTED FROM LAYER 3	2.2562	8190.109	4.87
PERC./LEAKAGE THROUGH LAYER 4	0.048296	175.313	0.10
AVG. HEAD ON TOP OF LAYER 4	3.1209		
PERC./LEAKAGE THROUGH LAYER 8	1.659812	6025.118	3.58
AVG. HEAD ON TOP OF LAYER 8	23.8976		
CHANGE IN WATER STORAGE	0.839	3044.908	1.81
SOIL WATER AT START OF YEAR	193.803	703503.937	
SOIL WATER AT END OF YEAR	196.031	711590.750	
SNOW WATER AT START OF YEAR	1.655	6006.088	3.57
SNOW WATER AT END OF YEAR	0.266	964.143	0.57
ANNUAL WATER BUDGET BALANCE	0.0000	0.033	0.00

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ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	32.04	116305.187	100.00
RUNOFF	10.971	39825.828	34.24
EVAPOTRANSPIRATION	18.722	67961.836	58.43
DRAINAGE COLLECTED FROM LAYER 3	3.9453	14321.610	12.31
PERC./LEAKAGE THROUGH LAYER 4	0.082874	300.833	0.26
AVG. HEAD ON TOP OF LAYER 4	5.4679		
PERC./LEAKAGE THROUGH LAYER 8	1.521198	5521.948	4.75
AVG. HEAD ON TOP OF LAYER 8	19.8973		
CHANGE IN WATER STORAGE	-3.120	-11326.081	-9.74
SOIL WATER AT START OF YEAR	196.031	711590.750	
SOIL WATER AT END OF YEAR	191.270	694310.062	

SNOW WATER AT START OF YEAR	0.266	964.143	0.83
SNOW WATER AT END OF YEAR	1.906	6918.781	5.95
ANNUAL WATER BUDGET BALANCE	0.0000	0.050	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	2.80	2.09	2.65	2.37	3.03	4.00
	4.17	4.03	5.43	4.15	2.36	3.07
STD. DEVIATIONS	2.10	0.80	0.63	0.94	0.94	1.09
	2.81	0.59	2.99	1.70	1.22	0.78
RUNOFF						
TOTALS	1.029	0.550	3.084	2.130	0.457	1.055
	1.329	1.092	2.226	1.570	0.380	0.658
STD. DEVIATIONS	1.240	0.940	1.297	2.626	0.324	0.614
	1.542	0.157	1.989	1.239	0.441	0.875
EVAPOTRANSPIRATION						
TOTALS	0.425	0.476	0.413	1.120	2.929	3.571
	4.826	2.523	2.373	1.670	1.072	0.456
STD. DEVIATIONS	0.060	0.051	0.125	0.523	0.571	0.652
	0.807	0.927	0.442	0.205	0.101	0.121
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	0.2390	0.1847	0.1733	0.1602	0.2369	0.2406
	0.2336	0.2408	0.2281	0.2420	0.2497	0.2683
STD. DEVIATIONS	0.1022	0.0780	0.0743	0.0642	0.1069	0.1175
	0.1039	0.0982	0.0819	0.0575	0.1069	0.1222
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0051	0.0040	0.0037	0.0035	0.0050	0.0051
	0.0050	0.0051	0.0049	0.0051	0.0053	0.0057
STD. DEVIATIONS	0.0021	0.0016	0.0015	0.0013	0.0022	0.0024
	0.0021	0.0020	0.0017	0.0012	0.0022	0.0025

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.1597	0.1461	0.1594	0.1532	0.1571	0.1509
	0.1548	0.1536	0.1476	0.1514	0.1454	0.1492
STD. DEVIATIONS	0.0195	0.0204	0.0224	0.0215	0.0220	0.0211
	0.0217	0.0215	0.0206	0.0212	0.0203	0.0208

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	3.8992	3.3199	2.8278	2.7013	3.8652	4.0568
	3.8120	3.9300	3.8467	3.9483	4.2101	4.3777
STD. DEVIATIONS	1.6674	1.4215	1.2124	1.0822	1.7438	1.9813
	1.6956	1.6032	1.3803	0.9378	1.8027	1.9937

DAILY AVERAGE HEAD ON TOP OF LAYER 8

AVERAGES	30.2373	30.5576	30.1646	29.7615	29.3632	28.9706
	28.5805	28.1869	27.8028	27.4214	27.0437	26.6696
STD. DEVIATIONS	6.6214	7.6559	7.5976	7.5380	7.4795	7.4199
	7.3607	7.3012	7.2438	7.1867	7.1286	7.0704

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

	INCHES		CU. FEET	PERCENT
PRECIPITATION	40.16	(5.757)	145773.5	100.00
RUNOFF	15.560	(4.1076)	56481.84	38.746
EVAPOTRANSPIRATION	21.853	(2.4141)	79325.95	54.417
LATERAL DRAINAGE COLLECTED FROM LAYER 3	2.69715	(0.77435)	9790.659	6.71635
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.05743	(0.01581)	208.459	0.14300
AVERAGE HEAD ON TOP OF LAYER 4	3.733	(1.075)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	1.82826	(0.25262)	6636.580	4.55266
AVERAGE HEAD ON TOP OF LAYER 8	28.730	(7.294)		

CHANGE IN WATER STORAGE	-1.780	(1.8419)	-6461.52	-4.433

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PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)
PRECIPITATION	3.13	11361.900
RUNOFF	2.556	9278.2217
DRAINAGE COLLECTED FROM LAYER 3	0.01626	59.01725
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000337	1.22399
AVERAGE HEAD ON TOP OF LAYER 4	8.224	
MAXIMUM HEAD ON TOP OF LAYER 4	15.639	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	9.2 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.006203	22.51528
AVERAGE HEAD ON TOP OF LAYER 8	41.318	
SNOW WATER	7.10	25775.8906
MAXIMUM VEG. SOIL WATER (VOL/VOL)		0.3869
MINIMUM VEG. SOIL WATER (VOL/VOL)		0.0560

