APPENDIX B

Record Of Decision
Conklin Dumps Site
March 1991

RECORD OF DECISION

EPA
Region 2

- All attachments

Conklin Dumps Site

Town of Conklin, Broome County, New York

March, 1991

001777

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Conklin Dumps Site
Town of Conklin, Broome County, New York

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Conklin Dumps Site (the "Site"), located in the Town of Conklin, Broome County, New York, which was chosen in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision document explains the factual and legal basis for selecting the remedy for the Site.

The State of New York concurs with the selected remedy. The information supporting this remedial action decision is contained in the administrative record for the Site. The administrative record index is attached.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from the Site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present a current or potential threat to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

This operable unit is the final action for the Site. The selected remedy will provide containment through the installation of caps over the landfill material and leachate collection. Leachate will be discharged to the Binghamton-Johnson City Joint Sewage Treatment Plant, with or without pretreatment, as appropriate. If the sewage treatment plant is not available, then the leachate will be treated on-site and the treated effluent will be discharged to the nearby Carlin Creek. Also included in the selected remedy is groundwater monitoring, fencing, and deed restrictions.

The selected response action does not provide for active remediation of groundwater contamination from the Site since the natural degradation of the contaminants in the groundwater will result in an earlier attainment of groundwater standards than would be the case with groundwater extraction and treatment. Five-year reviews will be conducted as required by the NCP due to the fact that waste will remain on-site. The purpose of the five-year review is to ensure that the remedy continues to provide adequate protection of human health and the environment.

The landfills will be regraded as necessary prior to the installation of the caps to establish slopes which will encourage runoff and minimize erosion. The caps will contain the landfill material and will minimize infiltration of precipitation into the landfill material. This will minimize the potential for future contamination of the groundwater.

The major components of the selected remedy include the following:

- Cutting the existing sides of the landfills to slopes of no greater than approximately 33%. The top surfaces of the landfills will be regraded to slopes of no less than 4% to provide for proper drainage.

- Installation of leachate collection wells and a leachate collection trench or toe drain at the Upper Landfill and leachate collection trench at the lower landfill to a depth sufficient to eliminate leachate seeps.

- Installation of multimedia caps over the landfill material. Water infiltrating through the vegetative and protective layers of the cap will be intercepted by the impermeable flexible membrane layer and conveyed away from the landfill material. The multi-media caps will be consistent with applicable regulations that require that when a flexible membrane liner (FML) is used in place of clay, the FML may have a permeability no greater than 1×10^{-12} cm/sec. The design requirements contained in the 6 NYCRR Part 360 standards will be incorporated into the cap design.

- Installation of a gravel gas venting layer, with a filter fabric layer placed over the gravel. The FML will be placed over the filter fabric, and another layer of filter fabric will be placed on top of the FML.

- Seeding and mulching of the topsoil layer to prevent erosion and provide for rapid growth of vegetation.

001778

Decision Summary

Conklin Dumps Site

Town of Conklin,
Broome County, New York

EPA
Region 2

March, 1991

TABLE OF CONTENTS

ATTACHMENTS

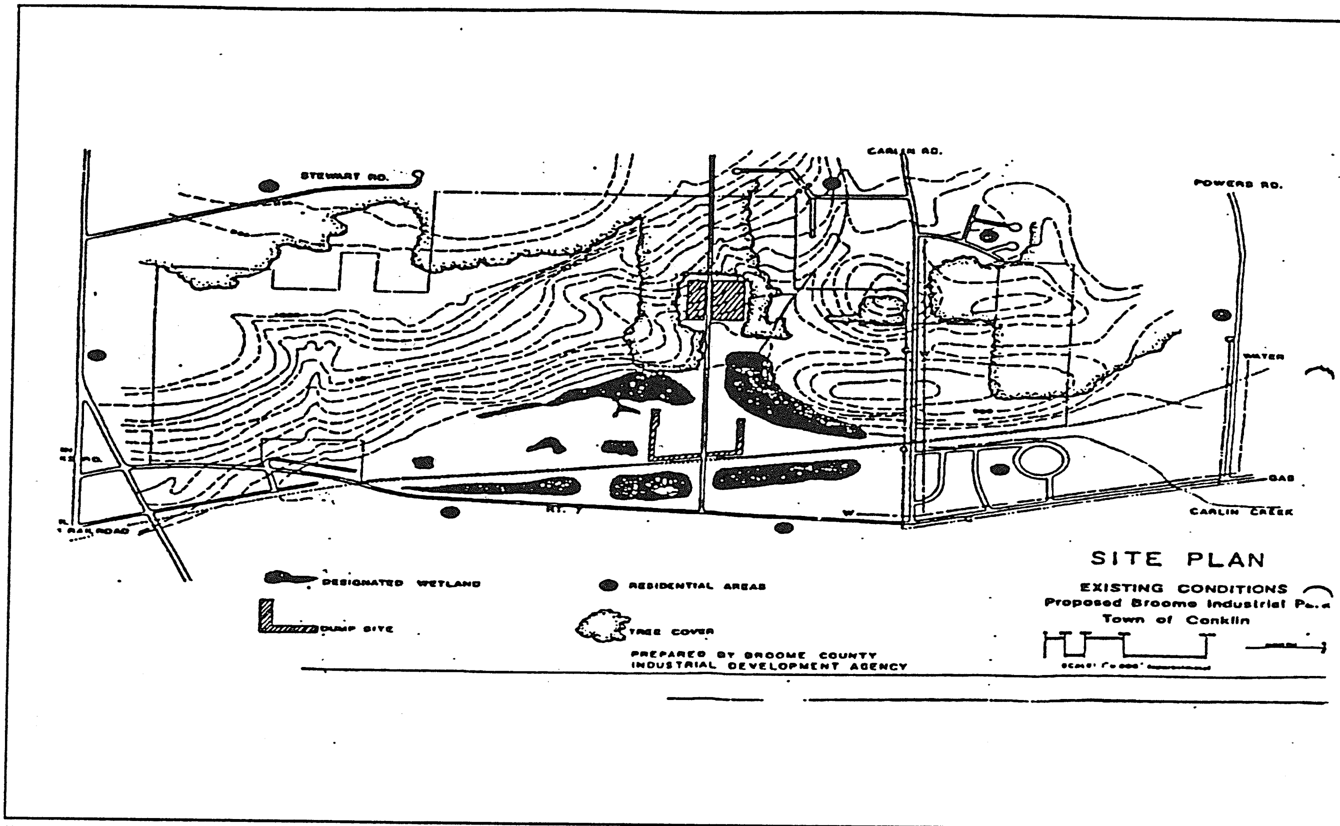

Figure 1 - Conklin Dumps Site Plan

SITE NAME, LOCATION, AND DESCRIPTION

The Site (see figure 1), located in the Town of Conklin in Broome County, New York, is an 8.5-acre landfill situated in a sparsely populated area within the perimeter of the Broome Corporate Park in Broome County. The Site is located approximately one mile north of the Kirkwood Interchange of Interstate Route 81 and approximately ten miles southeast of Binghamton, New York (population approximately 55,000, 1980 Census). The Site consists of two inactive municipal landfills (the "Upper" and the "Lower Landfill"), both owned by the Town of Conklin. The Lower Landfill was operated by the Town of Conklin from 1964 to 1969. This landfill was used to dispose of municipal refuse, and is estimated to contain a total fill volume of approximately 25,000 cubic meters. The Lower Landfill is located adjacent to the 100 year floodplain of the Susquehanna River, about 0.5 miles to the east of the river. Designated wetlands surround a large portion of the Lower Landfill.

SITE HISTORY AND ENFORCEMENT ACTIVITIES

The Upper Landfill was operated by the Town of Conklin for the disposal of municipal wastes from 1969 until 1975, when a closure order was issued by the New York State Department of Environmental Conservation (NYSDEC). The Upper Landfill is estimated to contain a total fill volume of approximately 55,000 cubic meters of waste material.

In 1984, O'Brien and Gere Engineers, Inc. initiated a two phase hydrogeologic investigation of the Broome Corporate Park for the Broome Industrial Development Agency. The purpose of the investigation was to determine whether the Broome Corporate Park could be developed. A phase I hydrogeologic investigation was completed in March 1984. This investigation evaluated the potential for contamination and development limitations of the area. A Phase II hydrogeologic investigation was completed in February 1985. This investigation characterized the local hydrogeology and identified the hydrogeologic conditions that would affect development of the industrial park. The investigations identified the presence of leachate seeps from the Site. In addition, groundwater monitoring wells located within the perimeter of the dumps indicated the presence of low levels of contaminants.

In 1985, a work plan for conducting a remedial investigation and feasibility study (RI/FS) was prepared by O'Brien and Gere and was submitted to NYSDEC. In June 1986, the field efforts were completed, but negotiations between the Town and the State on the Consent Order for funding of the project continued until June 1987 (the Consent Order was signed by the NYSDEC Commissioner on June 12, 1987), causing delays in finalizing the results of the investigations. The Site was proposed for inclusion on the National Priorities List in June, 1986 and was listed on the NPL on March 30, 1989.

An RI report was completed in December 1988. The RI Report was approved by NYSDEC on February 12, 1990, contingent upon the inclusion of additional groundwater sampling to obtain validated data at critical locations, methane monitoring, and field delineation of the wetlands in the vicinity of the Lower Landfill.

The required round of sampling was completed in June 1990. Groundwater samples from both the Upper and Lower Landfills were analyzed for volatile organics and selected metals.

Most of the contamination was found directly downgradient from the Upper Landfill in one well. Only inorganics were found in groundwater downgradient from the Lower Landfill. Leachate emanating from both the Upper and Lower Landfills was found to contain detectable levels of volatile organics and inorganics.

HIGHLIGHTS OF COMMUNITY PARTICIPATION

The RI/FS report and the Proposed Plan for the Conklin Dumps Site were released to the public for comment on February 4, 1991. These two documents were made available to the public in the administrative record and in information repositories maintained at the EPA Docket Room in Region II, New York, at the Conklin Town Hall, 1271 Conklin Road, Conklin, New York, and at NYSDEC's offices in Kirkwood and Albany, New York. Notice of the availability of these documents and a public comment period were published in the Press and Sun Bulletin, a newspaper of general circulation in Broome County. A public comment period on these documents was held from February 4, 1991 through March 6, 1991. In addition, a public meeting was held at the Town of Conklin Town Hall on February 25, 1991. At this meeting, representatives from the EPA and NYSDEC answered questions about problems at the Site and the remedial alternatives under consideration. Responses to the comments received during the public comment period are included in the Responsiveness Summary, which is appended to, and a part of, this ROD.

SCOPE AND ROLE OF OPERABLE UNIT

The purpose of this response action is to reduce the risk to human health and the environment due to the contamination of the on-site groundwater, to restore the groundwater underlying the Site to levels consistent with state and federal regulations, and to ensure protection of the air, and ground and surface water in the vicinity of the Site from continued release of contaminated leachate.

Human health and the environment will be protected through containment of the landfill material and collection and treatment of the leachate.

This response action applies a comprehensive approach (i.e., one operable unit) to remedial action at the site. In other words, this project has not been segmented into incremental portions.

NYSDEC is the lead agency for the project, EPA is the support agency.

SUMMARY OF SITE CHARACTERISTICS

Shale/siltstone bedrock underlies the entire site, with depth to bedrock varying from 80 feet (ft) below the surface of the Upper Landfill to 130 ft below the surface of the Lower Landfill. The bedrock is covered by a varying thickness of glacial till and other glacial deposits.

The depth of refuse at the Upper Landfill varies from approximately 10 ft to 30 ft. The refuse contained in the Upper Landfill is in direct contact with the underlying glacial till formation except along its eastern border. The east side of the landfill is underlain by a lens of low permeability silt and fine sand. This silt layer varies in depth from approximately 10 ft to 30 ft and extends downgradient from the base of the refuse.

The depth of refuse at the lower landfill varies from approximately 6 ft to 12 ft. Refuse contained in the Lower Landfill is underlain by sand and gravel glacial outwash. This sand and gravel layer is approximately 20 ft thick and is underlain by the glacial till. Groundwater is encountered at 1 and 14 ft below the ground surface except under the Upper Landfill, where the groundwater is approximately 24 ft below the surface.

The horizontal groundwater flow direction beneath the Site is from west to east toward the Susquehanna River. The hydraulic gradient is approximately 0.07 ft/ft in the upland portion of the Site where the Upper Landfill is located. The hydraulic gradient in the lower area of the Site, including the Lower Landfill and the sand and gravel outwash, is approximately 0.01 ft/ft.

The upland area encompassing the Upper Landfill is underlain predominantly by glacial till which has a low permeability (2.3×10^{-7} to 1.4×10^{-4} cm/sec), resulting in an estimated groundwater flow velocity of approximately 1.3×10^{-4} ft/day to 0.05 ft/day. The Lower Landfill is underlain by outwash sand and gravel which has a relatively high permeability (4.3×10^{-4} to 6.0×10^{-3} cm/sec). This, when combined with the low flow gradient, results in an estimated ground water velocity beneath the Lower Landfill ranging from 0.05 ft/day to 0.70 ft/day.

The RI report summarizes the data collected during the RI and from previous studies conducted at the Site. These data established the basis for completing the site risk assessment and were used in conjunction with the June 1990 groundwater data to evaluate remedial options for the Site.

The chemical analytical data resulting from the on-site investigation indicate that the groundwater at the Upper Landfill contained detectable levels of volatile organics and inorganics. Most of the contamination was found directly downgradient from the Upper Landfill in Well #11 (located at the toe of the Landfill). Only inorganics were found in groundwater downgradient from the Lower Landfill. Leachate emanating from both the Upper and Lower Landfills was found to contain detectable levels of volatile organics and inorganics. A comparison of the analytical data from leachate samples indicates that the disposal of hazardous substances in the Lower Landfill was probably minimal compared to that in the Upper Landfill.

Certain compounds in the ground water and leachate exceed New York State Class GA Groundwater Standards. Chloroethane, 1,2-dichloropropane, and xylene have been detected at concentrations above Class GA standards at the Upper Landfill. Xylene (7 parts per billion (ppb) in 1990) has historically been below or just above the Class GA standard (5 ppb). The concentration of 1,2-dichloropropane (9 ppb in 1990) has been decreasing over the past four years, and most recently was detected just above the Class GA standard (5 ppb). Chloroethane was observed at a concentration of 68 ppb in 1990. Chloroethane was utilized as the constituent of concern at the site. No detectable contaminants were found in Carlin Creek waters.

SUMMARY OF SITE RISKS

O'Brien & Gere conducted a Risk Assessment (part of the RI) of the "no-action" alternative to evaluate the potential risks to human health and the environment associated with the Site in its current state. The risk assessment focused on the groundwater contaminants which are likely to pose the most significant risks to human health and the environment (indicator chemicals).

The risk assessment evaluates the potential impacts on human health and the environment at the site assuming that the contamination at the site is not remediated. This information is used to make a determination as to whether remediation of the site may be required. The RI report presented a detailed site specific risk assessment which addressed site conditions and exposures. The risk assessment qualitatively and quantitatively evaluated the hazards to human health and the environment at the Landfills. The qualitative analysis characterized the potential exposure pathways while the quantitative analysis determined the risk of the complete pathways.

The air pathway for existing site conditions was identified in the RI report as incomplete. This determination was based upon the low levels of volatile organics detected in the Site ground water and leachate. Air monitoring conducted during the RI, soil vapor monitoring conducted during the Phase I Hydrogeologic Investigation, and methane monitoring conducted in June 1990 confirmed this determination.

Cancer potency factors (CPFs) have been developed by EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CPF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Cancer potency factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help

ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.
The direct contact exposure pathway was identified as functional due to the presence of detectable contaminants in the landfill leachate. Under future site development scenarios, the pathway was considered complete.

The human exposure pathways are ingestion of groundwater and dermal contact with leachate. EPA considers risks in the range of 10^{-4} to 10^{-6} to be acceptable. This risk range can be interpreted to mean than an individual may have a one in ten thousand to a one in a million increased chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at the Site.

The quantitative assessment evaluated intentional ingestion of groundwater by humans and dermal contact with leachate by humans. It was determined, based on the evaluation of sample concentrations from the most recent sampling round (June 1990), that neither pathway posed an unacceptable health risk.

Although current health risks are in the acceptable range, state and federal groundwater standards are being violated in the vicinity of Well #11 (See figure 2). Actual or threatened releases of hazardous substances from the Site, if not addressed by implementing the response action selected in this ROD, may present a current or potential threat to public health, welfare, or the environment. Therefore, remedial action is required.

DESCRIPTION OF REMEDIAL ALTERNATIVES

CERCLA requires that each selected site remedy be protective of human health and the environment, be cost effective, comply with other statutory laws, and utilize permanent

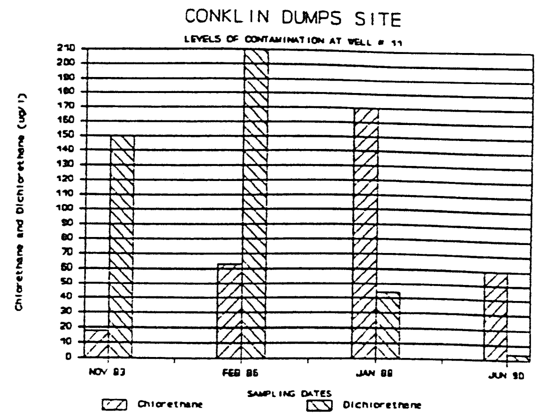

Figure 2 - Contamination Level at Well # 11

solutions and alternative treatment technologies and resource recovery alternatives to the maximum extent practicable. In addition, the statute includes a preference for the use of treatment as a principal element for the reduction of toxicity, mobility, or volume of the hazardous substances.

Remedial action objectives are specific goals to protect human health and the environment; they specify the contaminant(s) of concern, the exposure route(s), receptor(s), and acceptable contaminant level(s) for each exposure route. These objectives are based on available information and standards such as applicable or relevant and appropriate requirements (ARARs) and risk-based levels established in the risk assessment.

The risk assessment concluded that the risk to human health due to site-related exposure to groundwater, landfill leachate, or surface water (sediments) was at the upper bounds (10^{-4}) for acceptable exposure levels. However, certain compounds in the groundwater and leachate exceed New York State Class GA Groundwater Standards which have been determined to be ARARs for the Site. Chloroethane, 1,2-dichloropropane, and xylene have been detected at concentrations above Class GA standards at the Upper Landfill

Xylene (7 ppb in 1990) has historically been below or just above the Class GA standard (5 ppb). The concentration of 1,2-dichloropropane (9 ppb in 1990) has been decreasing over the past four years and most recently was detected just above the Class GA standard (5 ppb). Chloroethane was observed at a concentration of 68 ppb in 1990. The recent xylene and 1,2-dichloropropane concentrations are considered insignificant when compared to the standards (5 ppb).

The groundwater contamination is confined to a small area around Well # 11. It appears that due to the nature of the soil, very little off-site migration of contaminated groundwater has occurred since the closure of the landfill.

The following remedial action objectives were established for the FS:

- Prevent ingestion of groundwater containing site-related constituents of concern (chloroethane) at concentrations significantly exceeding Class GA standards.
- Prevent the migration of constituents of concern from the landfill material that could result in groundwater concentrations above Class GA standards.
- Restore the aquifer to concentrations that meet Class GA standards for site-related constituents of concern (chloroethane).

Accordingly, the FS evaluates in detail, six remedial alternatives for addressing the contamination associated with the Site.

These alternatives are:

Alternative 1: No Action with Monitoring

Capital Cost: none
O & M[1] Cost: $15,000/yr
Present Worth Cost: $111,446
Time to Implement*: 7-9 years
* Assuming Natural Degradation
[1]Operation & Maintenance

Alternative 1 is the no-action alternative. This alternative would provide for an assessment of the environmental conditions if no remedial actions are implemented. The no-action alternative would require implementation of a groundwater monitoring program. This program would be used to monitor groundwater conditions and provide a data-base for future remedial actions which may be required. Five-year reviews would be conducted as required by the NCP due to the fact that the landfilled material would remain on-site. The purpose of the five-year reviews is to ensure that adequate protection of human health and the environment is maintained.

Alternative 1 would rely upon natural degradation of the constituent of concern (chloroethane) to reduce the concentration of chloroethane in the groundwater near Well #11 to below Class GA groundwater standards (5 ppb).

Alternative 2: Multi-Media Cap on Both Landfills, Active Leachate Collection, and either discharge to the Binghamton-Johnson City Joint Sewage Treatment Plant or On-Site Treatment (Air Stripping)

Time to Implement*: 7-9 years (includes remedial design)
* Assuming Natural Degradation

There are four options associated with Alternative 2

Option A: Leachate Wells at the Upper Landfill, Interceptor Trench at the Lower Landfill, and On-Site Treatment (Air Stripping)

Capital Cost: $3,256,773
O & M Cost: $92,901/yr
Present Worth Cost: $4,558,947

Option B: Leachate Wells at the Upper Landfill, Interceptor Trench at the Lower Landfill, and Discharge to the Binghamton-Johnson City Joint Sewage Treatment Plant

Capital Cost: $3,145,703
O & M Cost: $86,669/yr
Present Worth Cost: $4,352,078

Option C: Interceptor Trenches at the Both Landfills, and On-Site Treatment (Air Stripping)

Capital Cost: $3,327,098
O & M Cost: $93,871/yr
Present Worth Cost: $4,644,183

Option D: Interceptor Trenches at Both Landfills, and Discharge to Binghamton-Johnson City Joint Sewage Treatment Plant

Capital Cost: $3,204,428
O & M Cost: $87,479/yr
Present Worth Cost: $4,423,255

This alternative would provide containment through the installation of caps over the landfill material and, unlike the other alternatives, active leachate collection at the Upper Landfill. Active leachate collection under options A and B at the Upper Landfill would be accomplished through the installation of leachate collection wells. The leachate collection wells would be drilled to the bottom of the fill material. It is anticipated that each well would have a deep and shallow well screen, with a removal seal separating the well screens. Initially, the shallow screened intervals would be pumped to remove leachate from refuse above the groundwater table. At some point in the future, the lower screened intervals located within the fill below the groundwater table may also be pumped. The leachate collection system at the Upper Landfill would also include a perimeter toe drain. Leachate would be collected at the Lower Landfill through a leachate collection trench installed to a depth sufficient to eliminate any future leachate seeps. Leachate would be treated on-site using air stripping, or at a nearby activated sludge sewage treatment plant (Binghamton-Johnson City Joint Sewage Treatment Plant). Under options A and C, treated effluent would be discharged to nearby Carlin Creek. Under options B and D, leachate collected at the landfills would be discharged into on-site sanitary sewer lines following any necessary pretreatment.

Also included in Alternative 2 would be groundwater monitoring, fencing, deed restrictions, and five-year reviews as required by the NCP. The landfills would be regraded as necessary prior to installation of the caps to establish slopes which would encourage runoff and minimize erosion. The caps would contain the landfill material and minimize infiltration of precipitation into the landfill material. This would minimize the potential for future contamination of the groundwater.

Under options A and C, air emissions would be in compliance with all applicable standards. Pre-treatment for removal of iron and manganese would likely be necessary. The on-site treatment plant would be located adjacent to the Lower Landfill. Leachate from the Upper Landfill would be transported to the treatment system at the Lower Landfill through a gravity-flow pipe. Treated effluent would be discharged to Carlin Creek. The treatment system would be operated 24 hours per day until the leachate generation rate drops below a predetermined practical treatment rate. At that time, leachate would be temporarily stored on-site and then treated by the air stripper whenever sufficient quantities were accumulated.

Alternative 2 would also rely upon natural degradation of chloroethane in excess of the Class GA groundwater standard in the groundwater in the vicinity of Well #11.

Alternative 3: Multi-Media Cap on Both Landfills, Leachate Collection, Groundwater Extraction (10,000 gallons per day (gpd)), and On-Site Treatment (Air Stripping)

Capital Cost: $3,392,130
O & M Cost: $111,468/yr
Present Worth Cost: $4,934,726
Time to Implement: 14-24 years (includes remedial design)

In addition to the actions comprising Alternative 2, Alternative 3 includes groundwater extraction and treatment.

The groundwater extraction system would remove impacted groundwater in the vicinity of Well #11 through extraction wells. The extraction wells would be located between Well #11 and Wells #3 and #4. The groundwater extraction system would be operated 24 hours per day until such time that the concentration of chloroethane is at or below Class GA standards. It is believed that the groundwater extraction process would interfere with the natural degradation process since the dilution of contaminant levels would inhibit biological degradation of such contaminants by the microbes in the soil. Therefore, an active system of groundwater extraction would actually take longer than the passive process of natural degradation in attaining Class GA groundwater standards.

Unlike Alternative 2, the groundwater and leachate treatment system (air stripping) for Alternative 3 would be located at the Upper Landfill, adjacent to an extraction well. Leachate from the Lower Landfill would be either pumped up to the treatment system or temporarily stored and then transported by a tanker truck to the treatment system. The treatment system would be designed to achieve effluent limitations established pursuant to the requirements of the State Pollutant Discharge Elimination System (SPDES) program. Pretreatment for iron and manganese in the groundwater and leachate would be required to prevent fouling of the stripping system. A backwash system would also be incorporated into the stripper design to obviate any fouling that might result from residual metals passing through the stripper. The treatment system would be operated 24 hours per day until the groundwater being extracted attained Class GA groundwater standards. At that time, leachate would be temporarily stored on-site and then treated by the air stripper whenever sufficient quantities were accumulated. Treated groundwater and leachate would be discharged to Carlin Creek.

Long-term monitoring and five-year reviews as required by the NCP would be included.

Alternative 4: Multi-Media Cap on Both Landfills, Leachate Collection, Groundwater Extraction (10,000 gpd) and On-Site Treatment (Oxidation)

Capital Cost: $3,480,580
O & M Cost: $138,188/yr
Present Worth Cost: $5,113,678
Time to Implement: 14-24 years (includes remedial design)

Alternative 4 is the same as Alternative 3, except that Alternative 4 would utilize on-site treatment by chemical oxidation instead of air stripping. A leachate collection system would be installed around the toe of each landfill and collected leachate would be treated with the groundwater. The groundwater extraction system would be as described in Alternative 3.

Long-term monitoring and five-year reviews as required by the NCP would be included.

Alternative 5: Multi-Media Cap on Both Landfills, Leachate Collection, Groundwater Extraction (10,000 gpd) and Treatment Off-Site

Capital Cost: $3,237,850
O & M Cost: $619,140/yr
Present Worth Cost: $10,893,217
Time to Implement: 14-24 years (includes remedial design)

Alternative 5 is the same as Alternatives 3 and 4, except it would utilize off-site treatment at a publicly owned treatment works (POTW) or a Resource Conservation and Recovery Act (RCRA) approved facility, if discharge to the Binghamton-Johnson City Joint Sewage Treatment Plant is not approvable.

The groundwater and leachate would be temporarily stored on-site and then transported to an approved facility for treatment and disposal. Approximately 40 tanker loads per week would be required during the period when both leachate and groundwater are being collected. Pump and treat operations would continue until the groundwater being extracted attained Class GA groundwater standards. At that time, only collected leachate would need to be transported to an approved facility for treatment and disposal.

Long-term monitoring and five-year reviews as required by the NCP would be included.

Alternative 6: Consolidation of Both Landfills, Multi-Media Cap on Upper Landfill, Leachate Collection, and On-Site Treatment (Air Stripper)

Capital Cost: $3,800,794
O & M Cost: $100,405/yr
Present Worth Cost: $5,218,316
Time to Implement*: 7-9 years (includes remedial design)
*Assuming Natural Degradation

Alternative 6 would provide containment of the landfill materials through consolidation of the Lower Landfill material with the Upper Landfill material at the Upper Landfill site and the installation of a cap over the consolidated material. Leachate collection would be implemented at the Upper Landfill. Leachate would be treated on-site at the Upper Landfill using air stripping. Treated effluent would be discharged to Carlin Creek. Also included in Alternative 6 would be groundwater monitoring, fencing, deed restrictions and five-year reviews as required by the NCP.
This alternative would involve excavating the material in the Lower Landfill and transporting it to and placing it on the Upper Landfill. Samples of the Lower Landfill material would have to be analyzed using the Toxicity Characteristic Leaching Procedure (TCLP) test to insure that the material is not hazardous. Any material deemed hazardous would have to be transported off-site to a RCRA facility for treatment and/or disposal. Additionally, dewatering of the landfill excavation would need to be performed in areas where the landfill material is located below the water table. It is assumed that the water would be managed as hazardous and would be transported to and disposed of at a RCRA facility.