*** 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	2.0446	0.3408
2	1.0325	0.0860
3	2.1574	0.1798
4	0.0000	0.0000
5	6.8160	0.2840
6	119.1360	0.2920
7	45.3714	0.3437
8	11.3040	0.4710
SNOW WATER	1.906	

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**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                 HELP MODEL VERSION 3.05a  (5 JUNE 1996)                  **
**                 DEVELOPED BY ENVIRONMENTAL LABORATORY                    **
**                   USAE WATERWAYS EXPERIMENT STATION                      **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:      c:\help305\DATA4.D4
TEMPERATURE DATA FILE:        c:\help305\DATA7.D7
SOLAR RADIATION DATA FILE:    c:\help305\DATA13.D13
EVAPOTRANSPIRATION DATA:      c:\help305\DATA11.D11
SOIL AND DESIGN DATA FILE:    c:\help305\RED16-20.D10
OUTPUT DATA FILE:             c:\help305\red16-20.OUT


TIME:   9: 7     DATE:   2/19/1998


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     TITLE:  Old Cortland County LF FS: Leachate Reduction (yrs 16-20)

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


                                  LAYER  1
                                  --------

                       TYPE 1 - VERTICAL PERCOLATION LAYER
                           MATERIAL TEXTURE NUMBER   0
           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  =       0.3408 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =   0.999999975000E-05 CM/SEC


                                  LAYER  2
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TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0860	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4170	VOL/VOL
FIELD CAPACITY	=	0.0450	VOL/VOL
WILTING POINT	=	0.0180	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1798	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC
SLOPE	=	18.00	PERCENT
DRAINAGE LENGTH	=	500.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 37

THICKNESS	=	0.04	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.	=	0.199999999000E-10	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	1.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	24.00	INCHES
POROSITY	=	0.5010	VOL/VOL
FIELD CAPACITY	=	0.2840	VOL/VOL
WILTING POINT	=	0.1350	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2840	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	408.00 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

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	132.00 INCHES
POROSITY	=	0.6710 VOL/VOL
FIELD CAPACITY	=	0.2920 VOL/VOL
WILTING POINT	=	0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3437 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 8

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4710 VOL/VOL
FIELD CAPACITY	=	0.3420 VOL/VOL
WILTING POINT	=	0.2100 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4710 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.670000020000E-07 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 5 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 18.% AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	65.50
FRACTION OF AREA ALLOWING RUNOFF	=	100.0 PERCENT

AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	20.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.436	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	9.060	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.080	INCHES
INITIAL SNOW WATER	=	1.906	INCHES
INITIAL WATER IN LAYER MATERIALS	=	187.859	INCHES
TOTAL INITIAL WATER	=	189.765	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
ITHACA NEW YORK

STATION LATITUDE	=	42.40	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	130	
END OF GROWING SEASON (JULIAN DATE)	=	279	
EVAPORATIVE ZONE DEPTH	=	20.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	69.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	75.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00	%

NOTE: PRECIPITATION DATA FOR ITHACA NEW YORK
WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ITHACA NEW YORK

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
22.20	22.70	32.20	44.50	54.80	64.30
68.80	67.10	60.20	49.60	39.30	27.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ITHACA NEW YORK
AND STATION LATITUDE = 42.40 DEGREES

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ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.02	134382.578	100.00
RUNOFF	13.832	50209.527	37.36
EVAPOTRANSPIRATION	20.894	75845.961	56.44
DRAINAGE COLLECTED FROM LAYER 3	1.9625	7123.918	5.30
PERC./LEAKAGE THROUGH LAYER 4	0.042450	154.095	0.11
AVG. HEAD ON TOP OF LAYER 4	2.7176		
PERC./LEAKAGE THROUGH LAYER 8	1.376797	4997.775	3.72
AVG. HEAD ON TOP OF LAYER 8	15.7404		
CHANGE IN WATER STORAGE	-1.045	-3794.596	-2.82
SOIL WATER AT START OF YEAR	191.267	694298.375	
SOIL WATER AT END OF YEAR	192.127	697422.562	
SNOW WATER AT START OF YEAR	1.906	6918.780	5.15
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.009	0.00

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ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.98	148757.406	100.00
RUNOFF	13.424	48729.516	32.76
EVAPOTRANSPIRATION	23.663	85896.023	57.74
DRAINAGE COLLECTED FROM LAYER 3	3.1433	11410.236	7.67
PERC./LEAKAGE THROUGH LAYER 4	0.066614	241.810	0.16
AVG. HEAD ON TOP OF LAYER 4	4.3523		
PERC./LEAKAGE THROUGH LAYER 8	1.277634	4637.810	3.12
AVG. HEAD ON TOP OF LAYER 8	12.8688		
CHANGE IN WATER STORAGE	-0.528	-1916.235	-1.29
SOIL WATER AT START OF YEAR	192.127	697422.562	

SOIL WATER AT END OF YEAR	189.277	687074.437	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	2.323	8431.890	5.67
ANNUAL WATER BUDGET BALANCE	0.0000	0.058	0.00

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ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.45	161353.516	100.00
RUNOFF	18.303	66441.383	41.18
EVAPOTRANSPIRATION	24.904	90401.867	56.03
DRAINAGE COLLECTED FROM LAYER 3	2.9649	10762.480	6.67
PERC./LEAKAGE THROUGH LAYER 4	0.062982	228.624	0.14
AVG. HEAD ON TOP OF LAYER 4	4.0962		
PERC./LEAKAGE THROUGH LAYER 8	1.174833	4264.642	2.64
AVG. HEAD ON TOP OF LAYER 8	9.8066		
CHANGE IN WATER STORAGE	-2.897	-10516.865	-6.52
SOIL WATER AT START OF YEAR	189.277	687074.437	
SOIL WATER AT END OF YEAR	187.048	678983.375	
SNOW WATER AT START OF YEAR	2.323	8431.890	5.23
SNOW WATER AT END OF YEAR	1.655	6006.088	3.72
ANNUAL WATER BUDGET BALANCE	0.0000	0.011	0.00

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ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.30	168069.031	100.00