Alternative 6 would rely upon natural degradation of chloroethane to reduce chloroethane levels to below Class GA standards in the groundwater in the vicinity of Well #11.

Long-term monitoring and five-year reviews as required by the NCP would be included.

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

During the detailed evaluation of remedial alternatives, each alternative is assessed against nine evaluation criteria, namely overall protection of human health and the environment, compliance with ARARs, long-term effectiveness and permanence, reduction of toxicity, mobility or volume, short-term effectiveness, implementability, cost, and state and community acceptance.

Each criteria will be briefly addressed with respect to the alternatives for remediation of the site.

- o <u>Overall Protection of Human Health and the Environment</u>

Alternative 1 would provide for overall protection of human health and the environment through natural degradation of constituents of concern in the groundwater. Alternative 1 would not include capping of the landfill material or leachate collection. While natural degradation of constituents of concern in groundwater could be expected to occur, the potential would remain for future migration of constituents of concern from the landfill material.

Alternative 2 would provide for overall protection of human health and the environment with capping of landfill materials and active leachate collection to prevent migration of constituents of concern from landfill materials to groundwater, and deed restrictions to prohibit potable use of groundwater. Natural degradation of constituents of concern in the groundwater is expected to reduce concentrations of those constituents to groundwater standards in the short term.

Alternatives 3 through 5 would provide for overall protection of human health and the environment with capping of landfill materials and leachate collection to prevent migration of constituents of concern from landfill materials to groundwater, extraction and treatment of groundwater to reduce concentrations of constituents of concern in the aquifer to groundwater standards, and deed restrictions to prohibit potable use of groundwater.

Alternative 6 would provide for overall protection of human health and the environment with capping of landfill materials and leachate collection to prevent migration of constituents of concern from landfill materials to groundwater, to reduce concentrations of constituents of concern in the aquifer to groundwater standards, and deed restrictions to prohibit potable use of groundwater.

- o <u>Compliance with ARARs</u>

All technologies proposed for use in Alternatives 2 through 6 would be designed and implemented to satisfy all ARARs. Federal and state regulations dealing with the handling and transportation of hazardous wastes to an off-site treatment facility would be followed. The off-site treatment facility would be fully EPA-approved. RCRA wastes would be treated using specific technologies or specific treatment levels, as appropriate, to comply with land disposal restrictions.

- o <u>Long-Term Effectiveness and Permanence</u>

Alternatives 2 through 6 would be equally effective over the long-term. Each of Alternatives 2 through 6 employ adequate and reliable controls to prevent future migration of constituents of concern from landfill materials to groundwater and reduce constituent concentrations in groundwater to Class GA groundwater standards. Alternative 1 would provide for reduction of constituent concentrations in groundwater to Class GA standards and would employ an adequate and reliable control to monitor groundwater conditions, but would not provide for prevention of migration of constituents from landfill materials to groundwater.

- o <u>Reduction in Toxicity, Mobility, or Volume Through Treatment</u>

Alternative 1 would not include the use of any treatment method. Concentrations of constituents of concern in groundwater would be expected to be reduced, however, through natural degradation processes in the aquifer.

Alternative 2 includes treatment of leachate with an on-site air stripper system (options A and C) or discharge to the Binghamton-Johnson City Joint Sewage Treatment Plant (options B and D), satisfying the statutory preference for treatment. Nearly complete removal of organic constituents in the leachate would be expected with air stripping. Air stripping is an irreversible treatment method. Further, concentrations of constituents of concern in groundwater would be expected to be reduced through natural degradation processes in the aquifer, and mobility of constituents of concern in the landfill materials would be reduced with capping and leachate collection.

Alternatives 3 and 6 would satisfy the statutory preference for treatment with the inclusion of air stripping of groundwater (Alternative 3 only) nd leachate. Air stripping would provide for nearly complete removal of volatile organics in groundwater and leachate. Air stripping is an irreversible treatment method. Minimal levels of residual constituents of concern in treated groundwater and leachate and in the aquifer would be further reduced through natural degradation processes. Further, a reduction in the mobility of constituents of concern in landfill materials would be expected with capping and leachate collection.
Alternative 6 would provide an additional reduction in mobility through consolidation of Lower Landfill material with the Upper Landfill.

Alternative 4 would satisfy the statutory preference for treatment with the inclusion of chemical oxidation of groundwater and leachate. Chemical oxidation would provide for nearly complete destruction of volatile organics in groundwater and leachate as ·ould the off-site treatment that would be ·equired under Alternative 5. Chemical oxidation is an irreversible treatment method. Minimal levels of residual constituents of concern in treated groundwater and leachate and in the aquifer would be further reduced through natural degradation processes. Further, a reduction in the mobility of constituents of concern in landfill materials would be expected with capping and leachate collection.

- o <u>Short-Term Effectiveness</u>

Although the remedial objective concerning prevention of migration of constituents from landfill materials to groundwater would not be achieved through Alternative 1, the remedial objectives related to prevention of ingestion of groundwater and the restoration of the aquifer to Class GA standards would likely be attained. Although it would be highly unlikely, the potential would exist for unrestricted installation of potable wells near the Site. Natural degradation processes are expected to reduce concentrations of constituents of concern to groundwater standards within approximately 7 to 9 years. Protection of workers during monitoring activities would be achieved through the use of appropriate protective equipment.

Alternative 2 would be effective over the short-term. There would be no short-term impacts on the community during remedial actions. Protection of workers during remedial activities would be achieved through the use of appropriate protective equipment. There would not be any environmental impacts during remediation; contaminant transport via fugitive emissions during cap construction would be minimized through appropriate methods such as dust control. Installation of a cap would prevent generation of additional leachate. Restoration of the aquifer to groundwater standards would likely be achieved within approximately 7 to 9 years through natural degradation. Prevention of ingestion of groundwater would likely be attained following implementation of deed restrictions.

Alternatives 3 through 5 would be effective over the short-term. There would be no short-term impacts on the community or the environment during remedial action. Protection of workers during remedial activities would be achieved through the use of appropriate protective equipment during remedial activities. Contaminant transport via fugitive emissions during cap construction would be minimized through appropriate methods such as dust control. Installation of a cap would prevent additional leachate generation. Restoration of the aquifer to groundwater standards would likely be achieved within approximately 14 to 24 years through extraction and treatment of groundwater. The groundwater extraction process would interfere with the natural degradation process since the dilution of contaminant levels would inhibit biological degradation of such contaminants by the microbes in the soil. Therefore, an active system of groundwater extraction will actually take longer than the passive process of natural degradation in attaining Class GA groundwater standards. Prevention of the potential for ingestion of groundwater would likely be attained following implementation of deed restrictions.

Alternative 6 would be effective over the short-term. There would be no short-term impacts on the community during remedial actions. Protection of workers during remedial activities would be achieved through the use of appropriate protective equipment. Contaminant transport during excavation of the Lower Landfill and consolidation with the Upper Landfill and during cap construction would be minimized through appropriate methods such as dust control. Consolidation of the two Landfills and installation of a cap on the Upper Landfill would prevent the generation of additional leachate. Restoration of the aquifer to groundwater standards would likely be achieved within approximately 7 to 9 years through natural degradation of contaminants in groundwater. Prevention of the potential for ingestion of groundwater would likely be attained following implementation of deed restrictions. However, excavating the Lower Landfill might create an environmental and public health threat as a result of runoff and air emissions. In light of the relatively low groundwater contamination at the Lower Landfill, excavation is not warranted.

o <u>Implementability</u>

There would be no construction or operation required for implementation of Alternative 1. Groundwater monitoring is a reliable method which would indicate changes in aquifer conditions. If the need for further action were identified through groundwater monitoring, the alternative evaluation and remedy selection process might need to be repeated for the Site. Sampling personnel, equipment, and an analytical laboratory would be readily available.

The cap and leachate collection system called for in Alternative 2 could be readily constructed and maintained. The air stripping system for leachate treatment could also be readily installed and operated. Diversion to the POTW via nearby sanitary sewer lines could also be readily constructed and maintained. Capping, leachate collection, air stripping, and treatment at a POTW (activated sludge) are reliable technologies. If additional remedial action were determined to be necessary, a groundwater extraction and treatment system could be designed and installed. Operation of the air stripping system could be readily extended if necessary. Discharge to the POTW could also be readily extended. The effectiveness of Alternative 2 could be readily monitored; groundwater monitoring would indicate changes in aquifer conditions, and discharge monitoring would indicate leachate treatment effectiveness. Coordination with the local government would be necessary to implement deed restrictions. Sampling equipment, sampling personnel, an analytical laboratory, construction equipment, cap materials, and an air stripping system would be expected to be readily available.

The cap and leachate collection system called for in Alternatives 3 through 6 could be readily constructed and maintained. The extraction system (Alternatives 3 through 5), air stripper (Alternatives 3 and 6), and chemical oxidation system (Alternative 4) could be readily constructed and operated. Capping, leachate collection, extraction, air stripping, and chemical oxidation are reliable technologies. If additional remedial action were determined to be necessary, the groundwater extraction system could be extended. Operation of the air stripper or chemical oxidation system could be readily extended if necessary. The effectiveness of Alternatives 3 through 6 could be readily monitored; groundwater monitoring would indicate changes in aquifer conditions, and discharge monitoring would indicate groundwater and leachate treatment effectiveness. Coordination with the local government would be necessary to implement deed restrictions. Sampling equipment, sampling personnel, an analytical laboratory, construction equipment, cap materials, and drillers would be expected to be readily available.

- Cost

The total present worth of the alternatives evaluated ranges from $111,446 (no action) to $10,893,000 (groundwater extraction and off-site treatment). Present worth considers a 5% discount rate, and a 30-year operational period. Only Alternative 1 would not require any capital costs. Alternative 2 is the least costly of the action alternatives ($4,352,078 - $4,644,183).

- State Acceptance

NYSDEC concurs with the selected remedy.

- Community Acceptance

One written comment regarding the selected remedy was received by EPA during the comment period. The one written comment and the comments received at the public meeting are addressed in the Responsiveness Summary. Neither the written comment nor the comments at the public meeting, however, raised substantive objections or concerns about the selected remedy. Therefore, EPA believes that the selected remedy has the support of the affected community.

THE SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, the detailed analysis of the alternatives, and public comments, both EPA and NYSDEC have determined that Alternative 2, Option B, Multi-Media Cap on Both Landfills, Active Leachate Collection and discharge to the Binghamton-Johnson City Joint Sewage Treatment Plant constitutes the appropriate remedy for the Site. If the Binghamton-Johnson City Joint Sewage Treatment Plant cannot accept the collected leachate, then Option A, on-site treatment, would be implemented in place of Option B. The major components of the selected remedy are as follows:

Containment through the installation of caps over the landfill material and leachate collection. The leachate would be treated at the Binghamton-Johnson City Joint Sewage Treatment Plant. If the Treatment Plant is not available, leachate would be treated on-site using air stripping and discharged to Carlin Creek.

The selected remedy also includes fencing, deed restrictions, and a groundwater monitoring program, which will provide data to evaluate the effectiveness of the remedial effort and will act as an early warning system to protect private wells in the area. Five-year reviews will be conducted as required by the NCP due to the fact that waste would remain on-site. The purpose of the five-year review is to ensure that the remedy continues to provide adequate protection of human health and the environment.

A multimedia cap will be considered for containment at this site, since it is more resistant to cracking due to settlement than asphalt and concrete. Clay was not chosen because it is not readily available locally. Capping will minimize surface water infiltration, provide for control of erosion, and isolate and contain certain wastes.

The multi-media cap will be consistent with applicable regulations that require that when a FML is used in place of clay, the FML may have a permeability no greater than 1×10^{-12} cm/sec. The design requirements contained in the 6 NYCRR Part 360 standards would be incorporated into the cap design.

The cap considered above would also attain the performance requirements for caps at hazardous waste landfills as specified in 40 CFR Part 264.310. These requirements, promulgated under the RCRA, specify that the cap should:

1. Provide long-term minimization of migration of liquids through the closed landfill;

2. Function with minimum maintenance;

3. Promote drainage and minimize erosion or abrasion of the cover;

4. Accommodate settling and subsidence so that the cap's integrity is maintained; and

5. Have a permeability less than or equal to the permeability of any bottom liner present or natural subsoils present.

The first RCRA performance requirement would be attained by establishing proper slopes for drainage of precipitation, vegetated topsoil to promote evapotranspiration, as well as the installation of a FML with a permeability of 1×10^{-12} cm/sec or less.

A minimum amount of maintenance would be required for the cap. Maintenance activities would primarily consist of periodic mowing.

Proper slopes and the vegetated topsoil would be established to promote drainage and minimize erosion of the cover.

It is expected that settling and subsidence have already occurred at the Site landfills due to their age and would not occur in the future to any substantial degree. However, FMLs as considered here typically accommodate settling satisfactorily.

The permeability of the natural subsoils beneath the landfills ranges from approximately 1.4×10^{-4} to 2.3×10^{-7} cm/sec at the Upper Landfill to approximately 6.0×10^{-3} to 4.3×10^{-4} cm/sec at the Lower Landfill. The 40 mil FML considered for the cap would have a permeability of no greater than 1×10^{-12} cm/sec. Therefore, the fifth RCRA performance requirement will be attained by the Part 360 design requirement.

Leachate collection systems will be installed in conjunction with the caps. A leachate collection system will be installed around the toe of each landfill and collected leachate will be discharged to the Binghamton-Johnson City Joint Sewage Treatment Plant, or if the Plant is not available, leachate would be treated on-site in an air stripper package treatment plant. At least two leachate collection wells will be installed at the Upper Landfill and will be connected to the leachate collection system.

The leachate collection wells will be drilled to the bottom of the fill material. It is anticipated that each well will have a deep and shallow well screen, with a removal seal or plug separating the deep and shallow screen zones. Initially, the shallow screened intervals will be pumped to remove leachate above the groundwater table, which occurs at approximately 16 ft below the surface of the landfill. If the Upper screened intervals dry out, the plug separating the screened zones may be removed to allow pumping deeper within the fill beneath the groundwater table. This will ensure effective removal of the leachate and protection of human health and the environment.

A collection trench will be installed along the toe of the Lower Landfill. The bottom of the trench will be located at approximately the same elevation as the groundwater table, or at a depth sufficient to eliminate seeps in the wetland areas. The edge of the cap will be keyed into the outer edge of the collection trench.

Off-site treatment at the Binghamton-Johnson City Joint Sewage Treatment Plant will involve discharging leachate into on-site sanitary sewer lines. Leachate collected at the Upper Landfill will be discharged into an 8-inch sanitary sewer located approximately 20 ft west of the Broome Parkway. Leachate collected at the Lower Landfill will be discharged into an 18-inch sanitary sewer located approximately 130 west of the northwest corner of the Lower Landfill. Effluent from the sewage treatment plant is discharged to the Susquehanna River.

If discharge to the Binghamton-Johnson City Sewage Treatment Plant is not possible, then leachate would be treated at an on-site treatment plant. The on-site treatment plant would be located adjacent to the Lower Landfill. Leachate from the Upper Landfill would be transported to the treatment system at the Lower Landfill through a gravity-flow pipe. Pretreatment for the removal of iron and manganese would likely be necessary. Treatability studies would be necessary during design to evaluate both system performance and potential fouling problems due to metal scaling and/or bacterial growth. The plant would be operated 24 hours per day until the leachate generation rate drops below a predetermined practical treatment rate. At that time, leachate would be temporarily stored on-site and then treated by the air stripper whenever sufficient quantities of leachate were accumulated. Treated effluent would be discharged to Carlin Creek.

Stripping is a physical treatment process in which air or steam is used to remove dissolved volatile organic compounds from water. Air stripping involves transferring a dissolved substance from the liquid phase to the gas phase whereas steam stripping is essentially a distillation process in which the volatile compounds are removed from the wastewater as distillate. An evaluation of the suitability of a stripper for treatment of a wastewater typically includes an evaluation of any treatment that may be needed for the air emissions which would be produced.

A wetlands delineation (utilizing the "three parameter method"), and a 500-year flood plain assessment will be undertaken during the remedial design phase. A Stage 1A cultural resources assessment has already been performed. A wetland assessment and restoration plan will be required for any wetlands impacted or disturbed by remedial activity.

REMEDIATION LEVELS

The purpose of this response action is to restore the groundwater underlying the Site to levels consistent with State and Federal ARARs, and to ensure protection of the air, and the ground and surface water in the vicinity of the Site from continued release of contaminated leachate.

The risk assessment concluded that the risk to human health or wildlife due to site-related exposure to ground water, landfill leachate, or surface water (sediments) is at the upper bounds of the acceptable risk range. However, certain compounds in the ground water and leachate exceed New York State Class GA Ground Water Standards. Chloroethane, 1,2-dichloropropane, and xylene have been detected at concentrations above Class GA standards at the Upper Landfill. Xylene (7 ppb in 1990) has historically been below or just above the Class GA standard (5 ppb). The concentration of 1,2-dichloro-propane (9 ppb in 1990) has been decreasing over the past four years and most recently was detected just above the Class GA standard (5 ppb). Chloroethane was observed at a concentration of 68 ppb in 1990. For the purpose of the study, chloroethane was considered the constituent of concern at the site.

STATUTORY DETERMINATIONS

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that achieve protection of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences. These specify that when completed, the selected remedial action for this site must comply with applicable or relevant and appropriate environmental standards established under federal and state environmental laws unless a statutory waiver is justified. The selected remedy also must be cost-effective and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that employ treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as their principal element. The following sections discuss how the selected remedy meets these statutory requirements.

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The selected remedy protects human health and the environment through containment of the landfill material and collection and treatment of leachate. The implementation of the selected remedy will not pose unacceptable short-term risks or cross-media impacts. Containment will be provided through caps installed over the landfill material. The multimedia capping system will limit infiltration of water by promoting controlled surface runoff and evapotranspiration. Natural degradation is expected to reduce the concentration of chloroethane to Class GA groundwater standards within approximately 7-9 years.

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE STANDARDS

ARARs identified for the selected remedy include the New York State Class GA Ground Water Quality Standards (6 NYCRR Part 703), SPDES program requirements (6 NYCRR Part 750-758), New York State Ambient Water Quality Standards (6 NYCRR Part 701), the NAAQS for particulate matter (40 CFR Part 50), Solid Waste Management Facilities Landfill Closure and Post-Closure Criteria (6 NYCRR Part 360-2.15), freshwater wetlands requirements (6 NYCRR Part 663), air emissions and guidelines (6 NYCRR Part 212 and New York Air Guide-1) and guidelines establishing test procedures for the analysis of pollutants (40 CFR 136). The selected remedy will rely upon natural degradation for compliance with Class GA ground water standards; it is estimated that compliance will be achieved in approximately 7 to 9 years. Capping and leachate collection/treatment is expected to prevent future groundwater impacts from constituents of concern in landfill materials. Leachate will be treated to levels which, when discharged to the Susquehanna River (off-site treatment) or Carlin Creek (on-site treatment), will comply with SPDES program requirements and will not cause contraventions of New York State Ambient Water Quality Criteria. Emissions from the air-stripper will be addressed as provided by New York Air Guide-1. Fugitive emissions during cap construction will be minimized through the use of dust suppressants and temporary cover, as needed, to comply with the NAAQS for particulates. Capping of the Site will be performed in compliance with New York State landfill closure and post-closure criteria (6 NYCRR Part 360-2.15). The use of EPA-certified Contract Laboratory Program analytical facilities will ensure that guidelines establishing test procedures for pollutant analysis will be complied with during the ground water monitoring program.

COST-EFFECTIVENESS

The selected remedy is cost-effective, since it provides overall effectiveness proportional to its cost. The estimated present worth cost for this remedy is $4,352,078. The total present worth of the alternatives evaluated ranged from $111,446 (no action) to $10,893,000 (groundwater extraction and off-site treatment). Present worth considers a 5% discount rate, and a 30-year operational period. Only Alternative 1 would not require any capital expenditures. Alternative 2, Option B is the least costly of the action alternatives ($4,352,078).

UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

EPA and New York State have determined that the selected remedy represents the maximum extent to which permanent solutions and alternative treatment technologies can be utilized in a cost-effective manner for the Conklin Dumps Site. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA and NYSDEC have determined that the selected remedy best balances the goals of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume achieved through treatment, short-term effectiveness, implementability, and cost-effectiveness, while also considering the statutory preference for treatment as a principal element and considering state and community acceptance.

The selected remedy will provide for long-term effectiveness and permanence. Capping and leachate collection would minimize the potential for the migration of constituents of concern from landfill materials to groundwater.

The selected remedy is also implementable. Both on-site treatment through air stripping and off-site treatment at a POTW are appropriate and dependable treatment methods for leachate. Natural degradation processes are expected to degrade the constituents of concern present in the aquifer to levels at or below New York State Class GA standards. The controls utilized in the selected remedy are both adequate and reliable. With appropriate maintenance, capping and leachate collection will be adequate and reliable containment measures for prevention of migration of constituents of concern from landfill materials. Air stripping will likely be an appropriate and dependable treatment method for leachate at the Site. Deed restrictions and fencing will be adequate and reliable in prohibiting well development and activities impacting cap integrity. Groundwater monitoring is a suitable and reliable means of following conditions in the aquifer and provides an early warning system to provide downgradient residential supply wells.

The selected remedy will be effective over the short-term. The alternatives do not differ significantly with respect to the ability to minimize impacts to the community during remedy installation. The natural degradation of contaminants in the groundwater provided by Alternative 2 is expected to result in a shorter 'erm attainment of groundwater standards than would be the case for the alternatives utilizing groundwater extraction.

PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

The selected remedy addresses one of the principal threats posed by the site through the use of treatment technologies by treating the leachate at the Binghamton-Johnson City Joint Sewage Treatment Plant, or if the sewage treatment plant is not available, by on-site air stripping. The statutory preference for remedies that employ treatment as a principal element is only partially satisfied, however, since treatment of contaminated groundwater was not found to be practicable and since the size of the landfill, and the absence of on-site "hot spots" of contaminants, precluded excavation and treatment of fill material as a means of source control.

DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for the Site was released to the public on February 4, 1991. The Proposed Plan identified Alternative 2, Option B as the preferred alternative; stating further that, in the event that Option B is not feasible, then Option A, on-site treatment, would be implemented in place of Option B. EPA reviewed all written and verbal comments submitted during the public comment period. Upon review of these comments, EPA has determined that no significant changes to the selected remedy, as it was originally identified in the Proposed Plan, are necessary.

BOOZ·ALLEN & HAMILTON INC.

101 PARK AVENUE • NEW YORK, NY 10178 • TELEPHONE: (212) 697-1900 • FAX: (212) 697-2628 • TELEX: 620196

March 18, 1991

Conklin Town Hall
1271 Conklin Road
Conklin, New York 13748

Subject: Conklin Dumps Site, Administrative Record File

Dear Sir/Madam:

The Administrative Record File for the Conklin Dumps Site is being sent to you at the instruction of the U.S. Environmental Protection Agency. Please make this file available to the public for review.

Thank you for your assistance. If you have any questions, please contact Ms. Jennie Delcimento, Environmental Specialist, U.S. EPA, at (212) 264-8676, or Mr. Richard Ramon, Project Manager, U.S. EPA, at (212) 264-1336.

Very Truly Yours,

BOOZ, ALLEN & HAMILTON Inc.

Eric Sean Goldstein
Researcher

cc: Ms. Jennie Delcimento
Mr. Richard Ramon

CONKLIN DUMPS SITE
ADMINISTRATIVE RECORD FILE
INDEX OF DOCUMENTS

SITE IDENTIFICATION

BACKGROUND - RCRA AND OTHER INFORMATION

P. 1 - 2	Letter to Ms. Patricia Ingraham, Broome County Planning Board, from Mr. Patrick Snyder, NYSDEC, Re: Environmental Impact Statement, April 18, 1985.
P. 3 - 4	Letter to Mr. Langdon Marsh, NYSDEC, from Mr. Carl Young, County Executive, Re: Background Information, October 9, 1985.
P. 5	Fact sheet on the Conklin dump site, 1988.

CORRESPONDENCE

P. 6 - 7	Letter to Mr. Henry Williams, NYSDEC, from Mr. Carl Young, County Executive - Broome County, Re: History of the site, March 19, 1985.
P. 8 - 9A	Letter to Mr. Carl Young, Broome County, from Mr. Henry Williams, NYSDEC, Re: Broome County Corporate/Industrial Park, April 4, 1985. Attachments.
P. 10	Letter to Mr. William Librizzi, U.S. EPA, from Mr. Norman Nosenchuck, NYSDEC, Re: Hazard ranking scoring packet, July 3, 1985.
P. 11 - 48	Memorandum to Mr. Michael J. O'Toole, Jr., NYSDEC, from Mr. Earl Barcomb, NYSDEC, Re: History of the dump, October 13, 1989. Attachments.

REMEDIAL INVESTIGATION

SAMPLING AND ANALYSIS PLANS

P. 49 - 50	Letter to Mr. Joseph Forti, NYSDEC, from Mr. James Madigan, NYS Department of Health, Re: Detailed plans for Preliminary report, August 25, 1987.

SAMPLING AND ANALYSIS DATA/ CHAIN OF CUSTODY FORMS

P. 51 - 179	Report: Hydrogeologic Investigation, prepared by O'Brien and Gere, March 1984.

p. 180 - 227 Data sheet for the Broome County Health Department, prepared by H2M, October 31, 1984.

P. 228 - 311 Report: Phase II - Hydrogeologic Investigation, prepared by O'Brien and Gere, February, 1985.

P. 312 - 313 Memorandum to Mr. Brian Davidson, NYSDEC, from Mr. John Munn, NYSDEC, Re: Data Validation, August 11, 1989.

P. 314 - 319 Summary of June 1990 Ground Water Sampling Events.

P. 320 - 707 Report: Volatile Analysis Analytical Data Package, prepared by Versar Inc, July 19, 1990.

P. 708 - 884 Report: Analytical Data Package - Metals Analysis, prepared by Versar Inc., July, 25, 1990.

P. 885 - 891 Site Characteristics fact sheet, Prepared by O'Brien & Gere, November 28, 1990.

P. 892 - 903 Letter to Mr. Brian Davidson, NYSDEC, from Mr. Paul Fox, O'Brien & Gere, Re: Enclosed revised tables 20 and 21, December 13, 1990. Attachments.

P. 904 - 926 Letter to O'Brien and Gere, from Ms. Judy Harry, Data Validation Services, Re: Validation of data, December 26, 1990. Attachments.

WORK PLANS

P. 927 - 928 EPA's Comments on Conklin Dump RI/FS Workplan.

REMEDIAL INVESTIGATION REPORTS

P. 929 - 1220 Report: Preliminary Report, prepared by, O'Brien and Gere, July, 1987.

P. 1221 - 1224 Letter to Mr. Mark Gorgos, Coughlin and Gerhart, from Mr. Brian Davidson, Re: Preliminary Report, October 2, 1987.

P. 1225 Memorandum to Mr. Joseph Slack, NYSDEC, from Mr. William Webster, NYSDEC, Re: Review of draft RI report. August 15, 1988.

P. 1226 - 1923 Report: Town of Conklin Landfills Remedial Investigation, prepared by O'Brien and Gere, December, 1988.

<u>CORRESPONDENCE</u>

P. 1924 - 1935 Letter to Honorable John Guinan, Broome County, from Mr. Raymond Lupe, NYSDEC, Re: ReClassification, April 4, 1985.

P. 1936 Letter to Mr. Carl Young, Broome County, from Mr. Henry Williams, NYSDEC, Re: Broome County Corporate/Industrial Park, April 4, 1985.

P. 1937 Memorandum to Mr. Charles Goddard, NYSDEC, from Mr. David King, NYSDEC, Re: Conklin Landfills, May 2, 1985.

P. 1938 - 1939 Memorandum to Mr. John Iannotti, NYSDEC, from Mr. John Morelli, NYSDEC, Re: Conklin Landfill meeting - May 5, 1985, May 10, 1985.