RUNOFF	19.864	72106.195	42.90
EVAPOTRANSPIRATION	21.672	78668.719	46.81
DRAINAGE COLLECTED FROM LAYER 3	1.8153	6589.647	3.92
PERC./LEAKAGE THROUGH LAYER 4	0.039248	142.469	0.08
AVG. HEAD ON TOP OF LAYER 4	2.5133		
PERC./LEAKAGE THROUGH LAYER 8	1.073163	3895.583	2.32
AVG. HEAD ON TOP OF LAYER 8	6.9685		
CHANGE IN WATER STORAGE	1.876	6808.840	4.05
SOIL WATER AT START OF YEAR	187.048	678983.375	
SOIL WATER AT END OF YEAR	190.312	690834.125	
SNOW WATER AT START OF YEAR	1.655	6006.088	3.57
SNOW WATER AT END OF YEAR	0.266	964.143	0.57
ANNUAL WATER BUDGET BALANCE	0.0000	0.039	0.00

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ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	32.04	116305.187	100.00
RUNOFF	11.492	41714.684	35.87
EVAPOTRANSPIRATION	18.727	67978.914	58.45
DRAINAGE COLLECTED FROM LAYER 3	3.8486	13970.393	12.01
PERC./LEAKAGE THROUGH LAYER 4	0.080907	293.694	0.25
AVG. HEAD ON TOP OF LAYER 4	5.3285		
PERC./LEAKAGE THROUGH LAYER 8	0.984968	3575.432	3.07
AVG. HEAD ON TOP OF LAYER 8	4.4231		
CHANGE IN WATER STORAGE	-3.012	-10934.256	-9.40
SOIL WATER AT START OF YEAR	190.312	690834.125	
SOIL WATER AT END OF YEAR	185.660	673945.250	

SNOW WATER AT START OF YEAR	0.266	964.143	0.83
SNOW WATER AT END OF YEAR	1.906	6918.781	5.95
ANNUAL WATER BUDGET BALANCE	0.0000	0.026	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	2.80	2.09	2.65	2.37	3.03	4.00
	4.17	4.03	5.43	4.15	2.36	3.07
STD. DEVIATIONS	2.10	0.80	0.63	0.94	0.94	1.09
	2.81	0.59	2.99	1.70	1.22	0.78
RUNOFF						
TOTALS	1.065	0.500	3.019	2.065	0.455	1.016
	1.325	1.086	2.220	1.570	0.381	0.682
STD. DEVIATIONS	1.266	0.790	1.425	2.480	0.323	0.649
	1.542	0.164	1.981	1.239	0.440	0.914
EVAPOTRANSPIRATION						
TOTALS	0.425	0.476	0.414	1.109	2.925	3.650
	5.008	2.430	2.430	1.647	1.012	0.446
STD. DEVIATIONS	0.060	0.051	0.123	0.538	0.568	0.554
	0.731	0.835	0.333	0.137	0.063	0.096
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	0.2535	0.1965	0.1838	0.1652	0.2378	0.2424
	0.2338	0.2449	0.2317	0.2266	0.2429	0.2879
STD. DEVIATIONS	0.0724	0.0566	0.0525	0.0545	0.1193	0.1312
	0.1188	0.1113	0.0955	0.0767	0.0671	0.0774
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0054	0.0042	0.0040	0.0036	0.0050	0.0051
	0.0050	0.0052	0.0049	0.0048	0.0052	0.0061
STD. DEVIATIONS	0.0015	0.0012	0.0011	0.0011	0.0024	0.0027
	0.0024	0.0023	0.0020	0.0016	0.0014	0.0016

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.1007	0.0942	0.1028	0.0988	0.1013	0.0974
	0.0999	0.0991	0.0953	0.0977	0.0939	0.0963
STD. DEVIATIONS	0.0100	0.0129	0.0142	0.0136	0.0139	0.0134
	0.0137	0.0136	0.0131	0.0134	0.0129	0.0132

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	4.1367	3.5215	2.9989	2.7851	3.8797	4.0867
	3.8154	3.9958	3.9066	3.6977	4.0964	4.6986
STD. DEVIATIONS	1.1816	1.0055	0.8560	0.9187	1.9460	2.2121
	1.9391	1.8160	1.6097	1.2520	1.1309	1.2623

DAILY AVERAGE HEAD ON TOP OF LAYER 8

AVERAGES	10.2120	11.1843	10.9351	10.6788	10.4258	10.1775
	9.9306	9.6813	9.4383	9.1965	8.9568	8.7207
STD. DEVIATIONS	3.4041	4.8484	4.8117	4.7743	4.7373	4.6985
	4.6600	4.6213	4.5843	4.5480	4.5112	4.4746

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

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.16 (5.757)	145773.5	100.00
RUNOFF	15.383 (3.5353)	55840.26	38.306
EVAPOTRANSPIRATION	21.972 (2.4103)	79758.30	54.714
LATERAL DRAINAGE COLLECTED FROM LAYER 3	2.74692 (0.85169)	9971.334	6.84029
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.05844 (0.01744)	212.138	0.14553
AVERAGE HEAD ON TOP OF LAYER 4	3.802 (1.179)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	1.17748 (0.15629)	4274.249	2.93212
AVERAGE HEAD ON TOP OF LAYER 8	9.961 (4.514)		

CHANGE IN WATER STORAGE	-1.121	(2.0043)	-4070.62	-2.792

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PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)
PRECIPITATION	3.13	11361.900
RUNOFF	2.555	9275.8486
DRAINAGE COLLECTED FROM LAYER 3	0.01406	51.04470
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000293	1.06304
AVERAGE HEAD ON TOP OF LAYER 4	7.113	
MAXIMUM HEAD ON TOP OF LAYER 4	13.596	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	6.7 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.003976	14.43185
AVERAGE HEAD ON TOP OF LAYER 8	17.868	
SNOW WATER	7.10	25775.8906

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3931
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0560

*** 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	1.2941	0.2157
2	1.7262	0.1439
3	2.2023	0.1835
4	0.0000	0.0000
5	6.8160	0.2840
6	119.1360	0.2920
7	39.7732	0.3013
8	11.3040	0.4710
SNOW WATER	1.906	