P. 1940 Letter to Mr. Perry Katz, U.S. EPA, from Mr. Raymond Lupe, NYSDEC, Re: Hydrogeologic Investigation of Broome County Industrial Park, July 5, 1985.

P. 1941 - 1943 Letter to Mr. Edward Murray, Broome County, from Mr. Joseph Forti, NYSDEC, Re: List of issues, August 6, 1985.

P. 1944 Letter to Ms. Lynn Wright, NYSDEC, from Mr. Joseph Forti, Re: Allowing work on the RI before the consent order, January 23, 1986.

P. 1945 - 1946 Letter to Mr. Robert Senior, NYSDEC, from Mr. Frank Hale, O'Brien and Gere, Re: Town of Conklin, January 21, 1986.

P. 1947 Letter to Mr. Frank Hale, O'Brien and Gere, from Mr. Robert Senior, NYSDEC, Re: Remedial investigation work, January 24, 1986.

P. 1948 Letter to Mr. Barry Kogut, Bond, Schoeneck & King, from Mr. Joseph Forti, NYSDEC, Re: Conklin consent plan and work plan, March 7, 1986.

P. 1949 Memorandum to Mr. Joseph Slack, NYSDEC, from Mr. Earl Barcomb, NYSDEC, Re: RI/FS work plan, 1987.

P. 1950 - 1953 Letter to Mr. Mark Gorgos, from Mr. Joseph Forti, NYSDEC, Re: RI/FS revisions, August 28, 1987.

P. 1954 Memorandum to distribution, from Mr. Joseph Forti, NYSDEC, Re: RI/FS workplan, September 1, 1987.

P. 1955	Memorandum to distribution, from Mr. Joesph Forti, NYSDEC, Re: RI/FS workplan, September 11, 1987.
P. 1956 - 1957	Letter to Mr. Joseph Forti, NYSDEC, from Mr. Barry Kogut, Bond, Schoeneck & King, Re: Preliminary report, October 30, 1987.
P. 1958	Memorandum to Mr. Joseph Slack, NYSDEC, from Mr. Earl Barcomb, NYSDEC, Re: RI/FS work plan, November 24, 1987.
P. 1959 - 1965	Memorandum to Mr. Brian Davidson, NYSDEC, from Mr. Frank Trent, NYSDEC, Re: Remedial investigation review, August 11, 1988. Attachments
P. 1966 - 1967	Letter to Mr. Brian Davidson, NYSDEC, from Mr. James Madigan, NY State Department of Health, Re: RI report, August 16, 1988.
P. 1968 - 1971	Letter to Mark Gorgos, Coughlin and Gerhart, from Mr. Brian Davidson, NYSDEC, Re: RI Report, September 15, 1988.
P. 1972	Letter to Mr. Brian Davidson, NYSDEC, from Mr. Mark Gorgos, Coughlin & Gerhart, Re: Remedial investigation report, September 23, 1988.
P. 1973 - 1975	Memorandum to Mr. Brian Davidson, NYSDEC, from Mr. Arthur Newell, NYSDEC, Re: Review of workplans, September 27, 1988. Attachments.
P. 1976	Letter to Mr. Brian Davidson, NYSDEC, from Mr. Mark Gorgos, Coughlin & Gerhart, Re: Remedial investigation report, October 3, 1988.
P. 1977	Letter to Mr. Brian Davidson, NYSDEC, from Ms. Caroline Kwan, U.S. EPA, Re: RI report comments, October 11, 1988.
P. 1978 - 1982	Memorandum to Mr. Brian Davidson, NYSDEC, from Mr. W.J. Webster, NYSDEC, Re: Revised RI report, December 14, 1988. Attachments.
P. 1983 - 1984	Letter to Mr. Mark Gorgos, Coughlin and Gerhart, from Mr. Brian Davidson, NYSDEC, Re: Revised RI report, December 16, 1988.
P. 1985 - 1986	Letter to Mr. Brian Davidson, NYSDEC, from Mr. James Madigan, NYS Department of Health, Re: Comments on Final RI report, December 20, 1988.

P. 1987 - 1992 Memorandum to Mr. Arthur Fossa, NYSDEC, from Mr. Joseph Slack, NYSDEC, Re: Review of RI report, January 6, 1989. Attachments.

P. 1993 - 1994 Memorandum to Mr. Brian Davidson, NYSDEC, from Mr. Joe Kelleher, NYSDEC, Re: Revised Remedial investigation report, January 6, 1989. Attachments.

P. 1995 Memorandum to Ms. Maureen Serafini, NYSDEC, from Mr. Brian Davidson, NYSDEC, Re: Revised RI report, January 9, 1989.

P. 1996 Memorandum to Mr. Brian Davidson, NYSDEC, from Mr. Frank Trent, NYSDEC, Re: Remedial Investigation - Revised, January 9, 1989.

P. 1997 Letter to Mr. Brian Davidson, NYSDEC, from Mr. James Madigan, NY State Department of Health, Re: Project status, January 24, 1989.

P. 1998 - 1999 Letter to Mr. Brian Davidson, NYSDEC, from Mr. Mark Gorgos, Coughlin & Gerhart, Re: RI Report, February 3, 1989.

P. 2000 - 2002 Letter to Mr. John Tomik, O'Brien & Gere, from Mr. Douglas Sheeley, NYTEST Environmental Inc., Re: Data Validation report, May 19, 1989.

P. 2003 Letter to Mr. Brian Davidson, NYSDEC, from Mr. John Tomik, O'Brien & Gere, Re: RI Report, June 5, 1989.

P. 2004 - 2005 Letter to Mr. John Tomik, O'Brien & Gere, from Mr. David Hill, OBG Laboratories Inc., Re: Comments made by NYTEST, June 16, 1989.

P. 2006 Memorandum to Ms. Maureen Serafini, NYSDEC, from Mr. Brian Davidson, NYSDEC, Re: Data validation report, July 6, 1989.

P. 2007 - 2009 Letter to Mr. John Tomlik, O' Brien & Gere, from Mr. Brian Davidson, Re: Town of Conklin landfills, August 22, 1989. Attachments.

P. 2010 Letter to Mr. Brian Davidson, NYSDEC, from Mr. Abram Miko Fayon, U.S. EPA, Re: RI/FS, October 25, 1989.

P. 2011 - 2012 Letter to Mr. Brian Davidson, NYSDEC, from Mr. Mark Gorgos, Coughlin & Gerhart, Re: RI/FS project and EQBA funding, January 31, 1990.

P. 2013 - 2014 Letter to Mr. Mark Gorgos, Coughlin and Gerhart, from Mr. Michael O'Toole, NYSDEC, Re: Town of Conklin Landfill, February 12, 1990.

P. 2015 - 2016 Letter to Mr. Brian Davidson, NYSEDC, from Mr. Mark Gorgos, Coughlin & Gerhart, Re: RI/FS project and EQBA funding, February 31, 1990.

P. 2017 - 2018 Letter to Mr. Mark Gorgos, Coughlin & Gerhart, from Mr. Michael O'Toole, NYSDEC, Re: Town of Conklin Landfills, April 25, 1990.

P. 2019 - 2022 Letter to Mr. Brian Davidson, NYSDEC, from Mr. John Tomlik, O' Brien & Gere, Re: RIFS, May 23, 1990. Attachments.

P. 2023 - 2024 Letter to Mr. Brian Davidson, NYSDEC, from Mr. John Tomlik, O'Brien & Gere, Re: RIFS, June 12, 1990.

P. 2025 Memorandum to Brian Davidson, NYSDEC, from Mr. Joseph Kelleher, NYSDEC, Re: Draft proposed plan, January 2, 1991.

P. 2026 - 2028 Letter to Mr. Joel Singerman, NYSDEC, from Mr. Robert Cozzy, NYSDEC, Re: Draft PRAP, January 4, 1991. Detailed assessment.

P. 2029 Letter to Mr. Brian Davidson, NYSDEC, from Mr. Paul Fox, O'Brien & Gere, Re: Enclosed copies of documents, January 11, 1991.

FEASIBILITY STUDY

CORRESPONDENCE

P. 2030.- 2031 Memorandum to Mr. Raymond Lupe, NYSDEC, from Mr. Brian Davidson, NYSDEC, Re: Comments on a report, March 22, 1985.

P. 2032 - 2033 Letter to Mr. Brian Davidson, NYSDEC, from Mr. John Tomlik, O'Brien & Gere, Re: Data validation report, June 22, 1989.

P. 2034 Letter to Mr. Brian Davidson, NYSDEC, from Mr. John Tomlik, O'Brien & Gere, Re: Feasibility study, October 11, 1989.

P. 2035 Letter to Distribution, from Mr. Brian Davidson, NYSDEC, Re: Draft feasibility study, November 20, 1990.

P. 2036 Letter to Mr. Brian Davidson, NYSDEC, from Mr. John Tomlik, O'Brien & Gere, Re: Draft feasibility study, November 20, 1990.

P. 2037 Letter to Mr. Joel Singerman, U.S. EPA, from Mr. Brian Davidson, NYSDEC, Re: Draft feasibility study, November 28, 1990.

P. 2038 Memorandum to Distribution, from Ms. Debra Hebert, NYSDEC, Re: Scheduled project review, December 13, 1990.

P. 2039 - 2043 Letter to Mr. Brian Davidson, NYSDEC, from Mr. Richard Ramon, U.S. EPA, Re: EPA review of FS, December 13, 1990. Detailed assessment

P. 2044 - 2045 Memorandum to Mr. Brian Davidson, NYSDEC, from Mr. Scott Rodabaugh, NYSDEC, Re: Review of draft FS, December 14, 1990.

P. 2046 Letter to Mr. Robert Cozzy, NYSDEC, from Mr. Joel Singerman, U.S. EPA, Re: Copy of draft proposed plan, December 14, 1990.

P. 2047 Memorandum to Mr. Brian Davidson, NYSDEC, from Mr. Joseph Kelleher, NYSDEC, Re: Review of draft FS, December 14, 1990.

P. 2048 - 2056 Letter to Mr. John Tomlik, O'Brien & Gere, from Mr. Brian Davidson, NYSDEC, Re: Draft feasibility study report, December 17, 1990.

P. 2057 - 2058 Memorandum to Mr. William McCabe, U.S. EPA, from Ms. Dore LaPosta, U.S. EPA, Re: Feasibility study, December 19, 1990.

P. 2059 - 2060 Memorandum to Mr. Joel Singerman, U.S. EPA, from Mr. William Lawler, U.S. EPA, Re: ARAR for FS, December 20, 1990.

P. 2061 - 2065 Letter to Mr. Bill Horrigan, Binghamton - Johnson City Joint Sewage Treatment Plant, from Mr. Paul Fox, O'Brien and Gere, Re: Feasibility of discharging leachate from the landfills, January 7, 1991. Attachments.

P. 2066 - 2067 Memorandum to Mr. Richard Ramon, U.S. EPA, and Mr. Raymond Werner, U.S. EPA, from Ms. Alison Devine, U.S. EPA, Re: Draft feasibility study and draft proposal plan, January 9, 1991.

P. 2068 Memorandum to Mr. Richard Ramon, U.S. EPA, from Mr. Stephen Gould, U.S. EPA, Re: Draft feasibility study, January 10, 1991.

P. 2069 Memorandum to Mr. Joel Singerman, U.S. EPA, from Ms. Dore LaPosta, U.S. EPA, Re: Proposed remedial action plan, January 10, 1991.

P. 2070 - 2071 Memorandum to Mr. William McCabe, U.S. EPA, from Mr. Andrew Bellina, U.S. EPA, Re: Branch review of the Draft Proposed Plan for the Conklin Dump Site, January 10, 1991.

P. 2072 - 2073 Memorandum to Mr. William McCabe, U.S. EPA, from Mr. Andrew Bellina, U.S. EPA, Re: Draft feasibility study, January 14, 1991.

P. 2074 Memorandum to Mr. Joel Singerman, U.S. EPA, from Mr. William Lawler, U.S. EPA, Re: Conklin dump site, January 16, 1991.

P. 2075 Memorandum to Mr. Richard Ramon, U.S. EPA, from Mr. Stephen Gould, U.S. EPA, Re: FS, January 17, 1991.

P. 2076 Memorandum to Mr. Richard Ramon, U.S. EPA, from Mr. Stephen Gould, U.S. EPA, Re: Draft PRAP, January 18, 1991.

P. 2077 Letter to Mr. Ronald Tramontano, New York State Department of Health, from Mr. Stephen Hammond, NYSDEC, Re: Final Proposed Plan, February 7, 1991.

RECORD OF DECISION

CORRESPONDENCE

P. 2078 Memorandum to Ms. Maureen Serafini, NYSDEC, from Mr. Brian Davidson, NYSDEC, Re: Data validation report, July 6, 1989.

STATE COORDINATION

CORRESPONDENCE

P. 2079 - 2080 Letter to Honorable John F. Guinan, Deputy County Executive, from Mr. Langdon Marsh, NYSDEC, Re: Proposed Broome County Industrial Park, May 7, 1985.

P. 2081 - 2082 Letter to Mr. Langdon Marsh, NYSDEC, from Mr. Carl Young, County Executive, Re: Broome County Corporate Park, October 9, 1985.

P. 2083 Letter to Mr. Brian Davidson, NYSDEC, from Ms. Caroline Kwan, U.S. EPA, Re: Transfer to Superfund, March 21, 1989.

P. 2084 Letter to Mr. Phillip Marks, Town of Conklin, from Mr. Brian Davidson, NYSDEC, Re: Amendment 1 to State Assistance contract, April 7, 1989.

P. 2085 - 2086 Memorandum to Mr. Richard Lynch, NYSDEC, from Mr. Michael O' Toole, NYSDEC, Re: Financial information, June 19, 1989.

P. 2087 Letter to Mr. Joel Singerman, U.S. EPA, from Mr. Brian Davidson, NYSDEC, Re: Administrative record file, January 9, 1991.

P. 2088 Letter to Mr. Stephen Hammond, NYSDEC, from Mr. Ronald Tramontano, New York State Department of Health, Re: Enforcement, February 14, 1991.

ENFORCEMENT

CORRESPONDENCE

P. 2089 - 2090 Letter to Mr. John Morelli, NYSDEC, from Ms. Patricia Ingraham, Broome County Department of Planning and Economic Development, Re: Meeting May 8th in Broome County, May 21, 1985.

P. 2091 Letter to Mr. John Morelli, NYSDEC, from Ms. Patricia Ingraham, Broome County Department of Planning and Economic Development, Re: Completion of EIS, May 24, 1985.

P. 2092 - 2094 Memorandum to Mr. David King, NYSDEC, from Mr. Charles Goddard, NYSDEC, Re: Conklin dump, May 30, 1985. Attachments.

P. 2095 - 2096 Letter to Mr. Langdon Marsh, NYSDEC, from Mr. John Guinan, County Executive, Re: Response to letter of May 7, June 6, 1985.

P. 2097 Memorandum to Mr. Ray Lupe, NYSDEC, from Mr. John Morelli, NYSDEC, Re: Consent orders, June 18, 1985.

P. 2098 - 2111 Memorandum to Mr. Langdon Marsh, NYSDEC, from Mr. Norman Nosenchuck, NYSDEC, Re: Negotiation of consent order, July 9, 1985. Attachments

P. 2112 - 2113 Memorandum to Mr. Langdon Marsh, NYSDEC, from Mr. Joseph Forti, NYSDEC, Re: Meeting on August 14, 1985, August 8, 1985.

P. 2114 Letter to Ms. Lynn Wright, U.S. EPA, from Mr. Joseph Forti, NYSDEC, Re: Consent order, January, 23, 1986.

P. 2115 - 2117 Letter to Mr. Joseph Forti, NYSDEC, from Mr. Barry Kogut, Bond, Schoeneck & King, Re: Draft consent order, June 6, 1986.

P. 2118 - 2119 Memorandum to Commissioner Williams, NYSDEC, from Mr. Joseph Forti, NYSDEC, Re; Proposed order on consent, June 8, 1987.

P. 2120 - 2122 Letter to Mr. Eric Schaaf, U.S. EPA, from Mr. David Engel, NYSDEC, Re: Conklin landfill site, June 18, 1987. Attachments.

P. 2123 Letter to Ms. Caroline Kwan, U.S. EPA, from Mr. Joseph Forti, NYSDEC, Re: Order of consent, August 3, 1987.

P. 2124 - 2125 Memorandum to Ms. Janice Corr, NYSDEC, from Mr. Dave Engel, NYSDEC, Re: Reimbursement of 75% of DEC settlement, August 31, 1987. Attachments

P. 2126 - 2129 Letter to Mr. Barry Kogut, Bond, Schoeneck & King, form Mr. Earl Barcomb, NYSDEC, Re: Order of Consent, November 13, 1987. Attachments.

P. 2130 - 2131 Letter to Mr. Mark Gorgos, Coughlin & Gerhart, from Mr. Michael O'Toole, NYSDEC, Re: Town of Conklin Landfills, February 12, 1990.

P. 2132 - 2133 Letter to Mr. Mark Gorgos, NYSDEC, from Mr. Michael O'Toole, NYSDEC, Re: Past disposal activities, April 25, 1990.

P. 2134 Letter to Mr. Michael O'Toole, NYSDEC, from Mr. Mark Gorgos, Coughlin & Gerhart, Re: Letter of April 25, April 26, 1990.

HEALTH ASSESSMENTS

CORRESPONDENCE

P. 2135 Letter to Mr. William Horrigan, Binghamton - Johnson City Joint Sewage Treatment Plant, from Mr. Brian Davidson, NYSDEC, Re: Alternatives to leachate, January 4, 1991.

NATURAL RESOURCES TRUSTEES

CORRESPONDENCE

P. 2136 - 2137 Memorandum to Mr. Brian Davidson,Division of Fish and Wildlife from Mr. Richard Koeppicus, Division of Fish and Wildlife, Re: Draft report feasibility study of Conklin Landfill site, December 11, 1990.

PUBLIC PARTICIPATION

COMMENTS AND RESPONSES

P. 2138 - 2144 Letter to Mrs. Carol Osterhout, Town Clerk, from Mr. Brian Davidson, NYSDEC, Re: Citizen participation plan, May 9, 1989. Attachments.

P. 2145 Article "State calls dump hazardous, will keep funding cleanup." Binghamton Press, Page B-1, May 1, 1990.

P. 2146 Article "Conklin to meet with EPA on dump." Press and Sun Bulletin, Page 3, February 19, 1991.

P. 2147 Article "Conklin to air dump cleanup options today." Press & Sun Bulletin, Page 2B, February 25, 1991.

DOCUMENTATION OF OTHER PUBLIC MEETINGS

P. 2148 - 2149 Summary of Broome Corporate Park Meeting Regarding Environmental issues, August 14, 1985.

FACT SHEETS AND PRESS RELEASES

P. 2150 News Release: NYSDEC, Immediate release. Wednesday, June 17, 1987, Re: Conklin site.

APPENDIX 4 - NYSDEC LETTER OF CONCURRENCE

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233 - 7010

Thomas C. Jorling
Commissioner

Mr. Constantine Sidamon-Eristoff
Regional Administrator
United States Environmental
Protection Agency, Region II
26 Federal Plaza
New York, New York 10278

MAR 2 2 1991

Dear Mr. Sidamon-Eristoff:

RE: Conklin Landfills - Site No. 704013
Record of Decision

The New York State Department of Environmental Conservation has reviewed the Record of Decision for the Conklin Landfills and the Department concurs with the selection of Alternative 2 with Leachate Option B. Alternative 2 with Leachate Option B consists of a landfill cap with leachate collection at the Upper and Lower Landfills, leachate collection wells within the Upper Landfill, discharge of leachate to the sanitary sewer lines, treatment at the Binghamton-Johnson City Joint Sewage Treatment Plant, groundwater monitoring, fencing and deed restrictions. The Department concurs that the Record of Decision adequately documents and justifies the selection of this remedy.

Should the discharge of leachate to the on-site sanitary sewer lines with treatment at the Binghamton-Johnson City Joint Sewage Treatment Plant prove to be impractical, Alternative 2 with leachate Option A would then be implemented. Leachate Option A involves on-site treatment and discharge of treated water to Carlin Creek.

Furthermore, as is documented in the Record of Decision, this site will be subject to five year reviews as required by the Comprehensive Environmental Response, Compensation and Liability Act as amended by the Superfund Amendments and Reauthorization Act.

Sincerely,

Edward O. Sullivan
Deputy Commissioner

cc: K. Callahan, USEPA
G. Pavlou, USEPA
J. Singerman, USEPA

APPENDIX 5 - RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY

Prepared By: Brian H. Davidson
Division of Hazardous Waste Remediation
New York State Department of Environmental Conservation

Conklin Dumps Site Record of Decision - Site No. 704013

A Responsiveness Summary is required by Superfund policy. It provides a summary of citizens' comments and concerns received during the public comment period, and the New York State Department of Environmental Conservation's (NYSDEC) responses to those comments and concerns. All comments summarized in this document will be considered in NYSDEC's and the United States Environmental Protection Agency 's (USEPA) final decision for selection of a remedial alternative for the Conklin Dumps Site.

The public comment period on the Conklin Dumps Site Proposed Plan began on February 4, 1991. The Proposed Plan is attached in Appendix 5.1. A public meeting was held at the Conklin Town Hall at 7:00 pm on February 25, 1991. The public comment period and public meeting were announced in legal notices which appeared in the February 5, 1991 and February 22, 1991 Binghamton Press and Sun-Bulletin attached in Appendix 5.2. A press release was also issued by the NYSDEC, and newspaper articles appeared in the February 19, 1991 and February 25, 1991 Binghamton Press and Sun-Bulletin which provided information on the project and announced the public comment period and public meeting. Residents, interested public, and local officials listed on the contact list in the Citizen Participation Plan for the Conklin Dumps Site were mailed letters to encourage their participation and solicit their comments. The press release, newspaper articles, Citizen Participation Plan and a copy of the letter mailed to residents are attached in Appendix 5.3.

The public comment period closed on March 6, 1991. Attached in Appendix 5.4 is the transcript and attendance list from the public meeting. About 25 people attended the public meeting, including government officials and members of the press. A February 26, 1991 article in the Binghamton Press and Sun-Bulletin summarized the public meeting and is included in Appendix 5.3. The questions asked at the public meeting were adequately answered by the responses given at the public meeting and are included in the attached transcript.

The public meeting lasted about one hour and relatively few questions were raised. One concern that was raised regarded the derivation of the annual operating and maintenance cost estimates for the preferred alternative. In response, it was noted that the operation and maintenance costs include leachate sampling, leachate treatment, five year reviews and an Insurance Fund and Reserve Fund which was estimated at 1 percent (1%) of the Direct Capital Cost. The Reserve Fund could be used to correct problems that could arise. The Reserve Fund may, in fact, not be needed at this site since there is one documented owner of the site (the Town of Conklin), who will be available to take care of any problems. The Insurance Fund will be used for liability insurance. Furthermore, cost estimates in feasibility studies generally assume an accuracy of plus 50 to minus 30 percent.

The other concerns raised at the meeting were primarily requests for clarification or further explanation. These concerns were addressed by NYSDEC and O'Brien and Gere personnel at the meeting and do not require further supplementation in the summary.

Written Comments

The only written comments received were from the Broome County Environmental Management Council (EMC), attached in Appendix 5.5. It is the opinion of the Broome County Environmental Management Council that the preferred alternative is protective of human health and the environment, and the EMC is in support of the feasibility study. The EMC feels that discharge to the on-site sanitary sewer lines and treatment at the Binghamton-Johnson City Joint Sewerage Treatment Plant can be supported, provided the following four conditions are met:

1. chemical composition and concentrations of leachate will not significantly increase over time;

2. organic constituents of the leachate will be effectively detoxified through the Publicly Owned Treatment Works (POTW) biodegradation treatment process (dilution is not an acceptable remedial treatment as it impacts the loading capacity of surface waters);

3. POTW sludge and discharges are not adversely impacted; and

4. storm conditions do not cause untreated leachate to be discharged to surface waters (i.e., the Susquehanna River).

Response

If leachate is discharged to the on-site sewer lines for treatment at the POTW, all of these conditions will be met. The chemical composition and concentrations of leachate will probably not significantly increase over time since the landfill has been closed for 16 years. Nevertheless, leachate will be sampled periodically. Extended dilution oxygen uptake inhibition testing has been performed, and additional testing will be performed to ensure that all the constituents of the leachate will be effectively detoxified through the treatment plant treatment processes. Treatment plant sludge and discharges will be monitored. No adverse impact on sludge or discharges are anticipated. Storm conditions will not cause untreated leachate to be discharged to surface waters since the site will be capped and will include leachate collection systems.

It should be noted that leachate management Option A, on-site treatment, may be employed instead of leachate management Option B, even though all of the above conditions could be met. The USEPA, New York State Department of Health and NYSDEC concur that discharge of leachate to the on-site sanitary sewer lines and treatment at the POTW is the preferred leachate management option. However, the POTW, which is under the control of the Binghamton-Johnson City Sewerage Authority has no obligation to accept the leachate.

APPENDIX C

Feasibility Study
Town of Conklin Landfills Site
Conklin, New York
O'Brien & Gere
January 1991

Report

Feasibility Study Town of Conklin Landfills Site Conklin, New York

Town of Conklin
Conklin, New York

January 1991

O'BRIEN & GERE

002089

REPORT

FEASIBILITY STUDY

TOWN OF CONKLIN LANDFILLS SITE

CONKLIN, NEW YORK

TOWN OF CONKLIN

JANUARY, 1991

O'BRIEN & GERE ENGINEERS, INC.
5000 BRITTONFIELD PARKWAY
SYRACUSE, NEW YORK 13221

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

Page

EXECUTIVE SUMMARY

The Town of Conklin Landfills Site is located in Conklin, New York. The site contains two inactive landfills. These landfills reportedly received municipal and industrial waste between the years of 1964 and 1975. In 1984, the Town of Conklin initiated an investigation of the Site in conjunction with development of the surrounding area for use as an industrial park. In 1987, the Town of Conklin entered into a consent order with New York State. Included in the Consent Order was the framework for the submittal of a Preliminary Report (detailing the status of the ongoing Remedial Investigation), the RI Report, and completion of a Feasibility Study. The RI Report was completed in December, 1988, and was formally approved by the New York State Department of Environmental Conservation (NYSDEC) in February, 1990. This Feasibility Study Report summarizes the Remedial Investigation, and presentes the results of the FS, including the identification or remedial action objectives, development and screening of remedial alternatives, and presents the detailed evaluation of the alternatives which passed the screening. Data from additional field work completed since the RI Report is also contained in this report.

The Feasibility Study was conducted to develop and evaluate remedial alternatives for the Site. The risk assessment conducted as part of the RI concluded that there is no risk to human health or the environment due to site-related exposure to ground water, landfill leachate, or surface water (sediments). However, certain compounds in the ground water and leachate exceed NYS Class GA ground water standards. One ground water plume was identified immediately adjacent to the Upper Landfill. The remedial objectives were therefore based upon Class GA standards and included the following: 1) prevent ingestion of ground water containing site related constituents of concern (chloroethane) at concentrations exceeding Class GA standards, 2) prevent the migration of constituents of concern from the landfill material that could result in ground water concentrations above Class GA standards, and 3) restore the aquifer to concentrations that meet Class GA standards for site-related constituents of concern (chloroethane).

Six remedial alternatives were developed to address the remedial objectives. These alternatives were screened using the criteria of effectiveness, implementability, and cost. As a result of this screening process, four of the six alternatives were carried through to the detailed analysis of alternatives phase of the FS.

During the detailed analysis of alternatives, the four alternatives were evaluated in detail relative to the following nine criteria:

1) overall protection of human health and the environment
2) compliance with ARARs
3) long-term effectiveness and permanence
4) reduction of toxicity, mobility, or volume through treatment
5) short-term effectiveness
6) implementability
7) cost
8) State acceptance
9) community acceptance

Alternative 2 with leachate management option B emerged as the preferred remedial alternative. The alternative includes the following: ground water monitoring, deed restrictions, fencing, capping of the landfills, natural degradation of constituents in ground water, leachate collection through leachate wells (Upper Landfill) and collection trenches (Lower Landfill), and leachate discharge/treatment at a POTW.