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**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                 HELP MODEL VERSION 3.05a  (5 JUNE 1996)                   **
**                 DEVELOPED BY ENVIRONMENTAL LABORATORY                    **
**                   USAE WATERWAYS EXPERIMENT STATION                      **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY             **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:     c:\help305\DATA4.D4
TEMPERATURE DATA FILE:       c:\help305\DATA7.D7
SOLAR RADIATION DATA FILE:   c:\help305\DATA13.D13
EVAPOTRANSPIRATION DATA:     c:\help305\DATA11.D11
SOIL AND DESIGN DATA FILE:   c:\help305\RED21-25.D10
OUTPUT DATA FILE:            c:\help305\red21-25.OUT


TIME:   9:14     DATE:   2/19/1998


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     TITLE:  Old Cortland County LF FS: Leachate Reduction (yrs 21-25)

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


                                  LAYER  1
                                  --------

                      TYPE 1 - VERTICAL PERCOLATION LAYER
                          MATERIAL TEXTURE NUMBER   0
           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   =       0.2157 VOL/VOL
           EFFECTIVE SAT. HYD. COND.    =   0.999999975000E-05 CM/SEC


                                  LAYER  2
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TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4570 VOL/VOL
FIELD CAPACITY	=	0.1310 VOL/VOL
WILTING POINT	=	0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1439 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05 CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4170 VOL/VOL
FIELD CAPACITY	=	0.0450 VOL/VOL
WILTING POINT	=	0.0180 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1835 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC
SLOPE	=	18.00 PERCENT
DRAINAGE LENGTH	=	500.0 FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 37

THICKNESS	=	0.04 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.	=	0.199999999000E-10 CM/SEC
FML PINHOLE DENSITY	=	1.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	1.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	24.00 INCHES
POROSITY	=	0.5010 VOL/VOL
FIELD CAPACITY	=	0.2840 VOL/VOL
WILTING POINT	=	0.1350 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2840 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05 CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	408.00	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

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	132.00	INCHES
POROSITY	=	0.6710	VOL/VOL
FIELD CAPACITY	=	0.2920	VOL/VOL
WILTING POINT	=	0.0770	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3013	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 8

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4710	VOL/VOL
FIELD CAPACITY	=	0.3420	VOL/VOL
WILTING POINT	=	0.2100	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4710	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.670000020000E-07	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 5 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 18.% AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	65.50	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT

AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	20.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.388	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	9.060	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.080	INCHES
INITIAL SNOW WATER	=	1.906	INCHES
INITIAL WATER IN LAYER MATERIALS	=	182.251	INCHES
TOTAL INITIAL WATER	=	184.157	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
ITHACA NEW YORK

STATION LATITUDE	=	42.40	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	130	
END OF GROWING SEASON (JULIAN DATE)	=	279	
EVAPORATIVE ZONE DEPTH	=	20.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	69.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	75.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00	%

NOTE: PRECIPITATION DATA FOR ITHACA NEW YORK
WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ITHACA NEW YORK

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
22.20	22.70	32.20	44.50	54.80	64.30
68.80	67.10	60.20	49.60	39.30	27.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ITHACA NEW YORK
AND STATION LATITUDE = 42.40 DEGREES

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ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.02	134382.578	100.00
RUNOFF	13.716	49790.605	37.05
EVAPOTRANSPIRATION	21.369	77568.937	57.72
DRAINAGE COLLECTED FROM LAYER 3	2.1166	7683.179	5.72
PERC./LEAKAGE THROUGH LAYER 4	0.045601	165.530	0.12
AVG. HEAD ON TOP OF LAYER 4	2.9295		
PERC./LEAKAGE THROUGH LAYER 8	0.902636	3276.570	2.44
AVG. HEAD ON TOP OF LAYER 8	2.0484		
CHANGE IN WATER STORAGE	-1.084	-3936.670	-2.93
SOIL WATER AT START OF YEAR	185.659	673940.562	
SOIL WATER AT END OF YEAR	186.480	676922.687	
SNOW WATER AT START OF YEAR	1.906	6918.780	5.15
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.045	0.00

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ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.98	148757.406	100.00
RUNOFF	12.999	47185.750	31.72
EVAPOTRANSPIRATION	23.685	85974.883	57.80
DRAINAGE COLLECTED FROM LAYER 3	3.1002	11253.708	7.57
PERC./LEAKAGE THROUGH LAYER 4	0.065742	238.645	0.16
AVG. HEAD ON TOP OF LAYER 4	4.2978		
PERC./LEAKAGE THROUGH LAYER 8	0.436271	1583.665	1.06
AVG. HEAD ON TOP OF LAYER 8	0.2344		
CHANGE IN WATER STORAGE	0.760	2759.406	1.85
SOIL WATER AT START OF YEAR	186.480	676922.687	

SOIL WATER AT END OF YEAR	184.917	671250.187	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	2.323	8431.890	5.67
ANNUAL WATER BUDGET BALANCE	0.0000	0.005	0.00

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ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.45	161353.516	100.00
RUNOFF	18.298	66421.930	41.17
EVAPOTRANSPIRATION	24.614	89348.828	55.37
DRAINAGE COLLECTED FROM LAYER 3	2.9585	10739.225	6.66
PERC./LEAKAGE THROUGH LAYER 4	0.062854	228.161	0.14
AVG. HEAD ON TOP OF LAYER 4	4.0868		
PERC./LEAKAGE THROUGH LAYER 8	0.062870	228.218	0.14
AVG. HEAD ON TOP OF LAYER 8	0.0001		
CHANGE IN WATER STORAGE	-1.483	-5384.760	-3.34
SOIL WATER AT START OF YEAR	184.917	671250.187	
SOIL WATER AT END OF YEAR	184.102	668291.250	
SNOW WATER AT START OF YEAR	2.323	8431.890	5.23
SNOW WATER AT END OF YEAR	1.655	6006.088	3.72
ANNUAL WATER BUDGET BALANCE	0.0000	0.077	0.00

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ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.30	168069.031	100.00