SECTION 1 - INTRODUCTION

1.01 Objectives and Overview

A Remedial Investigation/Feasibility Study (RI/FS) has been conducted for the Town of Conklin Landfills Site (Site) in Conklin, New York. The location of the Site is presented in Figure 1. The RI/FS was conducted by O'Brien & Gere Engineers, Inc. (O'Brien & Gere) on behalf of the Town of Conklin, in accordance with an Administrative Order on Consent between the Town of Conklin and the New York State Department of Environmental Conservation (NYSDEC). The results of the RI were documented in the December 1988 RI Report (O'Brien & Gere, 1988) for the Site.

This document presents the FS Report, which sets forth the formulation and evaluation of remedial alternatives for the Site. The FS was conducted in accordance with the Administrative Order on Consent, the USEPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (Interim Final, October 1988a), and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP, 40 CFR Part 300, *Federal Register*, March 8, 1990).

The FS Report is organized into five sections, with accompanying tables, figures, and appendices. A brief overview of these sections follows.

Section 1 summarizes the information contained in the approved RI Report. It presents information about the Site such as its history and environmental conditions. In addition, a discussion of contaminant fate and transport, as well as a summary of the baseline risk assessment is included. Additional field work which has been conducted since the submission of the RI Report is also presented. The additional field work included methane gas monitoring and additional ground water sampling.

Section 2 presents the identification and screening of remedial technologies. Included in this section is the presentation of remedial action objectives, general response actions, and identification of representative process options. The screening of remedial technologies which address the remedial action objectives is also discussed.

Section 3 presents the development and screening of remedial alternatives. In this section, remedial technologies which are applicable to different media are combined into remedial alternatives which address the remedial objectives. This section also documents the screening of alternatives using the criteria of effectiveness, implementability, and cost.

Section 4 presents the detailed evaluation of remedial alternatives which pass the screening phase. Each alternative is evaluated with respect to the following criteria:

- overall protection of human health and the environment;
- compliance with Applicable or Relevant and Appropriate Requirements (ARARs);
- long-term effectiveness and permanence;
- reduction of toxicity, mobility, and volume;
- short-term effectiveness;
- implementability;
- cost;
- state acceptance; and

- community acceptance.

A relative comparison of the alternatives based on the above criteria is also documented. Based on the detailed evaluation of the alternatives, a remedial alternative which is preferred over the others is identified and recommended for implementation.

Section 5 presents the recommended alternative based upon the detailed evaluation of alternatives. The conceptual design of the recommended alternative is also included in this section.

Tables have been prepared to summarize information generated as part of this study.

Figures prepared to help summarize and present key issues are included in the Report.

Appendices include raw data, calculations, or other materials prepared by O'Brien & Gere which support the information presented in the Report.

1.02 Site Background Information

1.02.1 Site Description

The Site consists of two inactive municipal landfills (Upper and Lower) and is located south of Powers Road, approximately one mile north of the Kirkwood Interchange of Interstate Route 81. The two landfills are located within the perimeter of the Broome County Corporate Park (Industrial Park) in Broome County, New York. Figure 2 illustrates the boundaries of the Upper and Lower Landfills and the locations of all boring, well, and sampling locations. The landfills are owned by the Town of Conklin. Information from soil borings, monitoring well borings, and operating history indicate that the refuse in both landfills is primarily municipal solid waste.

The Lower Landfill was operated by the Town of Conklin from 1964 to 1969. The landfill was used to dispose of municipal refuse and is estimated to contain a total fill volume of approximately 32,500 yd^3. Designated wetlands are located in the vicinity of the Lower Landfill, which is located in the east central portion of the Industrial Park. It should be noted that the actual boundaries of the Lower Landfill do not encroach upon the wetlands.

The Upper Landfill was operated by the Town of Conklin from 1969 to 1975, when a closure order was issued by the NYSDEC for the disposal of municipal wastes. The Upper Landfill, located in the west central portion of the Industrial Park, is estimated to contain a total fill volume of approximately 71,900 yd^3 of waste material. Tree cover is adjacent to the west, east, and north sides of the Upper Landfill (O'Brien & Gere, 1988).

1.02.2 Site History

Development of the Site for an Industrial Park was begun in the early 1980's by the Broome County Industrial Development Agency (BIDA). O'Brien & Gere was retained by BIDA to conduct a two phase hydrogeologic investigation of the site, the first phase being completed in March, 1984. The Phase I Hydrogeologic Investigation evaluated the potential for contamination and development limitations of the two inactive landfills located within the proposed Industrial Park. The Phase II Hydrogeologic Investigation was completed in February 1985. These investigations characterized the local hydrogeology and identified the hydrogeologic conditions that would affect development of the Industrial Park (O'Brien & Gere, 1984, 1985).

The hydrogeologic investigations identified the presence of leachate seeps from both landfills. In addition, ground water monitoring wells which were located downgradient from the landfills were shown to contain low levels of contaminants.

In 1985, an RI/FS Work Plan was prepared and submitted to NYSDEC, as requested by the Town of Conklin. In January 1986, the field investigations outlined in the approved Work Plan were begun. In June 1986 the field efforts were completed, but negotiations between the Town and the State on the form of the Consent Order for funding of the project caused delays in finalizing the results of the investigations. Between November 1986 and June 1987, work was suspended pending the renewal and completion of negotiations on the form of a Consent Order.

One requirement of the negotiated Consent Order (NYSDEC, 1987) signed by NYSDEC and the Town was the preparation of a Preliminary Report (O'Brien & Gere, 1987). The Preliminary Report included a review of the data generated to date, proposed supplemental characterization studies, and revisions to the Work Plan as required by the Superfund Amendments and Reauthorization Act (SARA) passed by Congress in October 1986. The RI Report was approved by NYSDEC on February 12, 1990 (NYSDEC, 1990a). This approval was contingent upon the completion of one additional round of ground water sampling, air monitoring at the landfills, and field delineation of the wetlands in the vicinity of the Lower Landfill.

The required round of sampling was completed in June 1990. Ground water samples from both the Upper and Lower Landfills were analyzed for volatile organics (NYSDEC 1989 Analytical Services Protocol) and selected metals. Data summaries for this and all other ground water and/or leachate sampling events can be found in Tables 16 through 21.

The only well found to contain volatile organic compounds above NYS Class GA ground water standards was Well #11 (Upper Landfill). Chloroethane was measured at 68 parts per billion (ppb), and total xylenes at 7 ppb. 1,2 dichloropropane was not positively identified but was suspected at 9 ppb. Further review of the lab data by Data Validation Services concluded that the presence of 1,2 dichloropropane was "very suspect" as the mass spectro data from the sample was missing several fragments found in the standard spectrum (Data Validation Services, Dec. 1990). The types of chemicals identified are consistent with previous sampling data for Well #11. It should be noted that detectable concentrations of acetone and methylene chloride were observed in several of the samples as well as the trip blank and several lab blanks. The presence of acetone and methylene chloride was attributed to laboratory contamination and does not represent ground water contamination. NYSDEC split samples collected at the same time from Well #11 indicated chloroethane at 120 ppb, 1,2 dichloropropane at 3 ppb, total xylenes at 3 ppb, and toluene at 1 ppb (NYSDEC, 1990b). Toluene was not identified in the original sample nor the matrix spike and duplicate matrix spike samples of Well #11.

Only two well samples were identified to contain inorganic contaminants in excess of Class GA ground water standards. Well #9 (Lower Landfill) was found to contain 32.7 ppb of lead. The Class GA ground water standard for lead is 25 ppb. This result is considered to be an anomaly as lead was undetected in all previous samples from this well and was undetected this sampling round for Wells #5 and #8, both located approximately 120 feet from Well #9. It should be noted that the NYSDOH Maximum Contaminant Level (MCL) for lead is 50 ppb.

Well #11 (Upper Landfill) was found to contain 12.1 ppb of cadmium. The NYS MCL for cadmium is 10 ppb. Cadmium was not detected in any of the previous samples from Well #11. Cadmium was also not detected in samples from Wells #38S and #38D which are downgradient from Well #11. The cadmium concentration in the June 1990 sample from Well #11 is the therefore considered anomalous.

Air monitoring for methane was conducted at both the Upper and Lower Landfills in September, 1990. Readings taken every 100 ft around the perimeter of each landfill found no methane gas (see Appendix D).

1.02.3 Site Conditions

1.02.3.1 Site Geology

Shale/siltstone bedrock underlies the entire site, with depth to bedrock varying from 80 feet below the surface of the Upper Landfill to 130 feet below the surface of the Lower Landfill. The bedrock is covered by a varying thickness of glacial till and other glacial deposits as illustrated by the geologic cross section in Figure 3.

The depth of refuse at the Upper Landfill varies from approximately 10 feet to 30 feet. The refuse contained in the Upper Landfill is in direct contact with the underlying glacial till formation except along its east border. The east side of the landfill is underlain by a lens of low permeability silt and fine sand. This silt layer varies in depth from approximately 10 feet to 30 feet and extends downgradient from the base of the refuse.

The depth of refuse at the lower landfill varies from approximately 6 feet to 12 feet. Refuse contained in the Lower Landfill is underlain by sand and gravel glacial outwash. This sand and gravel layer is approximately 20 feet thick and is underlain by the glacial till.

1.02.3.2 Site Hydrogeology

Ground water occurs between 1 and 14 ft below the ground surface except under the Upper Landfill, where ground water is approximately 24 ft below the surface.

The horizontal ground water flow direction beneath the Site is from west to east toward the Susquehanna River. The hydraulic gradient is approximately 0.07 ft/ft in the upland portion of the Site where the Upper Landfill is located. The hydraulic gradient in the lower area of the Site including the Lower Landfill and the sand and gravel outwash is approximately 0.01 ft/ft (see Figure 4). While some ground water may discharge locally into Carlin Creek and the nearby wetlands, most of the ground water from the Site likely discharges to the Susquehanna River.

The upland area encompassing the Upper Landfill is underlain predominantly by glacial till which has a low permeability (2.3 x 10^{-7} to 1.4 x 10^{-4} cm/sec), resulting in an estimated ground water flow velocity of approximately 1.3 x 10^{-4} ft/day to 0.05 ft/day. The Lower Landfill is underlain by outwash sand and gravel which has a relatively high permeability (4.3 x 10^{-4} to 6.0 x 10^{-3} cm/sec). This, when combined with the low flow gradient, results in an estimated ground water velocity beneath the Lower Landfill ranging from 0.05 ft/day to 0.70 ft/day.

1.02.4 Nature and Extent of Contamination

The December 1988 RI Report (O'Brien & Gere, 1988) summarized the data collected during the RI and from previous studies conducted at the Town of Conklin Landfills Site. These data established the basis for completing the site risk assessment and were used in conjunction with the June 1990 ground water data to evaluate remedial options for the Site.

The chemical analytical data resulting from the on-site investigation indicate that ground water at the Upper Landfill contained detectable levels of volatile organics and inorganics (see Tables 17 and 19). It should be noted that most of the contamination was found directly downgradient from the landfill in only one well, Well #11. Only inorganics were found in ground water downgradient from the Lower Landfill (see Table 18). Leachate emanating from both the Upper and Lower Landfills was found to contain detectable levels of volatile organics and inorganics (see Table 21).

1.02.5 Contaminant Fate and Transport

1.02.5.1 Air Pathway

The air pathway for existing Site conditions was identified in the RI Report as non-functional and incomplete. This determination was based upon the low levels of volatile organics detected in the Site ground water and leachate. Air monitoring conducted during the RI, soil vapor monitoring conducted during the Phase I Hydrogeologic Investigation, and methane monitoring conducted in June 1990 confirmed this determination (see Appendix D).

1.02.5.2 Direct Contact Pathway

The direct contact exposure pathway was identified as functional due to the presence of detectable contaminants in the landfill leachate. Under future Site development scenarios, the pathway was considered complete.

1.02.5.3 Surface Water Pathway

The surface water pathway was determined to be non-functional for the Carlin Creek surface waters but functional for the sediments contained in Carlin Creek and the associated wetlands. No detectable contaminants were found in the Carlin Creek waters while arsenic was present in both the Creek sediments and the wetlands sediments. Due to the probable presence of benthic organisms and the possibility of wildlife exposure to leachate runoff, this pathway was considered complete.

1.02.5.4 Ground Water Pathway

This pathway was considered functional due to the presence of Site indicator contaminants in both ground water and leachate samples and the high expected mobility of these contaminants. The pathway was considered complete as some of the detected contaminants could migrate off-site to drinking water wells.

1.02.5.5 Summary

The results of the evaluation of site-related contaminant fate and transport in the study area indicated that three exposure pathways were complete or potentially complete. These pathways were: 1) the ground water pathway for humans, who may consume site-related ground water, 2) the direct contact exposure pathway for humans under a future exposure scenario involving development of the landfill, and 3) the surface water (sediment) pathway for benthic organisms in wetlands adjacent to the landfill.

1.02.6 Baseline Risk Assessment

The RI Report presented a detailed site specific risk assessment which addressed site conditions and exposures. The risk assessment qualitatively and quantitatively evaluated the hazards to human health and the environment at the Landfills Site. The qualitative analysis characterized the potential exposure pathways for functionality and completeness (see above Section 1.02.5 - Contaminant Fate and Transport) while the quantitative analysis determined the risk of the complete pathways.

Under current conditions, the qualitative analysis identified the direct contact transport pathway to be potentially complete if the landfill site was developed. Under a future no action scenario, it was determined that the surface water (sediment) pathway and the ground water pathway would remain complete.

The quantitative analysis evaluated the three transport pathways determined to be complete or potentially complete in the qualitative assessment. The quantitative assessment initially calculated the excess cancer risk posed by ingestion of each carcinogenic site parameter and compared those risks to the USEPA's acceptable range of excess cancer risk. The second part of the quantitative assessment selected site parameters and their concentrations in the site ground water to calculate their chronic daily intakes (CDIs). The CDIs were then compared to Reference Doses (RfDs) as presented by the USEPA (USEPA, 1986). RfDs are equivalent to acceptable daily intake doses. A third approach assessed the risks posed to wildlife by any runoff containing leachate and by the contaminated sediments in Carlin Creek and the wetlands. Finally, the quantitative assessment evaluated direct contact risks posed by landfill leachate for both chronic and sub-chronic exposure scenarios.

The quantitative assessment evaluated intentional ingestion of ground water by humans and dermal contact with leachate by humans. It was determined, based on the evaluation of sample concentrations from the most recent sampling round (January 1988), that neither pathway posed an unacceptable health risk. No conclusions were made regarding the level of risk from the observed concentrations of arsenic in wetlands. This was due to the lack of data concerning the level of risk from the observed concentrations in the surface water sediments. It should be noted that the levels of arsenic observed were well within the expected background levels and may not be derived from landfill activities.

SECTION 2 - IDENTIFICATION AND SCREENING OF TECHNOLOGIES

2.01 Introduction

The objective of this phase of the FS was to identify general response actions and representative process options which may be assembled into a range of treatment and containment alternatives. This phase was the first stage of the development of alternatives process. The technology identification and screening process included the development of remedial action objectives; development of general response actions; identification and screening of remedial technologies and process options; and evaluation of remedial technologies and process options.

2.02 Remedial Action Objectives

Remedial action objectives are specific goals to protect human health and the environment; they specify the contaminant(s) of concern, the exposure route(s), receptor(s), and acceptable contaminant level(s) for each exposure route. These objectives are based on available information and standards such as ARARs and risk-based levels established in the risk assessment.

The risk assessment concluded there is no risk to human health or wildlife due to site-related exposure to ground water, landfill leachate, or surface water (sediments). However, certain compounds in the ground water and leachate exceed NYS Class GA Ground Water Standards. This FS was driven by Class GA standards as opposed to risk-related factors. Chloroethane and total xylenes have been detected at concentrations above Class GA standards at the Upper Landfill. The presence of 1,2 dichloropropane is suspected but not confirmed. Xylenes (7 ppb in

1990) has historically been below or just above the Class GA standard (5 ppb). Chloroethane was observed in ground water at a concentration of 68 ppb in 1990. For the purpose of the FS, chloroethane was considered the constituent of concern at the site. Xylenes and suspected 1,2-dichloropropane are considered insignificant relative to chloroethane. Accordingly, the following remedial action objectives were established for the FS:

Prevent ingestion of ground water containing site-related constituents of concern (chloroethane) at concentrations exceeding Class GA standards.

Prevent the migration of constituents of concern from the landfill material that could result in ground water concentrations above Class GA standards.

Restore the aquifer to concentrations that meet Class GA standards for site-related constituents of concern (chloroethane).

USEPA's *Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites* (USEPA, 1988a) directs that remedial action objectives be presented as estimates or ranges; that is, goals, whether achievable or not, sought through remediation. The remedial action may not attain these objectives. They may be necessarily modified during or after implementation of the remedial action to account for performance of the remedy. Then, institutional controls may be necessary to manage residual contamination. For example, a ground water remedial action may be implemented until remedial action objectives are obtained or until aquifer contaminant levels reach a constant value. At that time, remaining contamination would be managed through institutional controls.

2.03 General Response Actions

General response actions are medium-specific actions which may be combined into alternatives which satisfy the remedial objectives. General response actions for the site ground water include: institutional actions, containment actions, removal actions, treatment actions, and discharge actions. General response actions which may be combined into alternatives that satisfy the remedial objective for the landfill material include: institutional actions, containment actions, removal actions, and treatment actions.

2.04 Identification of Volumes or Areas of Media

Site conditions, the nature and extent of contamination, potential exposure routes, and acceptable exposure levels were taken into consideration to define the volumes or areas of media to be addressed by general response actions. The volume of ground water at the Study Area containing constituents of concern at levels exceeding Class GA standards was estimated to be 1.7 million gallons. The estimated volume of refuse in the Upper Landfill is 71,900 yd^3 and covers an area of approximately 5.5 acres. The estimated volume of fill in the Lower Landfill is 32,500 yd^3 and covers an area of approximately 2.5 acres (O'Brien & Gere, 1988).

2.05 Identification and Screening of Remedial Technologies and Process Options

This step required identification of potentially applicable remedial technology types and process options within each general response action. Process options were screened mainly on the basis of technical implementability. The technical implementability of each identified process option was evaluated with respect to site contaminant information, physical characteristics, volumes of affected media, and probable exposure levels. Technologies and process options identified for the Site are described and screened for technical implementability in Tables 1 and 2. A discussion of remedial technologies and eliminated process options follows.

2.05.1 Ground Water

Remedial technologies identified for the institutional general response action relative to ground water were access restrictions, alternate water supply, and monitoring. As a result of this screening step, development of an alternative water supply was eliminated from consideration since a municipal water supply is already in place. Thus, the ground water institutional general response remedial technologies remaining after this screening step were access restrictions and monitoring.

Potentially applicable remedial technologies for the ground water containment general response action were capping and subsurface barriers. Subsurface barriers, including slurry walls and grout curtains, were not determined to be technically implementable. These technologies need to be keyed into a low permeability unit to be effective. The subsurface conditions at the site are such that a geologic unit with a lower permeability than the surficial till does not exist at reasonable depths. In addition, the use of a slurry wall was screened out on the basis that the existing ground water flow velocity in the vicinity of the Upper Landfill is very low (1.3 x 10^{-4} to 5.0 x 10^{-2} ft/day) and the underlying glacial till has a low permeability. This is evident through the minimal migration of the constituents of concern in the ground water. Little advantage would be gained from the installation of a slurry wall. The grout curtain process option for the subsurface barrier remedial technology was screened out at this step for the same reason and because of the prevailing soil conditions at the site. Little penetration of the grout material would occur in the dense glacial till.

The remedial technology identified for the ground water removal general response action was extraction. All of the ground water removal remedial technologies except injection wells were deemed applicable to this site and were evaluated further. The use of injection wells in conjunction with extraction wells was screened out on the basis that the wells would not be technically feasible due to the low permeability of the glacial till.

Potentially applicable remedial technologies identified for the ground water treatment general response action included physical treatment, chemical treatment, thermal treatment, and biological treatment. Thermal treatment technologies were screened out as they are not appropriate technologies for the treatment of ground water contaminated with low levels of organics. Biological treatment technologies were screened out for the same reason. The precipitation and ion exchange process options were screened out from the chemical treatment technologies due to the organic nature of the ground water contamination. However, precipitation as a pretreatment process for inorganics removal may be necessary as part of the design for technologies such as oxidation, carbon adsorption, and stripping, due to operation and maintenance concerns related to the presence of naturally occurring iron and manganese in the ground water. It is assumed, for the purpose of the FS, that precipitation would be a necessary pretreatment process for metals removal prior to oxidation, carbon adsorption, or air stripping for treatment of organics. Bench scale testing of pre-treatment processes would need to be conducted during design. Reverse osmosis was screened out from the physical treatment remedial technologies as it is not applicable to the low molecular weight organics found in the site ground water.

Potentially applicable remedial technologies identified for the ground water discharge general response action included discharge with prior treatment and discharge without prior treatment. None of the process options associated with these remedial technologies were screened out.

2.05.2 Landfill Material

All of the potentially applicable remedial technologies associated with the landfill material institutional action passed the preliminary screening. These technologies included access restrictions and monitoring.

There were two remedial technologies associated with the landfill material containment general response action: capping and land disposal. All of the process options included under capping were considered to be potentially applicable. Both of the land disposal options were considered potentially applicable to a limited amount of landfill material.

The remedial technology associated with the landfill material removal general response action was excavation. Excavation was considered to be potentially applicable and was retained for further evaluation.

The remedial technologies associated with the general response action for treatment of the landfill material included thermal treatment, chemical/physical treatment, and biological treatment. Examination of the various process options available for the treatment of the landfill material concluded that none were applicable to the Site. This was primarily due to the physical characteristics and content of the landfill material.

2.06 Remedial Technology Process Option Descriptions

A discussion of the remedial technology process options which passed the technology screening phase follows. Treatability testing may be necessary to verify the efficacy of some of these technologies.

2.06.1 Institutional Process Options

The ground water institutional remedial technologies which passed the initial screening included deed restrictions and ground water monitoring. The landfill material institutional remedial technologies which passed the screening included access restrictions (deed restrictions and fencing), and ground water monitoring. A description of the process options which passed the screening follows.

Deed Restrictions

Deed restrictions incorporated into a property deed might include land use restrictions that would preclude the conduct of activities which would expose contaminated materials or impair the integrity of the cap. Restrictions precluding the placement of potable wells at the Site (until such time as the ground water attains Class GA standards) would prevent ingestion of ground water.

Fencing

Fencing would consist of the placement of a fence around the contaminated area to limit access to the site and thereby protect against activities which might adversely affect the integrity of any capping system in place.

Ground Water Monitoring

Ground water monitoring would include periodic sampling and analysis of ground water. Monitoring would provide a means of assessing the condition and the rate of improvement of the ground water.

2.06.2 Containment Process Options

The ground water containment remedial technology which passed the initial screening was capping. The landfill material containment remedial technologies which passed the screening were capping and land disposal. The two process options for on-site land disposal were on-site landfilling and commercial landfilling.

Caps

Capping techniques are used to cover materials. Capping would minimize surface water infiltration, provide for control of erosion, and isolate and contain certain wastes. This would be accomplished by the construction of a relatively impermeable cover over the landfilled material. Caps are typically constructed of clay and soil, asphalt, concrete, or multiple media (multimedia). The construction of a cap at this site would include a limited amount of grading of the side slopes or landfill faces to an acceptable grade.

A multimedia cap will be considered for containment at this site. This was chosen over asphalt and concrete, as the multimedia cap is more resistant to cracking due to settlement. Clay was not chosen because it is not readily available locally.

The multi-media cap would be consistent with 6 NYCRR Part 360-2.15 ("Part 360"). Part 360 requires that when a flexible membrane liner (FML) is used in place of clay, the FML may have a permeability no greater than 1 x 10^{-12} cm/sec. The design requirements contained in the Part 360 standards would be incorporated into the cap design and would include:

- 6 inch topsoil layer (vegetated)
- 24 inch barrier protection layer (soil)
- 40 mil FML
- 12 inch gas venting layer (gravel)
- gas vents extending from the gravel layer to the top of the cap

An additional design feature would be the use of filter fabric on both sides of the FML so as to protect it from stones in both the gas venting layer and the barrier protection layer. Alternatives to a 12-inch gravel gas venting layer may be possible as negligible amounts of methane gas are expected. This should be further evaluated during the remedial design. The minimum final grade of the cap would be 4% and the maximum final grade would be determined by slope stability analysis but in any case would be no greater than 33%. The cap would minimize infiltration by encouraging controlled surface runoff and evapotranspiration.

The cap considered above would also attain the performance requirements for caps at hazardous waste landfills as specified in 40 CFR Part 264.310. These requirements, promulgated under the Resource Conservation and Recovery Act (RCRA), specify that the cap should:

1. Provide long-term minimization of migration of liquids through the closed landfill;
2. Function with minimum maintenance;
3. Promote drainage and minimize erosion or abrasion of the cover;
4. Accommodate settling and subsidence so that the cap's integrity is maintained; and;
5. Have a permeability less than or equal to the permeability of any bottom liner present or natural subsoils present.

The first RCRA performance requirement would be attained by establishing proper slopes for drainage of precipitation, vegetated topsoil to promote evapotranspiration, as well as the installation of a FML with a permeability of 1 x 10^{-12} cm/sec or less. A minimum amount of maintenance would be required for the cap. Maintenance activities would primarily consist of periodic mowing. Proper slopes and the vegetated topsoil would be established to promote drainage and minimize erosion of the cover. It is expected that settling and subsidence has already occurred at the Site landfills due to their age and would not occur in the future. However, FMLs as considered here typically accommodate settling satisfactorily. The permeability of the natural subsoils beneath the landfills ranges from approximately 1.4 x 10^{-4} to 2.3 x 10^{-7} cm/sec at the Upper Landfill to approximately 6.0 x 10^{-3} to 4.3 x 10^{-4} cm/sec at the Lower Landfill. The 40 mil FML considered for the cap would have a permeability of no greater than 1 x 10^{-12} cm/sec. Therefore, the fifth RCRA performance requirement would be attained by the Part 360 design requirement.

On-Site Landfill

On-site landfilling would consist of consolidating the material from both landfills into one of the existing landfills. Placement of 32,500 yd^3 of material contained in the Lower Landfill would be possible at the Upper Landfill without exceeding slope limits for the landfill sides and without having to increase the areal extent of the Upper Landfill. The consolidation scenario would require the excavation, transportation, and placement of the waste material from the Lower Landfill to the Upper Landfill.

Commercial Landfill

Containment of the landfill material in a commercial landfill would involve excavating the landfill material and transporting it to a permitted off-site landfill. The landfill would have to be able to accept approximately 104,400 yd^3 of material. The type of landfill required would be dependent upon the results of Toxicity Characteristic Leaching Procedure (TCLP) analysis of the material to be landfilled.

2.06.3 Removal Process Options

The ground water removal remedial processes which passed the initial screening were extraction wells and subsurface drains (interceptor trenches). The landfill material removal remedial process option which passed the initial screening was excavation. A description of the removal process options which passed the screening follows.

Extraction Wells

Extraction wells are a ground water control technique which uses ground water pumping to collect ground water or alter the direction of ground water movement. Extraction wells would be used at this site to remove ground water with constituents of concern above Class GA standards. Extraction wells may be used with a ground water barrier to reduce the amount of water that requires removal.

Interceptor Trenches

Interceptor trenches consist of buried conduits used to intercept and collect ground water. These subsurface drains create a zone of influence in which ground water flows towards the drain. They can be used to contain or remove a plume or to lower the ground water table. These subsurface drains essentially function like an infinite line of extraction wells by creating a continuous zone of influence in which ground water within this zone flows toward the drain.

Landfill Material Excavation

Landfill material excavation would be required if either of the two landfill material disposal actions were chosen. Landfill material excavation would be accomplished primarily through the use of backhoes and front-end loaders. Additional equipment which may be required include sump pumps, cranes, and bulldozers. Sump pumps would be required to dewater excavations which intercept the water table. Cranes may be required to assist in the removal of large objects if encountered. Bulldozers would be required to regrade the Site after the landfill material has been excavated. Excavation operations would require on-site health and safety monitoring.