RUNOFF	20.053	72793.922	43.31
EVAPOTRANSPIRATION	21.853	79325.875	47.20
DRAINAGE COLLECTED FROM LAYER 3	1.9792	7184.509	4.27
PERC./LEAKAGE THROUGH LAYER 4	0.042713	155.050	0.09
AVG. HEAD ON TOP OF LAYER 4	2.7398		
PERC./LEAKAGE THROUGH LAYER 8	0.042693	154.976	0.09
AVG. HEAD ON TOP OF LAYER 8	0.0000		
CHANGE IN WATER STORAGE	2.372	8609.771	5.12
SOIL WATER AT START OF YEAR	184.102	668291.250	
SOIL WATER AT END OF YEAR	187.863	681942.937	
SNOW WATER AT START OF YEAR	1.655	6006.088	3.57
SNOW WATER AT END OF YEAR	0.266	964.143	0.57
ANNUAL WATER BUDGET BALANCE	0.0000	-0.030	0.00

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ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	32.04	116305.187	100.00
RUNOFF	11.492	41716.691	35.87
EVAPOTRANSPIRATION	19.103	69345.234	59.62
DRAINAGE COLLECTED FROM LAYER 3	3.4900	12668.573	10.89
PERC./LEAKAGE THROUGH LAYER 4	0.073624	267.255	0.23
AVG. HEAD ON TOP OF LAYER 4	4.8308		
PERC./LEAKAGE THROUGH LAYER 8	0.073644	267.328	0.23
AVG. HEAD ON TOP OF LAYER 8	0.0001		
CHANGE IN WATER STORAGE	-2.119	-7692.702	-6.61
SOIL WATER AT START OF YEAR	187.863	681942.937	
SOIL WATER AT END OF YEAR	184.103	668295.625	

SNOW WATER AT START OF YEAR	0.266	964.143	0.83
SNOW WATER AT END OF YEAR	1.906	6918.781	5.95
ANNUAL WATER BUDGET BALANCE	0.0000	0.063	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	2.80	2.09	2.65	2.37	3.03	4.00
	4.17	4.03	5.43	4.15	2.36	3.07
STD. DEVIATIONS	2.10	0.80	0.63	0.94	0.94	1.09
	2.81	0.59	2.99	1.70	1.22	0.78
RUNOFF						
TOTALS	1.108	0.485	2.927	2.022	0.456	1.055
	1.321	1.090	2.225	1.570	0.380	0.673
STD. DEVIATIONS	1.345	0.800	1.405	2.508	0.323	0.614
	1.544	0.159	1.987	1.239	0.441	0.908
EVAPOTRANSPIRATION						
TOTALS	0.425	0.476	0.412	1.123	2.936	3.646
	4.970	2.504	2.369	1.685	1.113	0.466
STD. DEVIATIONS	0.060	0.051	0.126	0.525	0.578	0.580
	0.735	0.842	0.422	0.182	0.119	0.124
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	0.2606	0.2019	0.1889	0.1633	0.2294	0.2350
	0.2279	0.2393	0.2257	0.2345	0.2359	0.2866
STD. DEVIATIONS	0.0632	0.0491	0.0459	0.0456	0.0963	0.1144
	0.1036	0.0940	0.0826	0.0518	0.0381	0.0655
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0055	0.0043	0.0041	0.0035	0.0049	0.0050
	0.0049	0.0051	0.0048	0.0050	0.0050	0.0061
STD. DEVIATIONS	0.0013	0.0010	0.0009	0.0009	0.0020	0.0023
	0.0021	0.0019	0.0017	0.0011	0.0008	0.0013

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.0335	0.0300	0.0326	0.0310	0.0329	0.0286
	0.0195	0.0195	0.0187	0.0192	0.0186	0.0193
STD. DEVIATIONS	0.0386	0.0354	0.0393	0.0380	0.0380	0.0327
	0.0319	0.0316	0.0304	0.0311	0.0298	0.0305

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	4.2520	3.6197	3.0827	2.7530	3.7426	3.9620
	3.7195	3.9047	3.8055	3.8272	3.9782	4.6759
STD. DEVIATIONS	1.0321	0.8788	0.7486	0.7684	1.5713	1.9296
	1.6904	1.5346	1.3922	0.8458	0.6419	1.0682

DAILY AVERAGE HEAD ON TOP OF LAYER 8

AVERAGES	0.6963	0.7360	0.6645	0.5905	0.5173	0.4459
	0.3984	0.3601	0.3227	0.2855	0.2487	0.2131
STD. DEVIATIONS	1.1268	1.2797	1.1991	1.1189	1.0428	0.9713
	0.8908	0.8050	0.7213	0.6383	0.5560	0.4765

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

	INCHES		CU. FEET	PERCENT
PRECIPITATION	40.16	(5.757)	145773.5	100.00
RUNOFF	15.312	(3.6703)	55581.78	38.129
EVAPOTRANSPIRATION	22.125	(2.1450)	80312.74	55.094
LATERAL DRAINAGE COLLECTED FROM LAYER 3	2.72888	(0.65321)	9905.839	6.79536
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.05811	(0.01337)	210.928	0.14470
AVERAGE HEAD ON TOP OF LAYER 4	3.777	(0.904)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.30362	(0.37261)	1102.151	0.75607
AVERAGE HEAD ON TOP OF LAYER 8	0.457	(0.896)		

CHANGE IN WATER STORAGE	-0.311	(1.8431)	-1128.99	-0.774

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PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)
PRECIPITATION	3.13	11361.900
RUNOFF	2.555	9275.3828
DRAINAGE COLLECTED FROM LAYER 3	0.01329	48.25090
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000277	1.00663
AVERAGE HEAD ON TOP OF LAYER 4	6.724	
MAXIMUM HEAD ON TOP OF LAYER 4	12.876	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	5.8 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.002580	9.36526
AVERAGE HEAD ON TOP OF LAYER 8	3.169	
SNOW WATER	7.10	25775.8906

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3932
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0574

*** 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	1.2937	0.2156
2	1.7006	0.1417
3	1.9011	0.1584
4	0.0000	0.0000
5	6.8160	0.2840
6	119.1360	0.2920
7	38.5440	0.2920
8	11.3040	0.4710
SNOW WATER	1.906	

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**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                  HELP MODEL VERSION 3.05a  (5 JUNE 1996)                 **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:     c:\help305\DATA4.D4
TEMPERATURE DATA FILE:       c:\help305\DATA7.D7
SOLAR RADIATION DATA FILE:   c:\help305\DATA13.D13
EVAPOTRANSPIRATION DATA:     c:\help305\DATA11.D11
SOIL AND DESIGN DATA FILE:   c:\help305\RED26-30.D10
OUTPUT DATA FILE:            c:\help305\red26-30.OUT


TIME:   9:18     DATE:   2/19/1998


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     TITLE:  Old Cortland County LF FS: Leachate Reduction (yrs 26-30)

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


                                  LAYER  1
                                  --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   0
          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  =       0.2156 VOL/VOL
          EFFECTIVE SAT. HYD. COND.   =   0.999999975000E-05 CM/SEC


                                  LAYER  2
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TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4570 VOL/VOL
FIELD CAPACITY	=	0.1310 VOL/VOL
WILTING POINT	=	0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1417 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05 CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4170 VOL/VOL
FIELD CAPACITY	=	0.0450 VOL/VOL
WILTING POINT	=	0.0180 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1584 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC
SLOPE	=	18.00 PERCENT
DRAINAGE LENGTH	=	500.0 FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 37

THICKNESS	=	0.04 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.	=	0.199999999000E-10 CM/SEC
FML PINHOLE DENSITY	=	1.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	1.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	24.00 INCHES
POROSITY	=	0.5010 VOL/VOL
FIELD CAPACITY	=	0.2840 VOL/VOL
WILTING POINT	=	0.1350 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2840 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05 CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	408.00	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

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	132.00	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

LAYER 8

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4710	VOL/VOL
FIELD CAPACITY	=	0.3420	VOL/VOL
WILTING POINT	=	0.2100	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4710	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.670000020000E-07	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 5 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 18.% AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	65.50	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT

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AREA PROJECTED ON HORIZONTAL PLANE    =      1.000   ACRES
EVAPORATIVE ZONE DEPTH                =     20.0     INCHES
INITIAL WATER IN EVAPORATIVE ZONE     =      3.311   INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE    =      9.060   INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE    =      1.080   INCHES
INITIAL SNOW WATER                    =      1.906   INCHES
INITIAL WATER IN LAYER MATERIALS      =    180.695   INCHES
TOTAL INITIAL WATER                   =    182.601   INCHES
TOTAL SUBSURFACE INFLOW               =      0.00    INCHES/YEAR
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EVAPOTRANSPIRATION AND WEATHER DATA

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NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
         ITHACA                NEW YORK

     STATION LATITUDE                              =  42.40 DEGREES
     MAXIMUM LEAF AREA INDEX                       =   2.00
     START OF GROWING SEASON (JULIAN DATE)         =    130
     END OF GROWING SEASON (JULIAN DATE)           =    279
     EVAPORATIVE ZONE DEPTH                        =  20.0  INCHES
     AVERAGE ANNUAL WIND SPEED                     =  10.30 MPH
     AVERAGE 1ST QUARTER RELATIVE HUMIDITY         =  74.00 %
     AVERAGE 2ND QUARTER RELATIVE HUMIDITY         =  69.00 %
     AVERAGE 3RD QUARTER RELATIVE HUMIDITY         =  75.00 %
     AVERAGE 4TH QUARTER RELATIVE HUMIDITY         =  76.00 %


NOTE:  PRECIPITATION DATA FOR     ITHACA                NEW YORK
         WAS ENTERED FROM THE DEFAULT DATA FILE.


NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR     ITHACA                NEW YORK
```

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
22.20	22.70	32.20	44.50	54.80	64.30
68.80	67.10	60.20	49.60	39.30	27.60

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NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR     ITHACA                NEW YORK
           AND STATION LATITUDE  =  42.40 DEGREES
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ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.02	134382.578	100.00
RUNOFF	13.750	49912.062	37.14
EVAPOTRANSPIRATION	20.787	75457.656	56.15
DRAINAGE COLLECTED FROM LAYER 3	1.7595	6386.837	4.75
PERC./LEAKAGE THROUGH LAYER 4	0.038243	138.821	0.10
AVG. HEAD ON TOP OF LAYER 4	2.4350		
PERC./LEAKAGE THROUGH LAYER 8	0.038260	138.882	0.10
AVG. HEAD ON TOP OF LAYER 8	0.0000		
CHANGE IN WATER STORAGE	0.685	2487.227	1.85
SOIL WATER AT START OF YEAR	184.103	668293.000	
SOIL WATER AT END OF YEAR	186.694	677699.000	
SNOW WATER AT START OF YEAR	1.906	6918.780	5.15
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.094	0.00

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ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.98	148757.406	100.00
RUNOFF	13.422	48723.211	32.75
EVAPOTRANSPIRATION	23.633	85787.125	57.67
DRAINAGE COLLECTED FROM LAYER 3	3.2008	11619.047	7.81
PERC./LEAKAGE THROUGH LAYER 4	0.067784	246.057	0.17
AVG. HEAD ON TOP OF LAYER 4	4.4320		
PERC./LEAKAGE THROUGH LAYER 8	0.067784	246.057	0.17
AVG. HEAD ON TOP OF LAYER 8	0.0001		
CHANGE IN WATER STORAGE	0.656	2381.927	1.60
SOIL WATER AT START OF YEAR	186.694	677699.000	

SOIL WATER AT END OF YEAR	185.027	671649.062	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	2.323	8431.890	5.67
ANNUAL WATER BUDGET BALANCE	0.0000	0.049	0.00

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ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.45	161353.516	100.00
RUNOFF	18.302	66437.812	41.18
EVAPOTRANSPIRATION	24.810	90060.180	55.82
DRAINAGE COLLECTED FROM LAYER 3	3.0167	10950.601	6.79
PERC./LEAKAGE THROUGH LAYER 4	0.064038	232.460	0.14
AVG. HEAD ON TOP OF LAYER 4	4.1677		
PERC./LEAKAGE THROUGH LAYER 8	0.064038	232.460	0.14
AVG. HEAD ON TOP OF LAYER 8	0.0001		
CHANGE IN WATER STORAGE	-1.743	-6327.598	-3.92
SOIL WATER AT START OF YEAR	185.027	671649.062	
SOIL WATER AT END OF YEAR	183.952	667747.250	
SNOW WATER AT START OF YEAR	2.323	8431.890	5.23
SNOW WATER AT END OF YEAR	1.655	6006.088	3.72
ANNUAL WATER BUDGET BALANCE	0.0000	0.063	0.00

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ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.30	168069.031	100.00

RUNOFF	20.757	75349.297	44.83
EVAPOTRANSPIRATION	20.745	75305.656	44.81
DRAINAGE COLLECTED FROM LAYER 3	1.9406	7044.478	4.19
PERC./LEAKAGE THROUGH LAYER 4	0.041872	151.995	0.09
AVG. HEAD ON TOP OF LAYER 4	2.6865		
PERC./LEAKAGE THROUGH LAYER 8	0.041872	151.995	0.09
AVG. HEAD ON TOP OF LAYER 8	0.0000		
CHANGE IN WATER STORAGE	2.815	10217.615	6.08
SOIL WATER AT START OF YEAR	183.952	667747.250	
SOIL WATER AT END OF YEAR	188.156	683006.812	
SNOW WATER AT START OF YEAR	1.655	6006.088	3.57
SNOW WATER AT END OF YEAR	0.266	964.143	0.57
ANNUAL WATER BUDGET BALANCE	0.0000	-0.013	0.00

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ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	32.04	116305.187	100.00
RUNOFF	11.491	41713.102	35.87
EVAPOTRANSPIRATION	18.738	68018.937	58.48
DRAINAGE COLLECTED FROM LAYER 3	3.8159	13851.896	11.91
PERC./LEAKAGE THROUGH LAYER 4	0.080247	291.296	0.25
AVG. HEAD ON TOP OF LAYER 4	5.2835		
PERC./LEAKAGE THROUGH LAYER 8	0.080247	291.296	0.25
AVG. HEAD ON TOP OF LAYER 8	0.0001		
CHANGE IN WATER STORAGE	-2.085	-7570.070	-6.51
SOIL WATER AT START OF YEAR	188.156	683006.812	
SOIL WATER AT END OF YEAR	184.430	669482.062	

SNOW WATER AT START OF YEAR	0.266	964.143	0.83
SNOW WATER AT END OF YEAR	1.906	6918.781	5.95
ANNUAL WATER BUDGET BALANCE	0.0000	0.029	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	2.80	2.09	2.65	2.37	3.03	4.00
	4.17	4.03	5.43	4.15	2.36	3.07
STD. DEVIATIONS	2.10	0.80	0.63	0.94	0.94	1.09
	2.81	0.59	2.99	1.70	1.22	0.78
RUNOFF						
TOTALS	1.108	0.558	3.042	2.081	0.457	1.019
	1.330	1.092	2.226	1.571	0.381	0.682