2.06.4 Ground Water Treatment Process Options

The ground water treatment technologies which passed the initial screening were chemical treatment (oxidation) and physical treatment (carbon adsorption and stripping). A description of the ground water treatment process options which passed the screening follows.

Carbon Adsorption

Carbon adsorption consists of the adsorption of organic compounds and a limited number of inorganic species onto activated carbon by a surface reaction in which contaminants are attracted to the internal pores of the carbon. Upon saturation, the spent carbon must either be replaced with fresh carbon or regenerated. Regeneration is typically accomplished thermally, resulting in simultaneous destruction of the organic constituents. Carbon adsorption could be used exclusively to remove organics from site ground water, or could be preceded by other treatment methods to remove some organic constituents and thereby reduce the frequency of carbon regeneration or replacement.

Oxidation

In chemical oxidation, the oxidation state of the target compound is raised while the oxidation state of the oxidizing agent is lowered. This results in destruction of the target compound. Ozone and hydrogen peroxide are suitable oxidants for organic contaminants. The removal efficiency of the ozone or hydrogen peroxide oxidation process may be enhanced by combining treatment with ultraviolet radiation. This combined treatment process is an innovative technology being evaluated under the demonstration program of the Superfund Innovative Technology Evaluation (SITE) program. It may be suitable for destruction of dilute organic compounds, including chlorinated hydrocarbons, in water.

Stripping

Stripping is a physical treatment process in which air or steam is used to remove dissolved volatile organic compounds from water. Air stripping involves transferring a dissolved substance from the liquid phase to the gas phase whereas steam stripping is essentially a distillation process in which the volatile compounds are removed from the wastewater as distillate. Stripping may be used as a cost-effective pretreatment step prior to carbon adsorption.

An evaluation of the suitability of a stripper for treatment of a wastewater typically includes an evaluation of the air emissions which would be produced.

2.06.5 Ground Water Discharge Process Options

All ground water discharge process options (treated and untreated) passed the initial technology screening. A description of each discharge process option follows.

Surface Water

Available water bodies located near the site include Carlin Creek and the wetlands located west of the Lower Landfill. Discharge of treated ground water would be to Carlin Creek, due to its proximity to the site. Water quality limits as dictated by NYSDEC would have to be achieved through treatment prior to discharge.

Sanitary Sewer

The industrial park is serviced by sanitary sewers located beneath the road right-of-ways. Treated ground water and/or leachate could be discharged to these sewers as an alternative to injection wells or surface waters. Sufficient system capacity would have to exist and any pre-treatment standards would have to be achieved prior to discharge.

Deep Well Injection

This process would involve injecting untreated ground water and leachate into a deep well. This would be accomplished through a facility with a permit issued by the USEPA.

Publicly Owned Treatment Works (POTW)

Untreated ground water and leachate could be either trucked or discharged to on-site sanitary sewers for subsequent treatment at a POTW. This option would be governed by the availability of treatment capacity and pre-treatment standards. Sanitary sewers located on-site are convenient to both the Upper and Lower Landfills. Ground water and leachate discharged to these sewers would be biologically treated at the Binghamton-Johnson City Joint Sewage Treatment Plant. Biological treatment is possible in this case as sufficient organic nutrients would combined with the ground water and/or leachate to sustain adequate biological activity. It should be noted that leachate compatibility testing has revealed that the leachate found on-site is not inhibitory to typical microorganisms typically found in POTW's (O'Brien & Gere, 1988).

RCRA Facility

Recovered ground water and leachate could be transported to a RCRA facility for treatment and/or disposal. RCRA facilities in New York could treat water containing the constituents of concern. Implementability is dependent upon ground water and leachate volume, transportation requirements, and available facility capacity.

2.07 Evaluation of Process Options

In this step the technology process options considered to be implementable were evaluated in greater detail before selecting one process to represent each type of technology for purposes of remedial alternative development. Process options were evaluated using the criteria of effectiveness, implementability, and cost. Effectiveness refers to: 1) the potential effectiveness of process options in handling the estimated areas or volumes of media and meeting the remediation goals identified in the remedial objectives; 2) the potential impacts to human health and the environment during the construction and implementation phase; and 3) how proven and reliable the process is with respect to the contaminants and conditions at the site. Implementability encompasses both the technical and administrative feasibility of implementing a technology process. Factors including the availability to obtain necessary permits for off-site actions, the availability of treatment, storage, and disposal facilities, and the availability of necessary equipment and skilled workers to implement the technology are addressed. Cost is assessed in the form of relative capital and O & M costs rather than detailed estimates, with each process evaluated as to whether costs are high, medium, or low relative to other process options in the same technology type. An evaluation of each technology process option which passed the initial screening is contained in Tables 3 and 4.

Representative process options were selected for purposes of developing remedial alternatives. It should be noted, however, that the process option actually used to implement remedial action at a site may not be selected until the remedial design phase (USEPA, 1988a). Selected representative process options for use in developing remedial alternatives are identified in Tables 3 and 4. The multimedia cap was chosen as the representative capping process option because it is the least susceptible to cracking and because clay is not readily available locally. On-site landfilling was chosen as the representative landfill material disposal process option, as the possibility of finding a commercial landfill willing to accept such a large volume of waste is unlikely. Extraction wells were chosen as the representative ground water collection process due to their comparatively low capital cost when compared to interceptor trenches. Air stripping was chosen as the ground water and leachate physical treatment representative process due to its effectiveness, simplicity, and cost. Surface water was chosen as the representative discharge with treatment process option because of its simplicity and low O & M costs. Discharge to a POTW was chosen as the representative discharge without treatment process option due to its availability and low O&M costs.

SECTION 3 - DEVELOPMENT AND SCREENING OF REMEDIAL ALTERNATIVES

3.01 Introduction

The objective of this phase of the FS was to develop a range of remedial alternative options which protect human health and the environment. Remedial alternatives were developed by assembling technologies into combinations which address the remedial objectives. The alternatives were then subjected to a screening process to eliminate alternatives that were significantly less implementable or more costly than comparably effective alternatives, and thereby narrowing the list of potential alternatives that would enter the detailed evaluation phase.

3.02 Assembly of Remedial Alternatives

Alternatives were developed by assembling general response actions and the process options chosen to represent the various technology types for each media into combinations which address the site. Typically a range of treatment alternatives are developed, with one or more alternatives that involve containment of the waste, and a no action alternative. Based on the technical infeasibility of the general response actions of landfill material treatment, development of treatment alternatives for the landfill material was not practical for this site.

Six alternatives have been developed for the site. Each are presented in Table 5 and described below.

3.02.1 Alternative 1

Alternative 1 is the no action alternative. The no action alternative is required by the NCP and serves as a benchmark for the evaluation of action alternatives. This alternative would provide for an assessment of the environmental conditions if no remedial actions are implemented. The no action alternative would require implementation of a ground water monitoring program. This program would be used to monitor ground water conditions and provide a data base for future remedial actions should they be required. Five-year reviews would be conducted as required by the NCP due to the fact that the landfilled material would remain on-site. The purpose of the five-year review is to ensure that adequate protection of human health and the environment is maintained.

Alternative 1 would rely upon natural degradation of the constituent of concern (chloroethane) to reduce the concentration of chloroethane in the ground water near Well #11 to below Class GA ground water standards. Sampling data indicate that chloroethane is undergoing degradation as would be expected from pertinent literature (Vogel and McCarty, 1987). A detailed discussion of the degradation process is presented in Appendix A. Chloroethane is a degradation product of trichloroethane. Chloroethane abiotically degrades and was measured in Well #11 at 170 ppb in January, 1988 and 68 ppb in June, 1990. These data, when considered in conjunction with matrix spike and matrix spike duplicate results for chloroethane in June, 1990 (both 78 ppb), result in a first order degradation rate constant between 0.32 and 0.38 $year^{-1}$. This agrees well with the literature value of 0.37 $year^{-1}$ (Vogel and McCarty, 1987). Using the sampling data rate constants, chloroethane levels in the ground water are expected to reach Class GA ground water standards between 7 and 9 years. It should be noted that this estimate assumes no further input of contaminants into the aquifer. Since this alternative does not include capping, the potential exists for future contamination of the aquifer.

3.02.2 Alternative 2

Alternative 2 would provide containment through the installation of caps over the landfill material and leachate collection. Leachate would be managed using one of four options discussed below. Natural degradation processes which are currently active would continue to reduce the concentration of the constituent of concern in ground water. Also included in Alternative 2 would be ground water monitoring, fencing, and deed restrictions. Five-year reviews would be conducted as required by the NCP due to the fact that waste would remain on-site. The purpose of the five-year review is to ensure that the remedy continues to provide adequate protection of human health and the environment.

The capping system which would be used in this alternative is the multimedia cap described in Section 2.06.2. The landfills would be regraded as necessary prior to installation of the caps to establish slopes which would encourage runoff and minimize erosion. The caps would contain the landfill material and minimize infiltration of precipitation into the landfill material.

This would minimize the potential for future contamination of the ground water.

Leachate collection systems would be installed in conjunction with the caps. Leachate generation from the capped landfills was estimated using the USEPA *Hydrologic Evaluation of Landfill Performance (HELP) Model Version 2* (USEPA, 1988b). A discussion of the usage of the HELP model and estimated leachate generation rates over time are presented in Appendix C. Two methods exist for both leachate collection and leachate treatment. Leachate collection would be accomplished by either placing infiltration/collection trenches at the toe of the landfill or leachate collection wells in the center of the landfill. It should be noted that the leachate well method would only be employed for the Upper Landfill. This is because only the Upper Landfill leachate has been found to contain significant concentrations of organics. For purposes of this Feasibility Study, when leachate wells are referred to as the leachate collection method, this means that leachate wells will be used at the Upper Landfill and collection trenches will be used at the Lower Landfill.

The use of leachate collection wells at the Upper Landfill would involve the installation of collection wells within the perched ground water within the fill material. These wells would serve to drain leachate from the saturated waste located above the water table. Leachate wells would provide a more cost-effective method for leachate collection then trenches placed within the waste due to: 1) the depth of the wells may be adjusted by installing removable telescope size wells screens, 2) the amount of leachate removed can be regulated by controlling the flow rates of the pumps within the wells, and 3) the high cost of constructing trenches within the fill, including excavating and removal of contaminated waste, sheeting the sides of the excavation during construction, dewatering the leachate from the excavation and providing for treatment of the leachate that is removed from the excavation.

The depth of the leachate collection wells would extend to the top of the water table, which occurs at a depth of approximately 16 feet below the surface of the landfill. This depth would ensure effective removal of the leachate and protection of human health and the environment based on the following: 1) the wells would effectively remove leachate above the water table that contains high levels of VOCs, 2) because the existing conditions indicate there is not significant impact on the ground water quality, there is no need to pump and treat ground water, 3) due to the low permeability of the subsurface materials and the minimal environmental impacts that have occurred at the Upper Landfill during the last 15 years, it is not anticipated that the future impacts would be worse than what exists today, and 4) pumping ground water beneath the fill could potentially cause environmental impacts by increasing the velocity of ground water flow by increasing the downward vertical gradient.

The use of collection trenches would involve the installation of a trench along the toe of each landfill. This trench would contain a perforated PVC pipe backfilled with crushed gravel. The bottom of the trench would be located at the same elevation as the ground water table. The edge of the cap would be keyed into the outer edge of the collection trench.

Leachate treatment would be accomplished through either an on-site air stripping system or off-site treatment at the Binghamton-Johnson City Joint Sewage Treatment Plant.

The on-site treatment plant would be located adjacent to the Lower Landfill. Leachate collected at the Upper Landfill would be conveyed to the treatment system through a gravity flow pipe. Pretreatment for the removal of iron and manganese would likely be necessary. Bench-scale treatability studies would be necessary during design to evaluate both system performance and potential fouling problems due to metal scaling and/or bacterial growth. It is anticipated that the air stripper would be 10 inches in diameter and 6 feet high. The treatment system would be operated 24 hours per day until the leachate generation rate drops below a practical treatment rate. At that time, leachate would be temporarily stored on-site and the treated by the air stripper whenever sufficient quantities of leachate are accumulated. Treated effluent would be discharged to Carlin Creek.

Off-site treatment at the Binghamton-Johnson City Joint Sewage Treatment Plant would involve discharging leachate into on-site sewers. Leachate collected at the Upper Landfill would be discharged into an 8-inch sanitary sewer located approximately 20 feet west of the Broome Parkway. Leachate collected at the Lower Landfill would be discharged into an 18-inch sanitary sewer located approximately 130 feet west of the northwest corner of the Lower Landfill. Effluent from the sewage treatment plant is discharged to the Susquehanna River.

The leachate collection and leachate treatment methods can be combined to form four distinct leachate management options:

Leachate Option	Collection Method	Treatment Method
A	Leachate Wells	Air Stripping
B	Leachate Wells	Discharge/Treatment at Sewage Treatment Plant
C	Interceptor Trench	Air Stripping
D	Interceptor Trench	Discharge/Treatment at Sewage Treatment Plant

Alternative 2 would rely upon natural degradation of chloroethane in excess of the Class GA ground water standard in the ground water in the vicinity of Well #11. Class GA standards are expected to be attained in approximately 7 to 9 years (see Section 3.02.1 and Appendix A).

Alternative process options potentially suitable for this alternative include: 1) use of an alternative landfill capping system; and 2) on-site treatment of leachate through carbon adsorption.

3.02.3 Alternative 3

This alternative would provide for containment of the landfill material with multimedia caps and leachate collection, collection of ground water containing chloroethane in excess of Class GA standards through extraction well(s), and physical treatment of collected ground water and leachate through on-site air stripping. Treated ground water and leachate would be discharged to Carlin Creek. This alternative would also include ground water monitoring, fencing, and deed restrictions. Five-year reviews would be conducted as required by the NCP due to the fact that waste would remain on-site. The purpose of the five-year review is to ensure that the remedy continues to provide adequate protection of human health and the environment.

The capping system which would be used in this alternative would be the multimedia cap described in Section 2.06.2. The landfill materials would be regraded as necessary prior to installation of the caps to establish slopes which would encourage runoff and minimize erosion. The caps would contain the landfill material and minimize infiltration of precipitation into the landfill material. This would minimize the potential for future contamination of the ground water.

Leachate collection systems would be installed in conjunction with the caps. Leachate generation from the capped landfills was estimated using the USEPA HELP Model (USEPA, 1988b). A discussion of the usage of the HELP Model and estimated leachate generation rates over time are presented in Appendix C. A leachate collection system would be installed around the toe of each landfill and collected leachate would be treated with the ground water.

The ground water extraction system would remove impacted ground water in the vicinity of Well #11 through two extraction wells. The extraction wells would be located between Well #11 and Wells #3 and #4. Using an aquifer thickness of 22 ft, a hydraulic conductivity of 34 gpd/ft^2, and a hydraulic gradient of 0.07 ft/ft, the pumping rate required to achieve a 90 ft radius of influence was calculated to be approximately 7 gpm per well (see Appendix B). This radius of influence for should be large enough to capture all ground water containing chloroethane above Class GA ground water standards. Due to variability in aquifer properties and the lack of information concerning the actual plume width, it is assumed that two wells will be used instead of one.

The ground water extraction system would be operated until such time that the concentration of chloroethane is at or below Class GA standards. The range of time required is estimated to be approximately 7 to 9 years (see Appendix B). It should be noted that this estimate assumes that pumping of the aquifer would have no detrimental effect upon the biological degradation processes which currently occur (see Appendix A). If pumping does adversely effect the degradation process, a worst-case estimate for the time required to achieve remedial objectives is approximately 14 to 24 years.

The ground water and leachate treatment system (stripping) would be located at the Upper Landfill, adjacent to the extraction well. Leachate from the Lower Landfill would be either pumped up to the treatment system or temporarily stored and then transported by a tanker truck to the treatment system. It is anticipated that the air stripper would be 18 inches in diameter and six feet high. The treatment system would be designed to achieve effluent limitations established pursuant to the requirements of the State Pollutant Discharge Elimination System (SPDES) program. Pretreatment for iron and manganese in the ground water and leachate would be required to prevent fouling of the stripping system. A backwash system would also be incorporated into the stripper design so as to remove any fouling that might result from residual metals passing through the stripper. The plant would be operated until the ground water being extracted attained Class GA ground water standards. At that time, leachate would be temporarily stored on-site and then treated by the air stripper whenever sufficient quantities of leachate were accumulated.

Alternate technology process options potentially suitable for this alternative include: 1) ground water extraction through subsurface drains; 2) ground water and leachate treatment through activated carbon adsorption; and 3) use of an alternate landfill capping system.

3.02.4 Alternative 4

This alternative would provide for containment of the landfill material with multimedia caps and leachate collection, collection of ground water containing chloroethane in excess of Class GA standards through extraction well(s), and on-site chemical treatment of collected ground water and leachate utilizing chemical oxidation. Treated ground water and leachate would be discharged to Carlin Creek. This alternative would also include ground water monitoring, fencing, and deed restrictions. Five-year reviews would be conducted as required by the NCP due to the fact that waste would remain on-site. The purpose of the five-year review is to ensure that the remedy continues to provide adequate protection of human health and the environment.

The capping system which would be used in this alternative would be the multimedia cap described in Section 2.06.2. The landfill material would be regraded as necessary prior to installation of the caps to establish slopes which would encourage runoff and minimize erosion. The caps would contain the landfill material and minimize infiltration of precipitation into the landfill material. This would minimize the potential for future contamination of the ground water.

Leachate collection systems would be installed in conjunction with the caps. Leachate generation from the capped landfills was estimated using the USEPA HELP Model (USEPA, 1988b). A discussion of the usage of the HELP Model and estimated leachate generation rates over time can be found in Appendix C. A leachate collection system would be installed around the toe of each landfill and collected leachate would be treated with the ground water.

The ground water extraction system would remove impacted ground water in the vicinity of Well #11 through two extraction wells. The extraction wells would be located between Well #11 and Wells #3 and #4. The estimated pumping rate would be 7 gpm for each recovery well(see Section 3.02.3 and Appendix B). The radius of influence created should be large enough to capture all ground water containing chloroethane above Class GA ground water standards.

The ground water extraction system would be operated until such time that the concentration of chloroethane is at or below Class GA standards. The range of time required is estimated to be approximately 7 to 9 years (see

Appendix B). It should be noted that this estimate assumes that pumping of the aquifer would have no detrimental effect upon the biological degradation processes which currently occur (see Appendix A). If pumping does adversely effect the degradation process, a worst-case estimate for the time required to achieve remedial objectives is approximately 14 to 24 years.

The ground water and leachate treatment system (chemical oxidation) would be located at the Upper Landfill, adjacent to the extraction well. Leachate from the Lower Landfill would be either pumped up to the treatment system or temporarily stored and then transported by a tanker truck to the treatment system. The treatment system would be designed to achieve effluent limitations established pursuant to the requirements of the State Pollutant Discharge Elimination System (SPDES) program. Pretreatment for iron and manganese in the ground water and leachate would be required to prevent fouling of the UV bulbs. The plant would be operated until the ground water being extracted attained Class GA ground water standards. At that time, leachate would be temporarily stored on-site and then treated by the air stripper whenever sufficient quantities of leachate were accumulated.

Alternate technology process options potentially suitable for this alternative include: 1) ground water extraction through subsurface drains; and 2) use of an alternate landfill capping system.

3.02.5 Alternative 5

This alternative would provide for containment of the landfill material with multimedia caps and leachate collection, collection of ground water containing chloroethane in excess of Class GA standards through extraction well(s), and off-site treatment of collected ground water and leachate at a POTW. This alternative would also include ground water monitoring, fencing, and deed restrictions. Five-year reviews would be conducted as required by the NCP due to the fact that waste would remain on-site. The purpose of the five-year review is to ensure that the remedy continues to provide adequate protection of human health and the environment.

The capping system which would be used in this alternative would be the multimedia cap described in Section 2.06.2. The landfill material would be regraded as necessary prior to installation of the caps to establish slopes which would encourage runoff and minimize erosion. The caps would contain the landfill material and minimize infiltration of precipitation into the landfill material. This would minimize the potential for future contamination of the ground water.

Leachate collection systems would be installed in conjunction with the caps. Leachate generation from the capped landfills was estimated using the USEPA HELP Model (USEPA, 1988b). A discussion of the usage of the HELP Model and estimated leachate generation rates over time can be found in Appendix C. A leachate collection system would be installed around the toe of each landfill.

The ground water extraction system would remove impacted ground water in the vicinity of Well #11 through two extraction wells. The extraction wells would be located between Well #11 and Wells #3 and #4. The required pumping rate would be 7 gpm for each well (see Section 3.02.3 and

Appendix B). The radius of influence created should be large enough to capture all ground water containing chloroethane above Class GA ground water standards.

The ground water extraction system would be operated until such time that the concentration of chloroethane is at or below Class GA standards. The range of time required is estimated to be approximately 7 to 9 years (see Appendix B). It should be noted that this estimate assumes that pumping of the aquifer would have no detrimental effect upon the biological degradation processes which currently occur (see Appendix A). If pumping does adversely effect the degradation process, a worst-case estimate for the time required to achieve remedial objectives is approximately 14 to 24 years.

The ground water and leachate would be discharged to on-site sanitary sewers for subsequent treatment at the Binghamton-Johnson City Joint Sewage Treatment Plant. Ground water pumping operations would continue until the ground water attained Class GA standards. At that time, only collected leachate would be discharged to the sanitary sewers.

Alternate technology process options potentially suitable for this alternative include: 1) ground water extraction through subsurface drains; 2) use of an alternate landfill capping system; and 3) use of a deep well injection system or a RCRA facility for ground water and leachate discharge.

3.02.6 Alternative 6

Alternative 6 would provide containment of the landfill materials through consolidation of the Lower Landfill material with the Upper Landfill material at the Upper Landfill site and the installation of a cap over the consolidated material. Leachate collection would be implemented at the Upper Landfill. Leachate would be treated on-site at the Upper Landfill using air stripping. Treated effluent would be discharged to Carlin Creek. Also included in Alternative 6 would be ground water monitoring, fencing, and deed restrictions. Five-year reviews would be conducted as required by the NCP due to the fact that waste would remain on-site. The purpose of the five-year review is to ensure that the remedy continues to provide adequate protection of human health and the environment.

This alternative would involve excavating the material in the Lower Landfill and transporting it to and placing it on the Upper Landfill. Daily cover would be required for open faces during the excavation process. Samples of the Lower Landfill material would have to be analyzed using the Toxicity Characteristic Leaching Procedure (TCLP) test to insure that the material is not hazardous. Any material deemed hazardous would have to be transported off-site to a RCRA facility for treatment and/or disposal. Additionally, dewatering of the landfill excavation would need to be performed in areas where the landfill material is located below the water table. It is assumed for the purpose of the FS that the water would be managed as hazardous and would be discharged to on-site sewers for subsequent treatment at the Binghamton-Johnson City Joint Sewage Treatment Plant.

The capping system which would be used in this alternative would be the multimedia cap described in Section 2.06.2. The consolidated material would be regraded as necessary prior to installation of the cap to establi: slopes which would encourage runoff and minimize erosion. The cap wou contain the landfill material and minimize infiltration of precipitation into tl material. This would minimize the potential for future contamination of th ground water.

Leachate collection systems would be installed in conjunction with th caps. Leachate generation from the capped landfills was estimated using th USEPA HELP Model (USEPA, 1988b). A discussion of the usage of th HELP Model and estimated leachate generation rates over time can be foun in Appendix C. A leachate collection system would be installed around th toe of the Upper Landfill and collected leachate would be treated on-site i an air stripper package treatment plant. Pre-treatment for removal of iro and manganese would likely be necessary. The on-site treatment plant woulc be located adjacent to the Upper Landfill. Treated effluent would be discharged to Carlin Creek. The plant would be operated 24 hours per da until the leachate generation rate drops below a predetermined practica treatment rate. At that time, leachate would be temporarily stored on-site and then treated by the air stripper whenever sufficient quantities of leachate were accumulated.

Alternative 6 would rely upon natural degradation of chloroethane to reduce chloroethane levels to below Class GA standards in the ground water in the vicinity of Well #11. Class GA standards are expected to be attained in approximately 7 to 9 years (see Section 3.02.1 and Appendix A).

Alternative process options potentially suitable for this alternative include: 1) use of an alternative landfill capping system; 2) placing the Lower Landfill material in a commercial landfill; and 3) treatment of leachate through carbon adsorption.

3.03 Screening of Remedial Alternatives

The intent of the screening of alternatives step is to eliminate alternatives that are significantly less implementable or more costly than comparably effective alternatives. The screening is conducted on the basis of effectiveness, ease of implementation, and cost. Alternative 1, the no action alternative, is not subjected to the Screening of Alternatives, but is carried through to the Detailed Analysis of Alternatives.

3.03.1 Effectiveness

The factors included under the criterion of effectiveness are: overall reduction in toxicity, mobility, or volume of the waste; long-term effectiveness and permanence; short-term impacts which the alternatives may pose during implementation; and how quickly protection can be achieved. Alternatives that do not protect human health and the environment to an acceptable degree are not carried through this initial screening, with the exception of the no-action alternative (Alternative 1). Alternatives which provide significantly less effectiveness than other more promising alternatives may also be eliminated. The no-action alternative is carried through to the detailed analysis step as a baseline for comparison with other alternatives, regardless of the degree of protectiveness it offers.

__Alternative 1__

Although Alternative 1 would not include capping of the landfill material or leachate collection, it would likely be effective in degrading the constituent of concern present in the aquifer to levels at or below the New York State Class GA standard through natural degradation, as discussed in Appendix A. Ground water monitoring would be an adequate and reliable method of following conditions in the aquifer. However, the long-term effectiveness and permanence of Alternative 1 is somewhat unknown as the potential for migration of constituents of concern from landfill materials to ground water would still exist.

__Alternative 2__

Alternative 2 would protect human health and the environment through containment of the landfill material and collection and treatment of leachate. Containment would be provided through caps installed over the landfill material. The multimedia capping system would limit infiltration of water by promoting controlled surface runoff and evapotranspiration. Water infiltrating through the vegetative and protective layers of the cap would be intercepted by the impermeable flexible membrane layer and conveyed away from the landfill material.

Leachate collection and treatment would be accomplished through one of four options described in Section 3.02.2. The options which employ leachate collection wells (options A and B) would be more effective than the options which employ interceptor trenches. This is because leachate wells, located in the center of the landfill material, would drain leachate from saturated material more quickly than interceptor trenches located at the edge of the landfill. Both leachate treatment options are equally effective in treating the constituents of concern. However, conveying leachate from the site to the sewage treatment plant does present a slight risk as constituents of concern may leak from sewer lines if they are in poor condition. Likewise, a slight risk is posed by the on-site treatment method as leachate may leak from the piping which conveys leachate from the Upper Landfill to the treatment system.

Deed restrictions would prohibit development of a drinking water well on-site and any activities which would impact the integrity of the caps. Fencing would further protect the integrity of the caps by restricting access to the landfills. Periodic inspection of the cap and maintenance as necessary would provide for long-term effectiveness and permanence of the alternative. This alternative would result in reductions in toxicity, mobility, and volume of the constituents of concern.

Alternative 2 would provide for remediation of ground water associated with the Upper Landfill through natural degradation of the constituent of concern (chloroethane). Sampling data indicate that natural degradative processes will reduce the concentration of chloroethane to below Class GA ground water standards within approximately 7 to 9 years (see Section 3.02.2 and Appendix A).

As standard construction techniques would be utilized, the actions associated with Alternative 2 could be implemented in a relatively short period of time. Short-term impacts would be minimized during construction through the use of dust and erosion control measures and developing health and safety procedures for workers.

<u>**Alternative 3**</u>

Alternative 3 would protect human health and the environment through capping of the landfill materials, collection of leachate and ground water with constituents of concern above Class GA standards, and treatment of leachate and ground water through physical treatment. The multimedia cap would limit infiltration of water by promoting controlled run-off and evapotranspiration of precipitation. Water which infiltrates through the vegetative and support layers would be intercepted by the impermeable flexible membrane liner and conveyed away from the landfill material. The ground water collection system would collect ground water containing chloroethane for subsequent treatment. These measures, in conjunction with the restrictions preventing the installation of wells and activities which would disturb the integrity of the caps, would eliminate the potential for human ingestion of constituents of concern and transport of constituents of concern with the ground water. Fencing would further protect the integrity of the caps by restricting access to the landfills. This alternative would result in reductions in toxicity, mobility, and volume of the constituents of concern. Periodic inspection of the cap and maintenance as necessary, together with operation of the ground water extraction and treatment system, would provide for long-term effectiveness and permanence of this alternative.

The effectiveness of the selected ground water treatment process option should be confirmed through treatability testing during design. If the representative process option (air stripping) is not effective in removing the constituents of concern from ground water and leachate, it is anticipated other standard wastewater treatment technologies would be able to achieve acceptable effluent quality.

Installation of the cap and leachate collection system could be implemented in a relatively short period of time. Ground water treatment is expected to be required for approximately 7 to 9 years (see Appendix B). It should be noted that this estimate assumes that pumping of the aquifer would have no detrimental effect upon the biological degradation processes which currently occur (see Appendix A). If pumping does adversely affect the degradation process, a worst-case estimate for the time required to achieve remedial objectives is approximately 14 to 24 years. However, this alternative would provide protectiveness throughout that time period, as the ground water and leachate containing constituents of concern would be collected and treated, and not allowed to migrate during that time period. Short-term impacts would be minimized during implementation through the use of dust and erosion control measures, by enclosing the ground water and leachate treatment system, and developing health and safety procedures for workers.

Alternative 4

Alternative 4 would protect human health and the environment through capping of the landfill materials, collection of leachate and ground water with constituents of concern above Class GA standards, and treatment of leachate and ground water through chemical treatment. The multimedia cap would limit infiltration of water by encouraging controlled runoff and evapotranspiration of precipitation. Water which infiltrates through the vegetative and support layers would be intercepted by the impermeable flexible membrane liner and conveyed away from the landfill material. The ground water and leachate collection systems would collect ground water and leachate containing constituents of concern for subsequent treatment. These measures, in conjunction with deed restrictions prohibiting well installations and activities which could adversely impact the cap, would prevent transport of constituents of concern by ground water and eliminate the potential for human ingestion of constituents of concern. Fencing would further protect the integrity of the caps by restricting access to the landfills. Alternative 4 would result in reductions in toxicity, mobility, and volume of constituents of concern.

Periodic inspection of the cap and maintenance as necessary, together with operation of the ground water extraction and treatment system, would provide for long-term effectiveness and permanence of Alternative 4.

Installation of the caps and leachate collection system could be implemented in a relatively short period of time. The ground water treatment provided in this alternative would be oxidation. Ground water treatment is expected to be required for approximately 7 to 9 years (see Appendix B). It should be noted that this estimate assumes that pumping of the aquifer would have no detrimental effect upon the biological degradation processes which currently occur (see Appendix A). If pumping does adversely affect the degradation process, a worst-case estimate for the time required to achieve remedial objectives is approximately 14 to 24 years. However, this alternative would provide protectiveness throughout that time period, as the ground water and leachate containing constituents of concern would be collected and treated, and not allowed to migrate during that time period. Short term impacts would be minimized during implementation through the use of dust and erosion control measures, by enclosing the ground water treatment system, and developing health and safety procedures for workers.

Alternative 5

Alternative 5 would protect human health and the environment through collection and off-site treatment and disposal of leachate and ground water with constituents of concern in excess of Class GA standards. Alternative 5 would also provide for containment of the landfill materials. Collected ground water and leachate would be transported via on-site sanitary sewers to the Binghamton-Johnson City Joint Sewage Treatment Plant for subsequent treatment. The multimedia caps would limit infiltration of water by promoting controlled run-off and evapotranspiration of precipitation. These measures, in conjunction with deed restrictions prohibiting well installations and activities which would adversely impact the integrity of the caps, would prevent transport of constituents by ground water and eliminate the potential for human ingestion of constituents of concern. Fencing would further protect the integrity of the caps by restricting access to the landfills. Alternative 5 would result in reductions in toxicity, mobility, and volume of the constituent of concern.

Periodic inspection of the cap and maintenance as necessary, together with operation of the ground water extraction and treatment system, would provide for long-term effectiveness and permanence of Alternative 5.

Installation of the cap and leachate collection system could be implemented in a relatively short period of time. Ground water treatment is expected to be required for approximately 7 to 9 years. It should be noted that this estimate assumes that pumping of the aquifer would have no detrimental effect upon the biological degradation processes which currently occur (see Appendix A). If pumping does adversely affect the degradation process, a worst-case estimate for the time required to achieve remedial objectives is approximately 14 to 24 years. However, this alternative provides protectiveness throughout that time period, as the ground water containing constituents of concern would be collected, and not allowed to migrate during that time period. Short term impacts would be minimized during implementation through the use of dust and erosion control measures and by developing health and safety procedures for workers.

<u>Alternative 6</u>

Alternative 6 would involve containment of the landfill material and collection and treatment of leachate. Containment would be provided through consolidation of the Lower Landfill material onto the Upper Landfill and the installation of a cap over the consolidated material. The multimedia capping system would limit infiltration of water by promoting controlled surface runoff and evapotranspiration. Water infiltrating through the vegetative and protective layers of the cap would be intercepted by the impermeable flexible membrane layer and conveyed away from the landfill material. Leachate would be collected and treated on-site with an air stripping treatment system. Deed restrictions would prohibit development of a drinking water well on-site and activities which would impact the integrity of the cap. Fencing would further protect the integrity of the cap by restricting access to the landfills. Periodic inspection of the cap and maintenance as necessary would provide for long-term effectiveness and permanence of the alternative.

Alternative 6 would provide for remediation of the Upper Landfill aquifer through natural degradation of the constituent of concern (chloroethane). Sampling data indicate that natural degradative processes will reduce the concentration of chloroethane to below Class GA ground water standards within approximately 7 to 9 years (see Section 3.02.2 and Appendix A).

Long-term effectiveness would be achieved as the landfill material would be contained under an impermeable cap, preventing precipitation from migrating through the material. However, it should be noted that, in its current state, the Lower Landfill material poses no unacceptable risks to human health and the environment.

Short-term effectiveness of this remedy is compromised by th excavation operations involved in consolidating the landfill materia Excavation of the materials in the Lower Landfill would result in unnecessar risks to public health and the environment. Although excavation of th landfill material would be technically feasible, it could make material currently contained in the landfill available for: 1) air and surface water transport to uncontaminated on-site areas and off-site receptors, and 2) for potential exposure to on-site workers. Based on these considerations, Alternative 6 is not effective on a short-term basis.

3.03.2 Implementability

Implementability is associated with the degree of difficulty in constructing, operating, and maintaining a particular alternative. The performance of a remedial action is subject to a number of technical, administrative, and logistical issues. These factors are assessed to characterize the implementability of each alternative. An alternative which would be more difficult or time consuming to implement than a comparably effective remedy would not be carried through this initial screening.

Alternative 1

There would be no construction or operation required for implementation of Alternative 1. Ground water monitoring is a reliable method which would indicate changes in aquifer conditions. If the need for further action was identified through ground water monitoring, the FS and Record of

Decision (ROD) process may need to be repeated for the Site. Sampling personnel, equipment, and an analytical laboratory would be readily available.

Alternative 2

Alternative 2 requires the installation of a multimedia cap, fencing, and one of the four leachate management options. Regrading of the landfill material would be required to meet 6 NYCRR Part 360 landfill closure requirements. Construction of the cap and fencing would involve readily implementable standard procedures. While all four of the leachate management options (see Section 3.02.2) would involve readily implementable standard procedures, it should be noted that the installation of collection trenches (options C and D) would require a significantly greater construction effort when compared to installing leachate wells (options A and B). Similarly, installing an on-site leachate treatment system (options A and C) would require a significantly greater construction effort when compared to installing connector lines from the leachate collection system to the on-site sanitary sewers (options B and D). Maintenance and monitoring would be readily implementable. However, maintenance and monitoring efforts for an on-site treatment system (options A and C) would be significantly greater than for options involving only discharge to the on-site sanitary sewers (options B and D).

Alternative 3

The cap, leachate collection system, fencing, ground water extraction well system, and leachate and ground water treatment system required for Alternative 3 are readily implementable. Treatability studies may be necessary to design the leachate and ground water treatment system (air stripping). The construction of the cap and associated regrading would be accomplished using readily implementable standard procedures. Operation, maintenance, and monitoring would be readily implemented.

Alternative 4

Alternative 4 requires installation of a cap, leachate collection system, ground water extraction system, fencing, and leachate and ground water treatment system. The construction activities associated with these actions are readily implementable standard procedures. Design of the leachate and ground water treatment system (oxidation) may be accomplished through the use of treatability studies. Operation, maintenance, and monitoring would be readily implemented.

Alternative 5

Alternative 5 would involve the installation of a cap, leachate collection system, fencing, and ground water extraction system. The construction activities associated with these actions are readily implementable standard procedures. Regrading of the landfill material would be required to meet 6 NYCRR Part 260 landfill closure requirements. Untreated ground water and leachate would be discharged to on-site sewers for subsequent treatment at the Binghamton-Johnson City Joint Sewage Treatment Plant. Maintenance and monitoring would be readily implementable.

Alternative 6

Alternative 6 requires excavation of the Lower Landfill material, consolidation of that material with the Upper Landfill, installation of a multimedia cap, fencing of the site, and construction of a leachate collection and treatment system. The construction activities associated with these actions are readily implementable standard procedures. Design of the leachate treatment system (air stripping) would include the use of treatability studies.

TCLP testing of the Lower Landfill material would be required since material is being move from one location to another. This is due to the Land Disposal Restrictions promulgated 40 CFR Part 268. If the material is found to be hazardous as specified in 40 CFR Part 261, the waste must be treated and/or disposed of in a manner consistent with the Land Disposal Restrictions. This could significantly affect the technical implementability of this remedy as appropriate treatment and/or disposal facilities with sufficient capacity would have to be located.

3.03.3 Cost

The objective of evaluating costs during the screening of alternatives is to make comparative analyses among alternatives based on cost. Cost factors include costs necessary to perform a remedial action, and any operating and maintenance costs associated with an action. Cost is used to eliminate alternatives which provide a similar degree of protectiveness and effectiveness at a significantly greater cost.

Preliminary cost estimates including capital and annual operation and maintenance costs were developed for each alternative, and are included as Tables 6 through 11. Four costs are shown for Alternative 2, representing the present worth cost of implementing the alternative with each of the four leachate management options. A range of costs are shown for the ground water pumping alternatives (3, 4, 5) so as to reflect the more likely case (7 to 9 years) and the worst case (14 to 24 years) for ground water remediation. The 30-year present worth cost estimates for implementing each alternative are as follows:

Alternative	Total Present Worth
1	$111,000
2	$4,559,000 Lecahate Option A $4,352,000 Lecahate Option B $4,644,000 Lecahate Option C $4,423,000 Lecahate Option D
3	$4,859,000 - $4,935,000
4	$5,114,000 - 5,344,000
5	$7,924,000 - $10,893,000
6	$5,218,000

It should be noted that the cost estimate for Alternative 6 assumes none of the material in the Lower Landfill to be hazardous waste. If hazardous waste was found during the excavation procedure, the costs for remediation would increase significantly.

3.03.4 Screening of Alternatives Summary

Remedial Alternatives 2 through 6 would protect human health and the environment through containment, treatment technologies, and/or natural degradation. The remedial objectives would be achieved by each of these alternatives.

A preliminary evaluation found that all of the alternatives would be readily implementable. However, only Alternatives 2 through 5 were found to possess a sufficient degree of effectiveness to pass the screening of alternatives. The excavation operations involved in Alternative 6 could create a significant risk by making previously contained materials available for off-site transport and contamination. Significant risks could also result from exposure of on-site workers and off-site receptors to excavated materials. Considering that the Lower Landfill poses no risks to human health or the environment in its current state, disturbing the material is not justified.

The cost evaluation indicated that the present worth costs for Alternative 5 was extremely high relative to Alternatives 3 and 4 while providing the same level of protectiveness. All three alternatives would include collection and treatment ground water and leachate while capping the landfills to minimize future contamination of the aquifer. It should be noted that although the present worth cost for Alternative 6 may be competitive with other alternatives, the cost for Alternative 6 could significantly increase if the material in the Lower Landfill were found to be hazardous.

Based on composite evaluations, Alternatives 2, 3, and 4 were carried onto the detailed analysis of alternatives along with the no-action alternative, Alternative 1. Alternative 5 was eliminated from further consideration due to its cost. Alternative 6 was eliminated from further consideration due to its low degree of effectiveness and its potential for significantly higher remediation cost.

SECTION 4 - DETAILED ANALYSIS OF ALTERNATIVES

4.01 Introduction

The objective of the detailed analysis is to analyze and present sufficient information to allow decision-makers to adequately compare alternatives and to select a remedy. The analysis is comprised of an assessment of the alternatives against nine evaluation criteria that encompass statutory requirements and includes other gauges of the overall feasibility and acceptability of remedial alternatives. It also includes a comparative evaluation to determine the relative performance of the alternatives and identify major trade-offs among them. The nine criteria are:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance

The preamble to the final NCP (Federal Register, March 1990) categorizes these nine criteria into three groups: threshold criteria, primary balancing criteria, and modifying criteria. The two threshold criteria, overall protection of human health and the environment and compliance with ARARs, must be satisfied in order for an alternative to be eligible for selection. Long-term effectiveness and permanence, reduction of toxicity, mobility, or volume through treatment, short-term effectiveness, implementability, and cost are primary balancing criteria which are used to balance the trade-offs between alternatives. The modifying criteria are state and community acceptance, which are formally considered after public comment is received on the RI/FS report.

The alternatives which passed the screening of alternatives and were subjected to the detailed analysis of alternatives are Alternatives 1, 2, 3, and 4. A summary of the detailed analysis can be found in Table 11.

4.02 Threshold Criteria

4.02.1 Overall Protection of Human Health and the Environment

The analysis of each alternative with respect to overall protection of human health and the environment provides an evaluation of whether the alternative achieves and maintains adequate protection and a description of how site risks are eliminated, reduced, or controlled through treatment, engineering, and institutional controls.

The RI Report concluded that concentrations of contaminants in "the ground water that may be transported downgradient or may be used for drinking are well below those which might constitute an unacceptable health risk, given standard upper bound conservative assumptions regarding ingestion." The RI Report also concluded that direct contact with leachate under worst case potential future exposure conditions (future site development) would not present an unacceptable health risk. The evaluation of potential ecological risks associated with arsenic levels in Carlin Creek sediments was inconclusive as arsenic concentrations were within expected background ranges and data concerning arsenic toxicity to benthic organisms is lacking.

Since the RI Report identified no unacceptable risks to human health and the environment, the primary function of the selected remedial action, as established in the remedial action objectives, would be to restore the ground water to Class GA standards and to prevent future contamination of the ground water above these standards.

Alternative 1

Alternative 1 would provide for natural degradation of constituents of concern in the ground water. Alternative 1 would not include capping of the landfill material or leachate collection. While natural degradation of constituents of concern in ground water could be expected to occur as discussed in Section 3.02.2 and Appendix A, the potential would remain for future migration of constituents of concern from the landfill material.

Alternative 2

Alternative 2 would provide for overall protection of human health and the environment with capping of landfill materials, deed restrictions to prohibit potable use of ground water, and leachate collection and treatment through one of the four leachate management options discussed in Section 3.02.2. Natural degradation is expected to reduce the concentration of the constituent of concern in ground water (chloroethane) to Class GA ground water standards within approximately 7 to 9 years, as discussed in Section 3.02.1 and Appendix A.

Alternative 3

Alternative 3 would provide for overall protection of human health and the environment with capping of landfill materials and leachate collection to prevent migration of constituents of concern from landfill materials to ground water, extraction and treatment of ground water to reduce concentrations of constituents of concern in the aquifer to ground water standards, and deed restrictions to prohibit potable use of ground water. Natural degradation is also expected to act upon constituents of concern in the ground water (see Appendix B). Ground water standards are expected to be achieved within approximately 7 to 9 years.

Alternative 4

Alternative 4 would provide for overall protection of human health and the environment with capping of landfill materials and leachate collection to prevent migration of constituents of concern from landfill materials to ground water, extraction and treatment of ground water to reduce concentrations of constituents of concern in the aquifer to ground water standards, and deed restrictions to prohibit potable use of ground water. Natural degradation is also expected to act upon constituents of concern in the ground water. Ground water standards are expected to be achieved within approximately 7 to 9 years.

4.02.2 Compliance With ARARs

Section 121(d) of CERCLA, as amended by SARA, requires that remedial actions comply with applicable or relevant and appropriate requirements (ARARs) or standards under Federal and State environmental law. Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or circumstance at a CERCLA site. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria or limitations promulgated under Federal or State law, that while not "applicable" to a hazardous substance, pollutant, or contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to that particular site. The requirement to attain State ARARs applies to requirements promulgated under State environmental or facility siting laws which are either more stringent than Federal requirements, or address a chemical, location or action that Federal ARARs do not.

SARA does allow selection of remedies which do not attain all ARARs, provided one or more of six waiver conditions are met and protection of human health and the environment remains assured. The six waiver conditions are:

- fund-balancing (need for protection versus funds availability - only applicable to federally funded projects)
- compliance is technically impractical
- alternative is only an interim action

- compliance will result in greater risk
- previous inconsistency in application of State standards
- alternate method or approach achieves equivalent standards

Alternatives are developed and refined throughout the CERCLA process to ensure either that they would meet all of their respective ARARs or that there is good rationale for waiving an ARAR. There are three types of ARARs: chemical-specific, location-specific, and action-specific ARARs.

Chemical-specific ARARs are usually health- or risk-based numerical values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to the ambient environment. Potential chemical-specific ARARs for this Site are applicable or relevant and appropriate for ground water clean-up standards and surface water discharges of treated ground water and leachate (see Table 13).

Applicable ground water standards are the NYS Class GA Ground Water Quality Standards (6 NYCRR Part 703). These standards are written so as to be the most stringent of:

- Standards listed in 6 NYCRR Part 703.5, *Class GA Ground Water*
- NYS MCLs listed in 10 NYCRR Subpart 5-1, *Public Water Supplies*
- MCLs listed in the Safe Drinking Water Act and 40 CFR Part 141

- Standards listed in 10 NYCRR Part 170, *Sources of Water Supply*

For Site constituents, the following Class GA ground water standards apply:

Compound	Class GA Standard (ppb)	Media
Chloroethane	5	GW
1,2-Dichloropropane	5	Leachate
Total Xylenes	5	GW & Leachate
Toluene	5	Leachate
Chlorobenzene	5	Leachate
Ethylbenzene	5	Leachate
Benzene	Not Detectable	Leachate
Methylene Chloride	5	Leachate

Location-specific ARARs set restrictions on activities based on the characteristics of the Site or immediate environs. The RI Report indicated that the Lower Landfill may encroach upon the 100-year flood plain for the Susquehanna River. However, further research has revealed that the flood plain (see Figure 5) does not extend west of the railroad tracks (US Army Corp. of Engineers, 1968). Available mapping of the landfills indicates that neither landfill infringes upon existing wetlands. However, the Lower Landfill may be within 100 ft of existing wetlands. This is currently being investigated through field delineation of the wetlands. If this is confirmed, the substantive requirements for obtaining a permit to disturb wetlands or areas adjacent to wetlands must be met. Typically, activities occurring adjacent to freshwater wetlands must meet the following three compatibility tests:

1. activity would be compatible with preservation, protection and conservation of the wetland and its benefits;

2. activity would result in no more than insubstantial degradation to, or loss of, any of the wetland; and

3. activity would be compatible with the public health and welfare.

Capping of the Lower Landfill would likely pass these three compatibility tests.

Action-specific ARARs set controls or restrictions on particular types of actions related to management of hazardous substances, pollutants, or contaminants (see Table 14). Proposed actions with potential ARARs include:

- Surface water discharge (Alternatives 2, 3, and 4)
- Capping (Alternatives 2, 3, and 4)
- Ground water monitoring (All alternatives)

Discharge to a surface water body is an action which must be conducted in accordance with the chemical-specific requirements established pursuant to the Clean Water Act. In New York State, the Clean Water Act requirements are implemented by the State Pollutant Discharge Elimination System (SPDES) program (6 NYCRR 750-758). The effluent limitations which are applicable to discharges include State Water Quality Standards based on the receiving stream and technology limitations based on best professional judgement.

In addition, the surface water body being discharged to would be required to meet Ambient Water Quality Standards (AWQS) promulgated under 6 NYCRR Part 701. Carlin Creek would be the receiving stream and is classified as a Class D stream. Class D AWQS are applicable as potential chemical-specific ARARs for the surface water in the creek. Discharges from a treatment system would have to be of sufficient quality so as to not cause contravention of these standards or existing concentrations in Carlin Creek.

Potential air quality ARARs related to capping are the National Ambient Air Quality Standards (NAAQS) for Particulate Matter (40 CFR Part 50). During construction of the cap the landfill would be graded to appropriate slopes. Fugitive emissions would have to be maintained below the NAAQS for particulates.

Another potential ARAR pertaining to capping is the Solid Waste Management Facilities Landfill Closure Criteria (6 NYCRR Part 360 - 2.15). These standards specify design and construction requirements for municipal landfill caps. These standards would be relevant and appropriate to alternatives which call for capping of landfill material.

Potential ARARs also exist for the analytical testing which would be conducted as part of the monitoring actions for each of the alternatives being considered. Guidelines which establish analytical test procedures for the constituents of concern are published in 40 CFR 136.

Potential ARARs relating to air discharges include 6 NYCRR Part 212 and the New York State Air Guide-1. 6 NYCRR Part 212 details emissions controls relating to overall discharge rates for four classes of chemicals. Part 212 states that, for any class of chemical, if the emission rate is less than 1.0 pounds per hour, the degree of air cleaning required shall be specified by the commissioner of the NYSDEC. New York State Air Guide-1 is a guidance document which provides Ambient Guideline Concentrations (AGCs) for specific chemicals. Air Guide-1 states that no further analysis of the emission is required if the in-stack concentration of the constituent of concern, when divided by 100, is less than the AGC for that constituent. Calculations for air stripping of leachate and/or ground water show that, for either situation, both of the above conditions will be met without the use of any control technology (see Appendix E).

Alternative 1

Potential ARARs identified for Alternative 1 include the NYS Class GA Ground Water Quality Standards (6 NYCRR Part 703) and guidelines establishing test procedures for the analysis of pollutants (40 CFR 136). Alternative 1 would rely on natural degradation for compliance with Class GA standards. It is estimated that concentration of the constituent of concern in ground water would be reduced to the Class GA standard in approximately 7 to 9 years, as discussed in Section 3.02.2 and Appendix A. Since Alternative 1 does not include capping and leachate collection, constituents of concern may continue to migrate to ground water and result in excursions above the Class GA standards. The use of USEPA certified CLP analytical facilities would ensure that guidelines establishing test procedures for pollutant analysis would be complied with during the ground water monitoring program.

Alternative 2

Potential ARARs identified for Alternative 2 include the NYS Class GA Ground Water Quality Standards (6 NYCRR Part 703), SPDES program requirements (6 NYCRR Part 750-758), NYS Ambient Water Quality Standards (6 NYCRR Part 701), the NAAQS for particulate matter (40 CFR Part 50), Solid Waste Management Facilities Landfill Closure Criteria (6 NYCRR Part 360-2.15), freshwater wetlands requirements (6 NYCRR Part 663), air emissions standards and guidelines (6 NYCRR Part 212 and New York State Air Guide-1), and guidelines establishing test procedures for the analysis of pollutants (40 CFR 136). Alternative 2 would rely upon natural degradation for compliance with Class GA ground water standards; it is estimated that compliance would be achieved in approximately 7 to 9 years (see Section 3.02.2 and Appendix A). Capping and leachate collection/ treatment would be expected to prevent future ground water impacts from constituents of concern in landfill materials. Leachate treated on-site would be treated to levels which, when discharged to Carlin Creek, would comply with SPDES program requirements and would not cause contraventions of NYS Ambient Water Quality Criteria. Air emissions from on-site leachate treatment operations would not be expected to exceed 1.0 pounds per hour or the AGC's found in Air Guide-1. Fugitive emissions during cap construction would be minimized through the use of dust suppressants and temporary cover, as needed, to comply with the NAAQS for particulates. Capping of the Site would be performed in compliance with 6 NYCRR Part 360-2.15. The use of USEPA certified CLP analytical facilities would ensure that guidelines establishing test procedures for pollutant analysis would be complied with during the ground water monitoring program.

Alternative 3

Potential ARARs identified for Alternative 3 include the NYS Class GA Ground Water Quality Standards (6 NYCRR Part 703), SPDES program requirements (6 NYCRR Part 750-758), NYS Ambient Water Quality Standards (6 NYCRR Part 701), the NAAQS for particulate matter (40 CFR Part 50), Solid Waste Management Facilities Landfill Closure Criteria (6 NYCRR Part 360-2.15), freshwater wetlands requirements (6 NYCRR Part 663), and guidelines establishing test procedures for the analysis of pollutants (40 CFR 136). Class GA standards would be expected to be achieved within approximately 7 to 9 years with extraction and treatment of ground water in excess of standards. It should be noted that this estimate assumes that pumping of the aquifer would have no detrimental effect upon the degradation processes which currently occur (see Appendix A). If pumping does adversely effect the degradation process, a worst-case estimate for the time required to achieve remedial objectives is approximately 14 to 24 years. The cap and leachate collection system in Alternative 3 would be expected to prevent future ground water impacts from constituents of concern in landfill materials. Leachate and ground water would be treated to levels which, when discharged to Carlin Creek, would comply with SPDES program requirements and would not cause contraventions of NYS Ambient Water Quality Criteria. Fugitive emissions during cap construction would be minimized through the use of dust suppressants and temporary cover, as needed, to comply with the NAAQS for particulates. Capping of the Site would be performed in compliance with NYS landfill closure criteria. The use of USEPA certified

CLP analytical facilities would ensure that guidelines establishing test procedures for pollutant analysis would be complied with during the ground water monitoring program.

Alternative 4

Potential ARARs identified for Alternative 4 include the NYS Class GA Ground Water Quality Standards (6 NYCRR Part 703), SPDES program requirements (6 NYCRR Part 750-758), NYS Ambient Water Quality Standards (6 NYCRR Part 701), the NAAQS for particulate matter (40 CFR Part 50), Solid Waste Management Facilities Landfill Closure Criteria (6 NYCRR Part 360-2.15), freshwater wetlands requirements (6 NYCRR Part 668), and guidelines establishing test procedures for the analysis of pollutants (40 CFR 136). Class GA standards would be expected to be achieved within approximately 7 to 9 years with extraction and treatment of ground water in excess of standards. It should be noted that this estimate assumes that pumping of the aquifer would have no detrimental effect upon the degradation processes which currently occur (see Appendix A). If pumping does adversely effect the degradation process, a worst-case estimate for the time required to achieve remedial objectives is approximately 14 to 24 years. The cap and leachate collection system in Alternative 4 would be expected to prevent future ground water impacts from constituents of concern in landfill materials. Leachate and ground water would be treated to levels which, when discharged to Carlin Creek, would comply with SPDES program requirements and would not cause contraventions of NYS Ambient Water Quality Criteria. Fugitive emissions during cap construction would be minimized through the use of dust suppressants and temporary cover, as needed, to comply with the NAAQS for particulates. Capping of the Site would be performed in compliance with NYS landfill closure criteria. The use of USEPA certified CLP analytical facilities would ensure that guidelines establishing test procedures for pollutant analysis would be complied with during the ground water monitoring program.

4.03 Primary Balancing Criteria

4.03.1 Long-Term Effectiveness and Permanence

In evaluating long-term effectiveness and permanence, the magnitude of residual risk remaining from untreated material or treatment residuals at the Site and the adequacy and reliability of controls used to manage untreated materials or treatment residuals are assessed for each alternative.

Alternative 1

Alternative 1 would likely be effective over the long-term in degrading constituents of concern present in the aquifer to levels at or below New York State Class GA standards through natural degradation, as discussed in Appendix A. Ground water monitoring would be an adequate and reliable method of following conditions in the aquifer. However, the long-term effectiveness and permanence of Alternative 1 is somewhat unknown as the potential for migration of constituents of concern from landfill materials to ground water would still exist.