STD. DEVIATIONS	1.344	0.944	1.463	2.475	0.323	0.646
	1.541	0.157	1.989	1.238	0.440	0.914
EVAPOTRANSPIRATION						
TOTALS	0.425	0.476	0.414	1.121	2.923	3.580
	4.805	2.497	2.384	1.647	1.022	0.449
STD. DEVIATIONS	0.060	0.051	0.123	0.524	0.570	0.625
	0.804	0.831	0.427	0.151	0.078	0.101
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	0.2506	0.1942	0.1816	0.1638	0.2392	0.2440
	0.2357	0.2447	0.2291	0.2260	0.2451	0.2926
STD. DEVIATIONS	0.0776	0.0607	0.0562	0.0580	0.1182	0.1285
	0.1156	0.1090	0.0930	0.0766	0.0726	0.0734
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0053	0.0042	0.0039	0.0035	0.0051	0.0052
	0.0050	0.0052	0.0049	0.0048	0.0052	0.0062
STD. DEVIATIONS	0.0016	0.0012	0.0012	0.0012	0.0024	0.0026
	0.0024	0.0022	0.0019	0.0016	0.0015	0.0015

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.0053	0.0042	0.0039	0.0035	0.0051	0.0052
	0.0050	0.0052	0.0049	0.0048	0.0052	0.0062
STD. DEVIATIONS	0.0016	0.0012	0.0012	0.0012	0.0024	0.0026
	0.0024	0.0022	0.0019	0.0016	0.0015	0.0015

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	4.0887	3.4806	2.9640	2.7627	3.9037	4.1144
	3.8453	3.9927	3.8632	3.6879	4.1336	4.7744
STD. DEVIATIONS	1.2657	1.0770	0.9167	0.9776	1.9286	2.1668
	1.8860	1.7792	1.5676	1.2504	1.2237	1.1981

DAILY AVERAGE HEAD ON TOP OF LAYER 8

AVERAGES	0.0001	0.0000	0.0000	0.0000	0.0001	0.0001
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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

	INCHES		CU. FEET	PERCENT
PRECIPITATION	40.16	(5.757)	145773.5	100.00
RUNOFF	15.545	(3.8384)	56427.09	38.709
EVAPOTRANSPIRATION	21.743	(2.4452)	78925.91	54.143
LATERAL DRAINAGE COLLECTED FROM LAYER 3	2.74671	(0.87276)	9970.571	6.83977
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.05844	(0.01786)	212.126	0.14552
AVERAGE HEAD ON TOP OF LAYER 4	3.801	(1.208)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.05844	(0.01786)	212.138	0.14553
AVERAGE HEAD ON TOP OF LAYER 8	0.000	(0.000)		

CHANGE IN WATER STORAGE	0.066	(2.0118)	237.82	0.163

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PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)
PRECIPITATION	3.13	11361.900
RUNOFF	2.555	9276.1904
DRAINAGE COLLECTED FROM LAYER 3	0.01401	50.86154
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000292	1.05935
AVERAGE HEAD ON TOP OF LAYER 4	7.088	
MAXIMUM HEAD ON TOP OF LAYER 4	13.549	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	6.6 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000292	1.05935
AVERAGE HEAD ON TOP OF LAYER 8	0.000	
SNOW WATER	7.10	25775.8906

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3932
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0560

*** 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	1.2941	0.2157
2	1.7239	0.1437
3	2.2044	0.1837
4	0.0000	0.0000
5	6.8160	0.2840
6	119.1360	0.2920
7	38.5440	0.2920
8	11.3040	0.4710
SNOW WATER	1.906	

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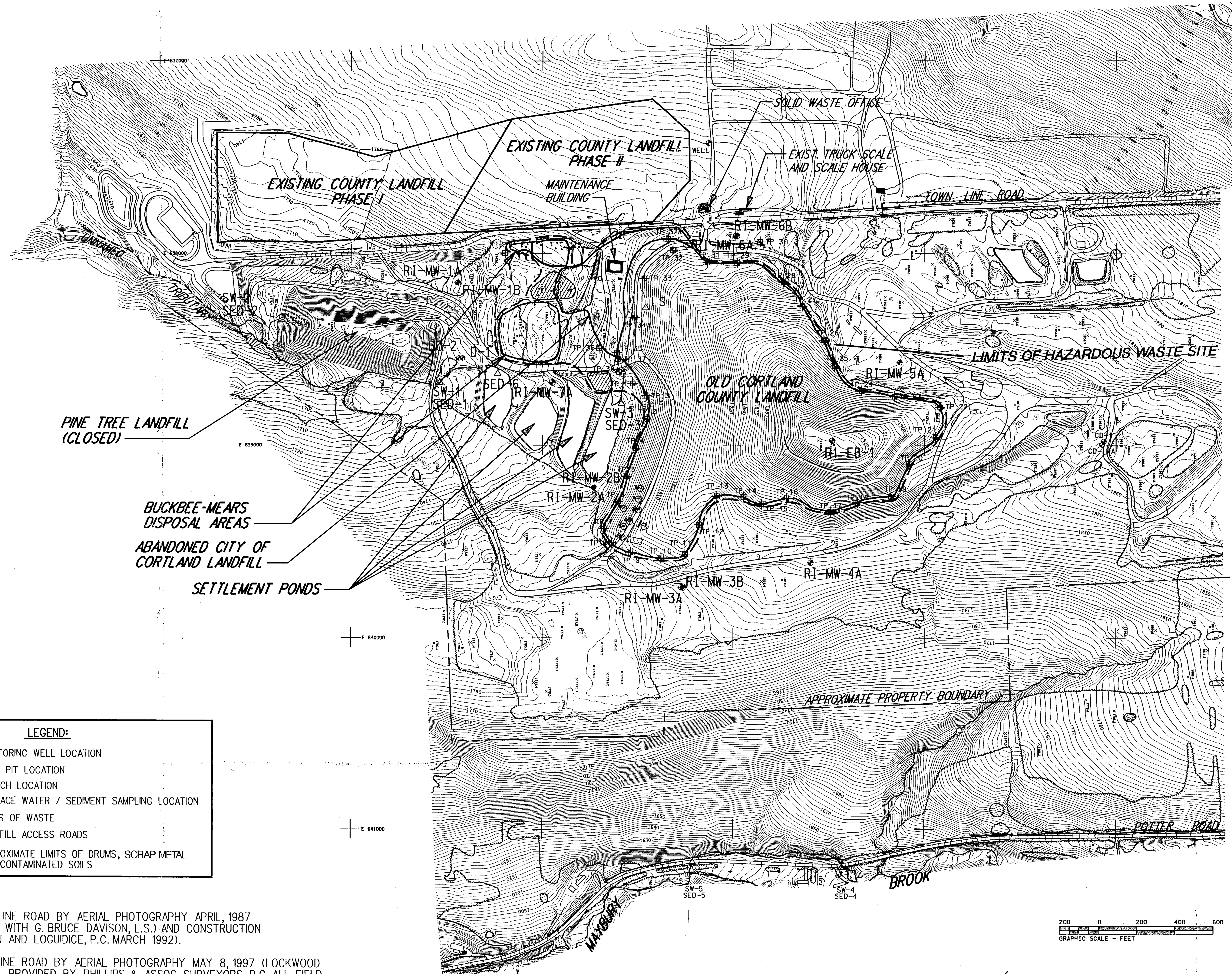

LEGEND:

- MONITORING WELL LOCATION
- TEST PIT LOCATION
- TRENCH LOCATION
- SURFACE WATER / SEDIMENT SAMPLING LOCATION
- LIMITS OF WASTE
- LANDFILL ACCESS ROADS
- APPROXIMATE LIMITS OF DRUMS, SCRAP METAL AND CONTAMINATED SOILS

MAP SOURCE: TOPOGRAPHY WEST OF TOWN LINE ROAD BY AERIAL PHOTOGRAPHY APRIL, 1987 (ERDMAN, ANTHONY ASSOCIATES WITH G. BRUCE DAVISON, L.S.) AND CONSTRUCTION CERTIFICATION REPORT (BARTON AND LOGUIDICE, P.C. MARCH 1992).

TOPOGRAPHY EAST OF TOWN LINE ROAD BY AERIAL PHOTOGRAPHY MAY 8, 1997 (LOCKWOOD MAPPING, INC.) GROUND CONTROL PROVIDED BY PHILLIPS & ASSOC. SURVEYORS, P.C. ALL FIELD INVESTIGATION LOCATIONS EXCEPT SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS SURVEYED BY G. BRUCE DAVISON, L.S. SEPT. 1997.

In charge of	PFD
Designed by	MJC
Drawn by	CDJ
Checked by	
Date	APRIL, 1998
Scale	

NO ALTERATION PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW.

REVISIONS

COMPLETED CONSTRUCTION
Significant Construction Changes Are Shown
By Date
Ck'd Date

Barton & Loguidice, P.C.
Consulting Engineers
290 Elwood Davis Road / Box 3107, Syracuse, New York 13220

OLD CORTLAND COUNTY LANDFILL
FEASIBILITY STUDY

SITE PLAN

TOWN OF SOLON CORTLAND COUNTY, N.Y.

Plate Number 1

File Number 331.22