Alternative 2

Implementation of Alternative 2 would provide for long-term effectiveness and permanence. Capping and leachate collection through either wells or collection trenches would minimize the potential for the migration of constituents from the landfill material to ground water. Both on-site treatment through air stripping and off-site treatment at a POTW would be appropriate and dependable treatment methods for leachate. However, transporting leachate from the site to the sewage treatment plant does present a slight risk as constituents of concern may leak from poorly built and/or poorly maintained sewer lines. Likewise, a slight risk is posed by the on-site treatment methods as leachate may leak from the leachate transport line transporting leachate from the Upper Landfill to the treatment system. Natural degradation processes are expected to degrade the constituents of concern present in the aquifer to levels at or below New York State Class GA standards, as discussed in Appendix A. The controls utilized in Alternative 2 would be both adequate and reliable. Deed restrictions and fencing would be adequate and reliable in restricting well development and activities impacting cap integrity. Ground water monitoring would be a suitable and reliable means of following conditions in the aquifer.

Alternative 3

Implementation of Alternative 3 would provide for long-term effectiveness and permanence. Capping and leachate collection would minimize the potential for the migration of constituents of concern from landfill materials to ground water. Concentrations of constituents of concern in the aquifer would be reduced to levels at or below New York State Class GA standards through both extraction and treatment of ground water exceeding standards and natural degradation of constituents of concern (see Appendix B). The controls utilized in Alternative 3 would be both adequate and reliable. With appropriate maintenance, capping and leachate collection would be adequate and reliable containment measures for prevention of migration of constituents of concern from landfill materials. Use of extraction wells would be an appropriate and reliable method of ground water collection at the Site. Air stripping is proven in effectiveness and reliability for constituents of concern. Deed restrictions and fencing would be adequate and reliable in restricting well development and activities impacting cap integrity. Ground water monitoring would be a suitable and reliable means of following conditions in the aquifer.

Alternative 4

Implementation of Alternative 4 would provide for long-term effectiveness and permanence. Capping and leachate collection would minimize the potential for the migration of constituents of concern from landfill materials to ground water. Concentrations of constituents of concern in the aquifer would be reduced to levels at or below New York State Class GA standards through both extraction and treatment of ground water exceeding standards and natural degradation of constituents of concern (see Appendix B). The controls utilized in Alternative 4 would be both adequate and reliable. With appropriate maintenance, capping and leachate collection would be adequate and reliable containment measures for prevention of migration of constituents of concern from landfill materials. Use of extraction wells is an appropriate and reliable method of ground water collection at the Site. Chemical oxidation is expected to be a suitable and dependable treatment method for ground water. Deed restrictions and fencing would be adequate and reliable in restricting well development and activities impacting cap integrity. Ground water monitoring would be a suitable and reliable means of following conditions in the aquifer.

4.03.2 Reduction of Toxicity, Mobility, or Volume Through Treatment

The evaluation of reduction of toxicity, mobility, or volume through treatment addresses the expected performance of treatment technologies employed in each alternative.

Alternative 1

Alternative 1 would not include the use of any treatment method. Concentrations of constituents of concern in ground water would be expected to be reduced, however, through natural degradation processes in the aquifer. The time required to reduce concentrations of constituents in ground water may be increased if the constituents continue to leach from the landfill into the ground water. It should be noted that, in its present state (i.e. not capped), ground water constituents are reducing in concentration. as long as there is no additional input of contaminants from the landfill.

Alternative 2

Alternative 2 includes leachate treatment through either on-site air stripping or off-site activated sludge treatment at the Binghamton-Johnson

City Joint Sewage Treatment Plant. Both treatment methods are irreversible. However, activated sludge treatment would result in the destruction of constituents of concern while air stripping would transfers the constituents from one medium (ground water) to another (air). It should be noted that most of the constituents found in the leachate will photochemically degrade when dispersed in the atmosphere. Concentrations of constituents of concern in ground water would be expected to be reduced through natural degradation processes in the aquifer, and mobility of constituents of concern in the landfill materials would be reduced with capping and leachate collection.

Alternative 3

Alternative 3 would satisfy the statutory preference for treatment with the inclusion of air stripping of ground water and leachate. Air stripping would provide for nearly complete removal of volatile organics in ground water and leachate. It should be noted that most of the constituents found in the leachate and ground water will photochemically degrade when dispersed in the atmosphere. Air stripping is an irreversible treatment method. Minimal levels of residual constituents of concern in treated ground water and leachate and in the aquifer would be further reduced through natural degradation processes. Further, a reduction in the mobility of constituents of concern in landfill materials would be expected with capping and leachate collection.

Alternative 4

Alternative 4 would satisfy the statutory preference for treatment with the inclusion of chemical oxidation of ground water and leachate. Chemical oxidation would provide for nearly complete destruction of volatile organics in ground water and leachate. Chemical oxidation is an irreversible treatment method. Minimal levels of residual constituents of concern in treated ground water and leachate and in the aquifer would be further reduced through natural degradation processes. Further, a reduction in the mobility of constituents of concern in landfill materials would be expected with capping and leachate collection.

4.03.3 Short-term Effectiveness

The short-term effectiveness criterion addresses: 1) the protection of workers and the community during construction and implementation of each alternative, 2) the environmental effects resulting from implementation of each alternative, and 3) the time required to achieve remedial objectives.

Alternative 1

Although the remedial objective concerning prevention of migration of constituents from landfill materials to ground water and prevention of ingestion of ground water would not be achieved through Alternative 1, the remedial objective related to restoration of the aquifer to Class GA standards would likely be attained. This is evidenced by the fact that the concentration of chloroethane at the Upper Landfill is decreasing even though there are no existing controls in place to prevent the migration of constituents from the landfill. Although it would be highly unlikely, the potential would exist for unrestricted installation of potable wells near the Site. Natural degradation processes are expected to reduce concentrations of constituents of concern to ground water standards within approximately 7 to 9 years, as discussed in Section 4.02.1 and Appendix A. If further contamination of the ground water by constituents leaching from the landfill does occur, remedial objectives may not be achieved within 7 to 9 years. Protection of workers during monitoring activities would be achieved through the use of appropriate protective equipment.

__Alternative 2__

Alternative 2 would be effective over the short-term. There would be no significant short-term impacts on the community during remedial actions. Protection of workers during remedial activities would be achieved through the use of appropriate protective equipment. Contaminant transport during cap construction would be minimized through appropriate methods such as dust control. Installation of a cap would significantly reduce generation of additional leachate. It should be noted that existing leachate would be extracted more effectively through the use of leachate wells rather than collection trenches. This is because leachate wells, located in the center of the landfill material, would extract leachate from saturated material more quickly than interceptor trenches located at the edge of the landfill. Both leachate options are equally effective in treating the constituents of concern.

__Alternative 3__

Alternative 3 would be effective over the short-term. There would be no significant short-term impacts on the community environment during remedial actions. Protection of workers during remedial activities would be achieved through the use of appropriate protective equipment. Contaminant transport via fugitive emissions during cap construction would be minimized through appropriate methods such as dust control. Installation of a cap would significantly reduce additional leachate generation. Restoration of the aquifer to ground water standards would likely be achieved within approximately 7 to 9 years through extraction and treatment of ground water, as discussed in Appendix B. It should be noted that this estimate assumes that pumping of the aquifer would have no detrimental effect upon the biological degradation processes which currently occur (see Appendix A). If pumping does adversely effect the degradation process, a worst-case estimate for the time required to achieve remedial objectives is approximately 14 to 24 years. Prevention of the potential for ingestion of ground water would likely be attained following implementation of deed restrictions.

Alternative 4

Alternative 4 would be effective over the short-term. There would be no significant short-term impacts on the community during remedial actions. Protection of workers during remedial activities would be achieved through the use of appropriate protective equipment. Contaminant transport during cap construction would be minimized through appropriate methods such as dust control. Installation of a cap would significantly reduce the generation of additional leachate. Restoration of the aquifer to ground water standards would likely be achieved within approximately 7 to 9 years through extraction and treatment of ground water, as discussed in Appendix B. It should be noted that this estimate assumes that pumping of the aquifer would have no detrimental effect upon the degradation processes which currently occur (see

Appendix A). If pumping does adversely effect the degradation process, a worst-case estimate for the time required to achieve remedial objectives is approximately 14 to 24 years. Prevention of the potential for ingestion of ground water would likely be attained following implementation of deed restrictions.

4.03.4 Implementability

The analysis of implementability involves an assessment of the following factors: the ability to construct and operate technologies, the reliability of technologies, the ease of undertaking additional remedial action, the ability to monitor the effectiveness of each remedy, the ability to obtain necessary approvals from other agencies, and the availability of services, capacities, equipment, materials, and specialists.

Alternative 1

There would be no construction or operation required for implementation of Alternative 1. Ground water monitoring is a reliable method which would indicate changes in aquifer conditions. If the need for further action was identified through ground water monitoring, the FS and ROD process may need to be repeated for the Site. Sampling personnel, equipment, and an analytical laboratory would be readily available.

Alternative 2

The cap and any one of the four leachate management options in Alternative 2 could be readily constructed and maintained. Construction of both leachate wells and leachate collection trenches are also readily implementable standard construction procedures. Construction activities associated with collection trenches will be significantly greater than for leachate wells as trench excavation will involve excavating large amounts of soil, some of which may be saturated with leachate. The on-site air stripping system, if chosen, could be readily installed and operated. Likewise, discharge lines to on-site sewers could be readily installed. If additional remedial action was identified as necessary, a ground water extraction and treatment system could be designed and installed. Operation of the air stripping system, if chosen, could be readily extended if required. The effectiveness of Alternative 2 could be readily monitored; ground water monitoring would indicate changes in aquifer conditions, and discharge monitoring would indicate the effectiveness of on-site treatment. Coordination with local government would be necessary to implement deed restrictions. Sampling equipment, sampling personnel, an analytical laboratory, construction equipment, cap materials, and an air stripping system would be expected to be readily available.

<u>Alternative 3</u>

The cap and leachate collection system in Alternative 3 could be readily constructed and maintained. The extraction system and air stripper could be readily constructed and operated. Capping, leachate collection, extraction, and air stripping are reliable technologies. If additional remedial action was identified as necessary, the ground water extraction system could be extended. Operation of the air stripper could be readily extended if necessary. The effectiveness of Alternative 3 could be readily monitored; ground water monitoring would indicate changes in aquifer conditions, and discharge monitoring would indicate ground water and leachate treatment effectiveness. Coordination with local government would be necessary to implement deed restrictions. Sampling equipment, sampling personnel, an analytical laboratory, construction equipment, cap materials, and drillers would be expected to be readily available. The air stripping technology should be readily obtainable.

<u>Alternative 4</u>

The cap and leachate collection system in Alternative 4 could be readily constructed and maintained. The extraction system and chemical oxidation system could be readily constructed and operated. Capping, leachate collection, extraction, and chemical oxidation are reliable technologies. If additional remedial action was identified as necessary, the ground water extraction system could be extended. Operation of the chemical oxidation system could be readily extended if necessary. The effectiveness of Alternative 4 could be readily monitored; ground water monitoring would indicate changes in aquifer conditions, and discharge monitoring would indicate ground water and leachate treatment effectiveness. Coordination with local government would be necessary to implement deed restrictions. Sampling equipment, sampling personnel, an analytical laboratory, construction equipment, cap materials, and drillers would be expected to be readily available. The chemical oxidation technology should be readily obtainable.

4.03.5 Cost

For the cost analysis, cost estimates are presented for each alternative based on vendor information and quotations, cost estimating guides, and experience. Cost estimates are prepared for the purpose of alternative comparison and are based on information known about the Study Area at the time of the FS. Actual costs of remediation will depend on a number of factors, such as actual site conditions at the time of remediation and results of any treatability studies performed during the remedial design phase. Each cost estimate includes capital costs, annual operation and maintenance costs, and a present worth cost. Four costs are shown for Alternative 2, representing the cost of implementing the alternative with each of the four leachate management options. Capital costs are those required to implement a remedy and include both direct and indirect capital costs. Annual operation and maintenance costs are costs which are expected to be incurred yearly throughout implementation of the remedy. The present worth cost for each alternative has been calculated for the expected duration of the remedy at a 5% discount rate.

Alternative	Capital Cost	O & M Costs	Total Present Worth
1	$0	$ 15,400	$ 111,400
2	$3,257,000	$ 92,900	$4,559,000 Option A
	$3,146,000	$ 86,700	$4,352,000 Option B
	$3,327,000	$93,900	$4,644,000 Option C
	$3,204,000	$ 87,500	$4,423,000 Option D
3	$3,392,000	$111,500	$4,859,000 - $4,935,000
4	$3,481,000	$138,200	$5,114,000 - $5,344,000

4.04 Modifying Criteria

4.04.1 State Acceptance

State acceptance will be addressed in the ROD following the public comment period.

4.04.2 Community Acceptance

Community acceptance will be addressed in the ROD following the public comment period.

4.05 Comparative Analysis of Alternatives

4.05.1 Overall Protection of Human Health and the Environment

Alternatives 2, 3, and 4 would be equally protective of human health and the environment. Capping and leachate collection/treatment in Alternatives 2,3, and 4 would significantly reduce migration of constituents of concern from landfill materials to ground water. Concentrations of constituents of concern in ground water would be reduced to Class GA ground water standards through natural degradation alone (Alternative 2) or both natural degradation and extraction/treatment (Alternatives 3 and 4). Deed restrictions in each of Alternatives 2, 3, and 4 would prohibit potable use of ground water. Alternative 1 may be less protective of human health and the environment than would Alternatives 2, 3, and 4. Although concentrations of constituents of concern in ground water would be reduced to ground water standards through natural degradation, Alternative 1 would not provide for prevention of future migration of constituents of concern from landfill materials to ground water or for prohibition of potable use of ground water.

4.05.2 Compliance With ARARs

ARARs would be attained in Alternatives 2, 3, and 4. Alternative 1 may attain ARARs through degradation of constituents in ground water. However, the potential would exist for future exceedences of ground water standards because future migration of constituents of concern from landfill materials to ground water would not be prevented.

4.05.3 Long-term Effectiveness and Permanence

Alternatives 2, 3, and 4 would be equally effective over the long-term. Each of Alternatives 2, 3, and 4 employ adequate and reliable controls to significantly reduce future migration of constituents of concern from the landfill material to ground water. Alternatives 2, 3, and 4 would remediate ground water to Class GA standards in the same length of time (approximately 7 to 9 years). Alternative 2 would achieve this through natural degradation alone. Alternatives 3 and 4 would achieve this through extraction/ treatment and natural degradation. Alternative 1 would provide for reduction of constituent concentrations in ground water to Class GA standards through natural degradation but would not provide for prevention of migration of constituents from landfill materials to ground water.

4.05.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternatives 3 and 4 would employ irreversible treatment processes combined with natural degradation to provide for a reduction in toxicity of ground water and leachate. However, Alternatives 1 and 2, which involve natural degradation ground water remediation, would achieve the same reduction in toxicity of ground water as

Alternatives 3 and 4, which involve active remediation of ground water. Alternative 2 would treat leachate through either on-site air stripping or off-site treatment at the Binghamton-Johnson City Joint Sewage Treatment Plant (POTW). While air stripping would transfer constituents from the ground water to the atmosphere, treatment at the POTW plant would degrade the constituents. Alternatives 2, 3, and 4 would also provide for a reduction in mobility of constituents in landfill materials through capping.

4.05.5 Short-term Effectiveness

Alternatives 2, 3, and 4 would be equally effective over the short-term. Of the two leachate collection options available for Alternative 2 (leachate wells and leachate collection trenches), leachate wells would collect existing leachate the quickest. The implementation of leachate wells rather than leachate trenches for Alternative 2 would present the least risk to workers as contact with contaminated soil/debris would be minimized. With implementation of Alternatives 2, 3, and 4, there would be no significant short-term impacts on the community, workers, or the environment. Capping would significantly reduce infiltration of precipitation into the fill, thereby precluding the generation of additional leachate; restoration of the aquifer to ground water standards would be accomplished in approximately 7 to 9 years; and prohibition of ingestion of ground water through deed restrictions would be accomplished nearly immediately following implementation. There would be no significant short-term impacts on the community or the environment for Alternatives 2, 3, and 4. With implementation of Alternative 1, there would be no short-term impacts on workers, but there would be potential short-term impacts to the environment and the community. The potential would exist for migration of constituents of concern from landfill materials to ground water and, although highly unlikely, for potable well installation without restriction for Alternative 1.

Restoration of the aquifer to Class GA ground water standards is expected to occur within approximately 7 to 9 years for Alternatives 2, 3, and 4.

<u>4.05.6 Implementability</u>

Each of the technologies included in Alternatives 2, 3, and 4 are reliable and could be readily constructed and operated. Alternatives 3, 4, and the air stripping leachate management option for Alternative 2 would require more construction and operation because they include ground water extraction schemes and/or on-site treatment systems. For leachate collection in Alternative 2, leachate wells would be more easily constructed than collection trenches. Ground water and discharge sampling would provide for monitoring of effectiveness of Alternatives 1, 2, 3, and 4. Coordination with local government would be necessary to implement deed restrictions in Alternatives 2, 3, and 4. Necessary equipment, specialists, materials, and technologies would be readily available for Alternatives 1, 2, 3, and 4. No construction would be required for Alternative 1. Ground water monitoring in Alternative 1 would be reliable and would allow the effectiveness of natural degradation to be observed, but the remedy decision-making process might have to be repeated if further action was identified as necessary.

4.05.7 Cost

Alternative 1, the no action alternative, is the least expensive alternative. Alternative 2 is the least costly of Alternatives 2, 3, and 4, with Alternative 4 being the most costly. Of the four leachate management options for Alternative 2, leachate management option B (leachate wells and discharge of leachate to on-site sewers) would be the least expensive.

4.06 Selection of Recommended Remedial Alternative

The risk assessment conducted during the RI concluded that there were no unacceptable risks to human health or the environment. Therefore, the remedial objectives were based upon ARARs and included attainment of Class GA standards for impacted ground water, prevention of ingestion of ground water above Class GA standards, and prevention of future contamination of ground water. While Alternative 1 (no action) would achieve the first two remedial objectives through deed restrictions and natural degradation, future contamination of the ground water would still be possible through the generation of leachate in the landfills that could enter the ground water.

Alternatives 2, 3, and 4 would achieve the remedial objectives as they would employ both containment (capping) of the landfill material and some method of leachate and ground water remediation. These methods include natural degradation and extraction with air stripping, chemical oxidation, or treatment at a POTW. However, pumping and treating of the ground water provides no significant advantage over natural degradation as both will achieve the remedial objectives in approximately 7 to 9 years. Pumping and treating of contaminated ground water would only serve to increase the cost of remediation. Alternative 2 offers equal protectiveness and is the most cost-effective alternative.

Of the two Upper Landfill leachate collection methods available for Alternative 2, leachate wells would be more effective over the short term, less costly, and more easily implemented than collection trenches. Of the two leachate treatment methods available for Alternative 2, discharge to on-site sewers for treatment at the POTW would be more easily implemented and less costly than treatment on-site through air striping.

Alternative 2 with leachate management option B is the alternative which is recommended for implementation.

SECTION 5 - CONCEPTUAL DESIGN

5.01 Conceptual Design

Remedial Alternative 2 with leachate management option B is recommended for implementation at the Site. This alternative includes capping of the landfills, collection of the leachate through leachate wells (Upper Landfill) and collection trenches (Lower Landfill), discharge of leachate to on-site sewers, natural degradation of impacted ground water, and fencing of the landfills. Deed restrictions, ground water monitoring, and five-year reviews would also be implemented.

Construction activities would be initiated by establishing proper grades on the landfills. This would entail cutting the existing sides of the landfills to slopes of no greater than approximately 33% (1 vertical on 3 horizontal). The top surfaces of the landfills would be regraded to slopes of no less than 4% to provide for proper drainage. Additional clean fill may be necessary to achieve this.

The multimedia cap would then be constructed. Gas vents and leachate collection wells (Upper Landfill) would first be installed, the gravel gas venting layer placed, and a filter fabric layer placed over the gravel. As discussed in Section 2.06.2, the gas venting layer may be changed to account for the fact that little or no methane gas is currently being generated at the landfill. The FML would be placed over the filter fabric, and another layer of filter fabric would be placed on top of the FML. At the Lower Landfill, leachate collection trenches would be lined with filter fabric and filled with gravel. The edge of the Lower Landfill FML would be keyed into the outer edge of the leachate collection trench to prevent runoff from entering the leachate collection system. The edge of the Upper Landfill FML would be keyed into a shallow drainage trench surrounding the perimeter of the landfill. The purpose of this trench would be to collect water draining from the top of the FML and divert it away from the landfill.

Geogrids would be placed on the steeper slopes of the landfills over the second filter fabric layer to prevent the soil barrier layer from sliding off the slope. The soil barrier layer would be placed next, with the topsoil layer being placed on top of that. The topsoil layer would be seeded and mulched to prevent erosion and provide for rapid growth of vegetation.

The leachate management system would be constructed concurrently with the cap. Telescoping well screens would be employed in the Upper Landfill leachate wells so that the depth of the well could be adjusted to compensate for any variations in the water table. Leachate withdrawn from the landfills would be piped to the on-site sewers via pipelines similar in construction to sanitary sewers. These pipelines would contain metering devices to record the amount of leachate being discharged. Following completion of well and pipeline construction, leachate collection would commence.

Site fencing would be installed last. It would consist of six foot high chain link industrial fencing. Property deed restrictions could be imposed at any point during implementation of the remedy. The deed restrictions would include measures to prevent the installation of drinking water wells at the Site, and restrict activities which could affect the integrity of the cap. The monitoring program would be initiated upon completion of the closure activities. The monitoring program would provide data to evaluate the effectiveness of the remedial effort over time, including natural degradation of chloroethane in the ground water. The ground water is expected to comply with NYS Class GA ground water standards in approximately 7 to 9 years (see Appendix A). If it was found that natural degradation was not taking place as anticipated, the feasibility of other more active ground water remediation schemes could be investigated. Five-year reviews would be conducted in accordance with the NCP. Plans of the conceptual designs for the Upper and Lower Landfills are presented in Figures 6 and 7, respectively.

The total 30-year present worth of Alternative 2 with leachate management option B is approximately $4.35 million. This includes a capital cost of $3.15 million and an annual O&M cost of $86,700.

Standard construction methods would be used to implement this alternative. Level C or D protection is expected to be adequate to protect on-site workers during construction.

Respectfully submitted,

O'BRIEN & GERE ENGINEERS, INC.

Steve R. Garver, P.E.
Vice President

Prepared by:

Douglas M. Crawford, P.E., Managing Engineer
Paul D. Fox, Design Engineer
Maureen Salanger, Project Engineer
John C. Tomik, CPG, Managing Hydrogeologist

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Tables

O'BRIEN & GERE

TABLE 1

Town of Conklin Landfills Site
Screening of Technologies and Process Options
GROUNDWATER

General Response Action	Remedial Technology	Process Options	Description	Screening Comments
NO ACTION	None	Not Applicable	No Action	Required for consideration by NCP.
INSTITUTIONAL ACTIONS	Access Restrictions	Deed Restrictions	Well and/or land use restrictions for areas of influence.	Potentially applicable.
	Alternate Water Supply	Municipal Water Supply	Extension of municipal water supply to area of influence	Currently in place
		New Community Well	New uncontaminated well in area of influence	Municipal well currently in place
	Monitoring	Ground Water Monitoring	Monitoring of wells.	Potentially applicable.
CONTAINMENT ACTION	Cap	Clay and Soil	Compacted clay and soil covering contaminated areas.	Potentially applicable.
		Asphalt	Application of a layer of asphalt over contaminated areas.	Potentially applicable.
		Concrete	Application of a concrete slab over contaminated areas.	Potentially applicable.
		Multimedia Cap	A synthetic membrane covered with a protective layer of soil	Potentially applicable.
	Subsurface Barriers	Slurry Wall	Soil or cement bentonite slurry wall enclosing contaminated areas	Provides no significant benefit due to low permeability of glacial till
		Grout Curtain	Pressure injection of grout into soil or rock	Not applicable to glacial till at site due to its low porosity
REMOVAL ACTIONS	Extraction	Extraction Wells	Series of wells to extract contaminated ground water	Potentially applicable
		Extraction/Injection Wells	Injection wells inject uncontaminated water to increase flow to extraction well	Does not provide a significant advantage over extraction wells in glacial till material
		Interceptor Trenches	Perforated pipes in trenches backfilled with media to collect contaminated ground water	Potentially applicable

TABLE 1

Town of Conklin Landfills Site
Screening of Technologies and Process Options

GROUNDWATER

General Response Action	Remedial Technology	Process Options	Description	Screening Comments
TREATMENT ACTIONS	Physical Treatment	Reverse Osmosis	Use of high pressure to force water through a membrane, filtering out contaminants	Not applicable to low molecular weight organics in ground water on site
		Stripping	Mixing large volumes of air or steam with water to promote the transfer of volatile organics	Potentially applicable although metals pretreatment will be required
		Carbon Adsorption	Adsorption of contaminants onto activated carbon	Potentially applicable although metals pretreatment will be required
	Chemical Treatment	Ion Exchange	Exchange of ions between ion exchange resin and water	Not applicable to organic contaminants
		Oxidation	Detoxification of contaminants by oxidation-reduction reactions	Potentially applicable although metals pretreatment will be required
		Precipitation	Alteration of chemical equilibria to reduce contaminant solubility	Not applicable to organic contaminants
	Biological Treatment	Aerobic	Degradation of organic contaminants by aerobic microorganisms	Infeasible for site due to dilute contaminant levels
		Anaerobic	Degradation of organic contaminants by anaerobic organisms	Infeasible for site due to dilute contaminants levels
	Thermal Treatment	Rotary Kiln	Combustion of waste in rotating horizontal cylinder	Infeasible for site due to dilute contaminant levels
		Fluidized Bed	Combustion of waste in a hot sand bed	Infeasible for site due to dilute contaminant levels

TABLE 1

Town of Conklin Landfills Site
Screening of Technologies and Process Options

GROUNDWATER

General Response Action	Remedial Technology	Process Options	Description	Screening Comments
DISCHARGE ACTIONS	With Treatment	Surface Water	Discharge of treated water to a nearby body of water	Potentially applicable
		Injection Wells	Discharge of treated water to the local aquifer	Not applicable to site due to low permeability of glacial till
		Sanitary Sewer	Discharge of treated water to the sanitary sewer	Potentially applicable
	Without Treatment	Deep Well Injection	Discharge of untreated water to a deep well injection system	Potentially applicable
		Publicly Owned Treatment Works	Discharge of untreated water to an off-site POTW	Potentially applicable
		RCRA Facility	Discharge to a RCRA facility for treatment and/or disposal	Potentially applicable

TABLE 2

Town of Conklin Landfills Site
Screening of Technologies and Process Options

LANDFILL MATERIAL

General Response Action	Remedial Technology	Process Options	Description	Screening Comments
NO ACTION	None	Not Applicable	No Action	Required for consideration by NCP.
INSTITUTIONAL ACTIONS	Access Restrictions	Deed Restrictions	Well and/or land use restrictions for areas of influence	Potentially applicable.
		Fencing	Installation of a fence surrounding area of contamination	Potentially applicable.
	Monitoring	Ground Water Monitoring	Monitoring of wells	Potentially applicable.
CONTAINMENT ACTIONS	Cap	Clay and Soil	Compacted clay and soil covering contaminated areas.	Potentially applicable.
		Asphalt	Application of a layer of asphalt over contaminated areas.	Potentially applicable.
		Concrete	Application of a concrete slab over contaminated areas.	Potentially applicable.
		Multimedia Cap	A synthetic membrane covered with a protective layer of soil.	Potentially applicable.
	Land Disposal	On-Site Landfill	Placement of waste in on-site landfill or consolidation of waste on site	Potentially applicable for a limited amount of the waste material.
		Commercial Landfill	Placement of waste in off-site landfill	Potentially applicable for a limited amount of the waste material
REMOVAL ACTION	Removal Action	Excavation	Removal of waste using applicable construction equipment such as: backhoes, cranes, front-end loaders	Potentially applicable for a limited amount of waste

TABLE 2
Town of Conklin Landfills Site
Screening of Technologies and Process Options

LANDFILL MATERIAL

General Response Action	Remedial Technology	Process Options	Description	Screening Comments
TREATMENT ACTIONS	Thermal Treatment	Rotary Kiln	Combustion of waste in rotating horizontal cylinder	Infeasible for the site due to the size, shape, and content of much of the waste material
		Fluidized Bed	Combustion of waste in hot sand bed	Infeasible for the site due to the size, shape, and content of much of the waste material
		In Situ Vitrification	Vitrification in place	Infeasible due to the presence of metal objects in the waste which would short circuit the process
	Chemical/Physical Treatment	Stabilization	Solidification of material	Infeasible for the site due to the size of much of the waste material
		Water/Solvent Wash	Extraction of contaminants from the material	Infeasible for the site due to the texture of much of the waste material
	Biological Treatment	Aerobic	Degradation of organic contaminants by aerobic microorganisms	Infeasible for typical contents of sanitary landfills
		Anaerobic	Degradation of organic contaminants by anaerobic microorganisms	Infeasible for typical contents of sanitary landfills

TABLE 3

Town of Conklin Landfills Site
Evaluation of Process Options

GROUNDWATER

General Response Action	Remedial Technology	Process Options	Effectiveness	Implementability	Cost
NO ACTION	None	Not Applicable*	Does not reduce contamination.	Readily implementable	None
INSTITUTIONAL ACTIONS	Access Restrictions	Deed Restrictions*	Effectiveness depends on continued implementation. Does not reduce contamination or prevent migration.	Readily implementable	Low capital No O & M
	Monitoring	Ground Water Monitoring*	Useful for documenting conditions. Does not eliminate contamination.	Readily implementable	Low capital Medium O & M
CONTAINMENT ACTIONS	Cap	Clay and Soil	Prevents migration of contaminants. Does not eliminate contamination. May crack, but can self heal.	Easily implemented	Moderate capital Low O & M
		Asphalt	Effectively prevents migration of contaminants, but susceptible to cracking.	Easily implemented	Moderate capital Moderate O & M
		Concrete	Effectively prevents migration of contaminants, but is susceptible to cracking.	Easily implemented	Moderate capital High O & M
		Multimedia Cap*	Effectively prevents migration of contaminants. Is least susceptible to cracking and weathering.	Easily implemented	Moderate capital Low O & M
COLLECTION ACTIONS	Extraction	Extraction Wells*	Effective collection methods for small quantities of ground water.	Readily Implementable	Low capital Low O & M
		Interceptor Trenches	Effective for flow interception low flowrate	Readily Implementable	High capital Low O & M

* Representative Process Options

TABLE 3

Town of Conklin Landfills Site
Evaluation of Process Options

GROUNDWATER

General Response Action	Remedial Technology	Process Options	Effectiveness	Implementability	Cost
TREATMENT ACTIONS	Physical Treatment	Carbon Adsorption	Effective treatment for most organic contaminants. Carbon regeneration or disposal required. Effective for removal of organics.	Readily Implementable	Medium capital High O & M
		Stripping*	Effective treatment for volatile organic contaminants. Air pollution control may be required.	Readily Implementable; attainment of air quality limits required	Medium capital Medium O & M
	Chemical Treatment	Oxidation*	Research indicates variable effectiveness in organic reduction. Treatability study required to determine effectiveness. UV/Ozone oxidation considered to be an innovative technology	Readily Implementable	Medium capital Medium O & M
DISCHARGE ACTIONS	With Treatment	Surface Water*	Effective discharge method	Attainment of discharge limits required	Low capital Very Low O & M
		Sanitary Sewer	Effective discharge method.	Implmentability depends upon availability of capacity.	No capital Low O & M
	Without Treatment	Deep Well Injection	Effective discharge method. Does not reduce contamination.	Implementability depends upon availability of facility services.	No capital Moderate O & M
		Publicly Owned Treatment Works*	Effective discharge method.	Attainment of pre-treatment standards required. Available capacity must exist.	No capital Low O & M
		RCRA Facility	Effective discharge method for treatment and/or disposal. Transportation required.	Implementability depends upon availability of facility services.	No capital Moderate O & M

* Representative Process Option

TABLE 4

Town of Conklin Landfills Site
Evaluation of Process Options

LANDFILL MATERIAL

General Response Action	Remedial Technology	Process Options	Effectiveness	Implementability	Cost
NO ACTION	None	Not Applicable*	Does not reduce contamination.	Readily implementable	None
INSTITUTIONAL ACTIONS	Access Restriction	Deed Restrictions*	Effectiveness depends on continued implementation. Does not reduce contamination or prevent migration.	Readily implementable	Low capital No O & M
		Fencing*	Limits damage to any waste containment system	Readily implementable	Low capital Very low O & M
	Monitoring	Ground Water Monitoring*	Useful for documenting conditions. Does not eliminate contamination.	Readily implementable	Low capital Medium O & M
CONTAINMENT ACTIONS	Cap	Clay and Soil	Prevents migration of contaminants. Does not eliminate contamination. May crack, but can self heal.	Easily implemented	Moderate capital Low O & M
		Asphalt	Effectively prevents migration of contaminants, but susceptible to cracking.	Easily implemented	Moderate capital Moderate O & M
		Concrete	Effectively prevents migration of contaminants, but is susceptible to cracking.	Easily implemented	Moderate capital High O & M
		Multimedia Cap*	Effectively prevents migration of contaminants. Is least susceptible to cracking and weathering.	Easily implemented	Moderate capital Low O & M
	Land Disposal	On-Site Landfill*	Effectively contains waste materials. Does not eliminate contamination.	Easily implemented for limited quantities of waste.	Moderate capital Low O & M
		Commercial Landfill	Effectively contains waste materials. Does not eliminate contamination.	Easily implemented for limited quantities of waste.	High capital No O & M
REMOVAL ACTION	Removal Action	Excavation	Effectively removes landfilled waste material.	Implementability is a function of material to be excavated. Implementability is questionable for municipal waste.	Moderate capital No O & M

*Representative Process Option

Table 5
Town of Conklin Landfills Site
Remedial Alternatives

General Response Action	Technology	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6
No Action	No Action	✓					
Institutional Actions	Monitoring (Ground Water)	✓	✓	✓	✓	✓	✓
	Fencing		✓	✓	✓	✓	✓
	Deed Restrictions		✓	✓	✓	✓	✓
Containment Actions	Cap (Multimedia)		✓	✓	✓	✓	✓
	Land Disposal On-Site (Consolidation)						✓
Collection Actions	Excavation of Landfill Material						✓
	Ground Water Extraction (Wells)			✓	✓	✓	
Leachate/ Ground Water Treatment Actions	Physical Treatment (Stripping)		✓[1]	✓			
	Chemical Treatment (Oxidation)				✓		
Discharge Action	With Treatment (Surface Water)		✓[1]	✓	✓		✓
	Without Treatment (POTW)		✓[1]			✓	

1) Treatment/discharge method(s) chosen depends upon leachate management option chosen (see Section 3.02.2).

TABLE 6

TOWN OF CONKLIN LANDFILLS SITE

Cost Estimate - Alternative 1
No Action Alternative

ANNUAL OPERATING AND MAINTENANCE COSTS

Item	Quantity	Units	Unit Cost	Total Cost
Groundwater sampling	8	mandays	$350	$2,800
Sample analysis	24	samples	$110	$2,640
Five-Year Review	Lump Sum	Lump Sum	$10,000	$10,000
		Estimated Annual Operating and Maintenance Costs		$15,440
	PRESENT WORTH OF ANNUAL OPERATING & MAINTENANCE COST FOR 30 YRS (i=5%)			$111,446
		REMEDIAL ALTERNATIVE 1 TOTAL ESTIMATED COST		$111,446

Cost information sources include:
O'Brien & Gere Engineers, Inc. - Professional Experience

TABLE 7

TOWN OF CONKLIN LANDFILLS SITE

Cost Estimate - Alternative 2
Multi-Media Cap On Both Landfills, Leachate Management

LEACHATE MANAGEMENT OPTIONS:

- A COLLECTION WITH LEACHATE WELLS, ON-SITE TREATMENT THROUGH AIR STRIPPING
- B COLLECTION WITH LEACHATE WELLS, DISCHARGE/TREATMENT AT POTW
- C COLLECTION WITH INTERCEPTOR TRENCHES, ON-SITE TREATMENT THROUGH AIR STRIPPING
- D COLLECTION WITH INTERCEPTOR TRENCHES, DISCHARGE/TREATMENT AT POTW

DIRECT CAPITAL COSTS

Item	Quantity	Units	Unit Cost	TOTAL COST, EMPLOYING LEACHATE MANAGEMENT OPT			
				A	B	C	D
SITE PREPARATION							
Clearing and Grubbing Landfill Area	8.4	Acres	$5,000	$42,000	$42,000	$42,000	$42,
Miscellaneous Site Grading	30,000	CY	$5	$150,000	$150,000	$150,000	$150,
CAP MATERIALS AND INSTALLATION							
Buy/Haul/Place 1 ft. Gas Venting Layer	13,600	CY	$25	$340,000	$340,000	$340,000	$340,
Buy/Place 10 oz. Filter Fab. (beneath FML)	384,000	SF	$0.30	$115,200	$115,200	$115,200	$115,
Buy/Place 40 mil VLDPE FML	384,000	SF	$0.45	$172,800	$172,800	$172,800	$172,
Buy/Place 10 oz. Filter Fab. (over FML)	384,000	SF	$0.30	$115,200	$115,200	$115,200	$115,
Buy/Place Geogrids (Tensar UX1600)	125,000	SF	$1.05	$131,250	$131,250	$131,250	$131,
Buy/Place Filter Fabric Layer	384,000	SF	$0.30	$115,200	$115,200	$115,200	$115,
Buy/Haul/Place Barrier Protection Layer	27,100	CY	$12	$325,200	$325,200	$325,200	$325,
Buy/Haul/Place Topsoil	6,800	CY	$17	$115,600	$115,600	$115,600	$115,6
Buy/Place Seed, Fertilizer, and Mulch	40,700	SY	$1	$40,700	$40,700	$40,700	$40,7
Buy/Place Gas Vents	13	Each	$500	$6,500	$6,500	$6,500	$6,5
Proof Rolling	8.4	Acres	$1,000	$8,400	$8,400	$8,400	$8,4
Cap Quality Assurance/Quality Control	Lump Sum	Lump Sum	$150,000	$150,000	$150,000	$150,000	$150,
Buy/Build Leachate Trench Collect. System	Lump Sum	Lump Sum	Variable	$70,000	$70,000	$135,000	$135,
Buy/Build Leachate Well Collection System	90	VF	$150	$13,500	$13,500	$0	
Buy/Install Leachate Well Pumps/Controls	Lump Sum	Lump Sum	$5,000	$5,000	$5,000	$0	
LEACHATE TREATMENT SYSTEM							
Buy/Install Equipment Building	Lump Sum	Lump Sum	$25,000	$25,000	$0	$25,000	
Buy/Install Leachate Pretreatment System	Lump Sum	Lump Sum	$54,000	$54,000	$0	$54,000	
Buy/Install Leachate Air Stripping System	Lump Sum	Lump Sum	$32,000	$32,000	$0	$32,000	
Buy/Build Leachate Discharge Lines	2800	LF	$8.00	$0	$22,400	0	$22,4
OTHER COSTS							
Site Fencing	6,200	LF	$10	$62,000	$62,000	$62,000	$62,
Miscellaneous Site Improvements	Lump Sum	Lump Sum	$31,000	$25,000	$31,000	$25,000	$25,
Safety Program	Lump Sum	Lump Sum	$56,500	$56,500	$56,500	$56,500	$56,5
Dust Control	Lump Sum	Lump Sum	$10,000	$10,000	$10,000	$10,000	$10,
Off-Site Drainage Control	Lump Sum	Lump Sum	$5,000	$5,000	$5,000	$5,000	$5,
Equipment Decontamination	Lump Sum	Lump Sum	$6,000	$6,000	$12,000	$6,000	$12,
Mobilization/Demobilization	Lump Sum	Lump Sum	Variable	$54,000	$54,000	$56,000	$54,
	Estimated Direct Capital Cost			$2,246,050	$2,169,450	$2,294,550	$2,209,
INDIRECT CAPITAL COSTS							
Contingency Allowance (25%)				$561,513	$542,363	$573,638	$552,4
Engineering Fees (15%)				$336,908	$325,418	$344,183	$331,4
Legal Fees (5%)				$112,303	$108,473	$114,728	$110,4
	Estimated Indirect Capital Cost			$1,010,723	$976,253	$1,032,548	$994,4
	TOTAL ESTIMATED CAPITAL COST			$3,256,773	$3,145,703	$3,327,098	$3,204,4

TABLE 7

TOWN OF CONKLIN LANDFILLS SITE

Cost Estimate - Alternative 2
Multi-Media Cap On Both Landfills, Leachate Management

LEACHATE MANAGEMENT OPTIONS:

- A COLLECTION WITH LEACHATE WELLS, ON-SITE TREATMENT THROUGH AIR STRIPPING
- B COLLECTION WITH LEACHATE WELLS, DISCHARGE/TREATMENT AT POTW
- C COLLECTION WITH INTERCEPTOR TRENCHES, ON-SITE TREATMENT THROUGH AIR STRIPPING
- D COLLECTION WITH INTERCEPTOR TRENCHES, DISCHARGE/TREATMENT AT POTW

ANNUAL OPERATING AND MAINTENANCE COSTS

				TOTAL COST, EMPLOYING LEACHATE MANAGEMENT OPT			
Item	Quantity	Units	Unit Cost	A	B	C	D
Operate Leachate Treatment System	Lump Sum	Lump Sum	$1,800	$1,800	$0	$1,800	
Leachate Treatment System Maintenance	12	mandays	$250	$3,000	$0	$3,000	
POTW Leachate Treatment	VARIABLE	gallons	$0.07	$0.00	$11,100.00	$0.00	$11,100.
Five-Year Review	Lump Sum	Lump Sum	$10,000	$10,000	$10,000	$10,000	$10,0
Leachate Treatment Sample Analysis	100	samples	$110	$11,000	$0	$11,000	
Groundwater Sampling	8	mandays	$350	$2,800	$2,800	$2,800	$2,8
Sample Analysis	24	samples	$110	$2,640	$2,640	$2,640	$2,6
Site Mowing	26	mandays	$250	$6,500	$6,500	$6,500	$6,5
Site Inspection	8	mandays	$280	$2,240	$2,240	$2,240	$2,2
Miscellaneous Site Work	24	mandays	$250	$6,000	$6,000	$6,000	$6,0
Site Work Materials	Lump Sum	Lump Sum	$2,000	$2,000	$2,000	$2,000	$2,0
Insurance @ 1% of Direct Capital Cost	Lump Sum	Lump Sum	Variable	$22,461	$21,695	$22,946	$22,1
Reserve Fund @ 1% of Direct Capital Cost	Lump Sum	Lump Sum	Variable	$22,461	$21,695	$22,946	$22,1
		Estimated Annual Operating and Maintenance Costs		$92,901	$86,669	$93,871	$87,4
	PRESENT WORTH OF ANNUAL OPERATING & MAINTENANCE COST (i=5%)			$1,302,174	$1,206,376	$1,317,085	$1,218,8
		REMEDIAL ALTERNATIVE 2 TOTAL ESTIMATED COST		$4,558,947	$4,352,078	$4,644,183	$4,423,2

Cost information sources include:
R.S. Means Co., Inc., 1989. Building Construction Cost Data - 1990.
O'Brien & Gere Engineers, Inc. - Professional Experience
Dorr-Oliver Inc.
Duall Industries

TABLE 8

TOWN OF CONKLIN LANDFILLS SITE

Cost Estimate - Alternative 3
Multi-Media Cap On Both Landfills
Extract Ground Water And Treat With Stripping

DIRECT CAPITAL COSTS

Item	Quantity	Units	Unit Cost	Total Cost
SITE PREPARATION				
Clearing and Grubbing Landfill Areas	8.4	Acres	$5,000	$42,000
Miscellaneous Site Grading	30,000	CY	$5	$150,000
CAP MATERIALS AND INSTALLATION				
Buy/Haul/Place 1 ft. Gas Venting Layer	13,600	CY	$25	$340,000
Buy/Place Filter Fabric (underlying FML - 10 oz.)	384,000	SF	$0.30	$115,200
Buy/Place 40 mil VLDPE Flexible Membrane Liner	384,000	SF	$0.45	$172,800
Buy/Place Filter Fabric (overlying FML - 10 oz.)	384,000	SF	$0.30	$115,200
Buy/Place Geogrids (Tensar UX1600 - 2 layers)	125,000	SF	$1.05	$131,250
Buy/Place Filter Fabric Layer	384,000	SF	$0.30	$115,200
Buy/Haul/Place Barrier Protection Layer	27,100	CY	$12	$325,200
Buy/Haul/Place Topsoil	6,800	CY	$17	$115,600
Buy/Place Seed, Fertilizer, and Mulch	40,700	SY	$1	$40,700
Buy/Place Gas Vents	13	Each	$500	$6,500
Proof Rolling	8.4	Acres	$1,000	$8,400
Cap Quality Assurance/Quality Control	Lump Sum	Lump Sum	$150,000	$150,000
ON-SITE GROUND WATER AND LEACHATE COLLECTION AND TREATMENT				
Extraction wells (1 @ 30 ft)	30	LF	$100	$3,000
Submersible pumps and piping	1	Each	$1,000	$1,000
Buy/Install Leachate Collection System	Lump Sum	Lump Sum	$135,000	$135,000
Ground water and leachate holding tank	Lump Sum	Lump Sum	$15,000	$15,000
Buy/Install Equipment Building	Lump Sum	Lump Sum	$25,000	$25,000
Buy/Install Metals Pretreatment System	Lump Sum	Lump Sum	$64,600	$64,600
On-site package Air Stripper	Lump Sum	Lump Sum	$26,000	$26,000
Miscellaneous appurtenances (controls, piping, etc)	Lump Sum	Lump Sum	$5,000	$5,000
OTHER COSTS				
Site Fencing	6,200	LF	$10	$62,000
Miscellaneous Site Improvements	Lump Sum	Lump Sum	$25,000	$25,000
Safety Program	Lump Sum	Lump Sum	$72,750	$72,750
Dust Control	Lump Sum	Lump Sum	$10,000	$10,000
Off-Site Drainage Control	Lump Sum	Lump Sum	$5,000	$5,000
Equipment Decontamination	Lump Sum	Lump Sum	$6,000	$6,000
Mobilization/Demobilization	Lump Sum	Lump Sum	$56,000	$56,000
		Estimated Direct Capital Cost		$2,339,400

INDIRECT CAPITAL COSTS

Contingency Allowance (25%)	$584,850
Engineering Fees (15%)	$350,910
Legal Fees (5%)	$116,970
Estimated Indirect Capital Cost	$1,052,730
TOTAL ESTIMATED CAPITAL COST	$3,392,130

TABLE 8

TOWN OF CONKLIN LANDFILLS SITE

Cost Estimate - Alternative 3
Multi-Media Cap On Both Landfills
Extract Ground Water And Treat With Stripping

ANNUAL OPERATING AND MAINTENANCE COSTS

Item	Quantity	Units	Unit Cost	Total Cost	
Five-Year Review	Lump Sum	Lump Sum	$10,000	$10,000	
Ground Water and Leachate Treatment System	Lump Sum	Lump Sum	$3,500	$3,500	
Treatment System Maintenance For G.W. and Leachate	52	mandays	$250	$13,000	
Treatment System Maintenance For Leachate Flow Only	12	mandays	$250	$3,000	
Treatment System Sampling	100	samples	$110	$11,000	
Groundwater Sampling	8	mandays	$350	$2,800	
Sample Analysis	24	samples	$110	$2,640	
Site Mowing	26	mandays	$250	$6,500	
Site Inspection	8	mandays	$280	$2,240	
Miscellaneous Site Work	36	mandays	$250	$9,000	
Site Work Materials	Lump Sum	Lump Sum	$4,000	$4,000	
Insurance @ 1% of Direct Capital Cost	Lump Sum	Lump Sum	$23,394	$23,394	
Reserve fund @ 1% of Direct Capital Cost	Lump Sum	Lump Sum	$23,394	$23,394	
		Estimated Annual Operating and Maintenance Costs		$111,468	
	PRESENT WORTH OF ANNUAL OPERATING & MAINTENANCE COST (i=5%)			$1,467,356	Best Case
				$1,542,596	Worst Case
		REMEDIAL ALTERNATIVE 3 TOTAL ESTIMATED COST		$4,859,486	Best Case
				$4,934,726	Worst Case

NOTE: "Best Case" refers to ground water clean-up in 7 to 9 years.
"Worst Case" refers to ground water clean-up in 14 to 24 years.

Cost information sources include:
R.S. Means Co., Inc., 1989. Building Construction Cost Data - 1990.
O'Brien & Gere Engineers, Inc. - Professional Experience
Duall Industries
Dorr-Oliver Inc.

TABLE 9

TOWN OF CONKLIN LANDFILLS SITE

Cost Estimate - Alternative 4
Multi-Media Cap On Both Landfills
Extract Ground Water And Treat With Oxidation

DIRECT CAPITAL COSTS

Item	Quantity	Units	Unit Cost	Total Cost
SITE PREPARATION				
Clearing and Grubbing Landfill Areas	8.4	Acres	$5,000	$42,000
Miscellaneous Site Grading	30,000	CY	$5	$150,000
CAP MATERIALS AND INSTALLATION				
Buy/Haul/Place 1 ft. Gas Venting Layer	13,600	CY	$25	$340,000
Buy/Place Filter Fabric (underlying FML - 10 oz.)	384,000	SF	$0.30	$115,200
Buy/Place 40 mil VLDPE Flexible Membrane Liner	384,000	SF	$0.45	$172,800
Buy/Place Filter Fabric (overlying FML - 10 oz.)	384,000	SF	$0.30	$115,200
Buy/Place Geogrids (Tensar UX1600 - 2 layers)	125,000	SF	$1.05	$131,250
Buy/Place Filter Fabric Layer	384,000	SF	$0.30	$115,200
Buy/Haul/Place Barrier Protection Layer	27,100	CY	$12	$325,200
Buy/Haul/Place Topsoil	6,800	CY	$17	$115,600
Buy/Place Seed, Fertilizer, and Mulch	40,700	SY	$1	$40,700
Buy/Place Gas Vents	13	Each	$500	$6,500
Proof Rolling	8.4	Acres	$1,000	$8,400
Cap Quality Assurance/Quality Control	Lump Sum	Lump Sum	$150,000	$150,000
ON-SITE GROUND WATER AND LEACHATE COLLECTION AND TREATMENT SYSTEM				
Extraction Wells (1 @ 30 ft)	30	LF	$100	$3,000
Submersible Pumps and Piping	1	Each	$1,000	$1,000
Buy/Install Leachate Collection System	Lump Sum	Lump Sum	$135,000	$135,000
Ground Water and Leachate Holding Tank	Lump Sum	Lump Sum	$15,000	$15,000
Buy/Install Equipment Building	Lump Sum	Lump Sum	$25,000	$25,000
Buy/Install Package Oxidation Plant	Lump Sum	Lump Sum	$85,000	$85,000
Buy/Install Metals Pretreatment System	Lump Sum	Lump Sum	$64,600	$64,600
Miscellaneous Appurtenances (controls, piping, etc)	Lump Sum	Lump Sum	$5,000	$5,000
OTHER COSTS				
Site Fencing	6,200	LF	$10	$62,000
Miscellaneous Site Improvements	Lump Sum	Lump Sum	$25,000	$25,000
Safety Program	Lump Sum	Lump Sum	$72,750	$72,750
Dust Control	Lump Sum	Lump Sum	$10,000	$10,000
Off-Site Drainage Control	Lump Sum	Lump Sum	$5,000	$5,000
Equipment Decontamination	Lump Sum	Lump Sum	$6,000	$6,000
Mobilization/Demobilization	Lump Sum	Lump Sum	$58,000	$58,000
		Estimated Direct Capital Cost		$2,400,400

INDIRECT CAPITAL COSTS

Contingency Allowance (25%)	$600,100
Engineering Fees (15%)	$360,060
Legal Fees (5%)	$120,020
Estimated Indirect Capital Cost	$1,080,180
TOTAL ESTIMATED CAPITAL COST	$3,480,580

TABLE 9

TOWN OF CONKLIN LANDFILLS SITE

Cost Estimate - Alternative 4
Multi-Media Cap On Both Landfills
Extract Ground Water And Treat With Oxidation

ANNUAL OPERATING AND MAINTENANCE COSTS

Item	Quantity	Units	Unit Cost	Total Cost	
Five-Year Review	Lump Sum	Lump Sum	$10,000	$10,000	
Ground Water and Leachate Treatment System Operation	Lump Sum	Lump Sum	$31,000	$31,000	
Treatment System Maintenance For G.W. and Leachate	52	mandays	$250	$13,000	
Treatment System Maintenance for Leachate Flow Only	12	mandays	$250	$3,000	
Treatment System Sampling	100	samples	$110	$11,000	
Groundwater Sampling	8	mandays	$350	$2,800	
Sample Analysis	24	samples	$110	$2,640	
Site Mowing	26	mandays	$250	$6,500	
Site Inspection	8	mandays	$280	$2,240	
Miscellaneous Site Work	36	mandays	$250	$9,000	
Site Work Materials	Lump Sum	Lump Sum	$2,000	$2,000	
Insurance @ 1% of Direct Capital Cost	Lump Sum	Lump Sum	$24,004	$24,004	
Reserve fund @ 1% of Direct Capital Cost	Lump Sum	Lump Sum	$24,004	$24,004	
		Estimated Annual Operating and Maintenance Costs		$138,188	
	PRESENT WORTH OF ANNUAL OPERATING & MAINTENANCE COST (i=5%)			$1,633,098	Best Case
				$1,863,600	Worst Case
		REMEDIAL ALTERNATIVE 4 TOTAL ESTIMATED COST		$5,113,678	Best Case
				$5,344,180	Worst Case

NOTE: "Best Case" refers to ground water clean-up in 7 to 9 years.
"Worst Case" refers to ground water clean-up in 14 to 24 years.

Cost information sources include:
R.S. Means Co., Inc., 1989. Building Construction Cost Data - 1990.
O'Brien & Gere Engineers, Inc. - Professional Experience
Peroxidation Systems Inc.
Dorr-Oliver Inc.

TABLE 10

TOWN OF CONKLIN LANDFILLS SITE

Cost Estimate - Alternative 5
Multi-Media Cap On Both Landfills
Extract Ground Water And Treat Off-Site

DIRECT CAPITAL COSTS

Item	Quantity	Units	Unit Cost	Total Cost
SITE PREPARATION				
Clearing and Grubbing Landfill Areas	8.4	Acres	$5,000	$42,000
Miscellaneous Site Grading	30,000	CY	$5	$150,000
CAP MATERIALS AND INSTALLATION				
Buy/Haul/Place 1 ft. Gas Venting Layer	13,600	CY	$25	$340,000
Buy/Place Filter Fabric (underlying FML - 10 oz.)	384,000	SF	$0.30	$115,200
Buy/Place 40 mil VLDPE Flexible Membrane Liner	384,000	SF	$0.45	$172,800
Buy/Place Filter Fabric (overlying FML - 10 oz.)	384,000	SF	$0.30	$115,200
Buy/Place Geogrids (Tensar UX1600 - 2 layers)	125,000	SF	$1.05	$131,250
Buy/Place Filter Fabric Layer	384,000	SF	$0.30	$115,200
Buy/Haul/Place Barrier Protection Layer	27,100	CY	$12	$325,200
Buy/Haul/Place Topsoil	6,800	CY	$17	$115,600
Buy/Place Seed, Fertilizer, and Mulch	40,700	SY	$1	$40,700
Buy/Place Gas Vents	13	Each	$500	$6,500
Proof Rolling	8.4	Acres	$1,000	$8,400
Cap Quality Assurance/Quality Control	Lump Sum	Lump Sum	$150,000	$150,000
ON-SITE GROUND WATER AND LEACHATE COLLECTION SYSTEM				
Extraction Well (1 @ 30 ft)	30	LF	$100	$3,000
Submersible Pump and Piping	1	Each	$1,000	$1,000
Buy/Install Leachate Collection System	Lump Sum	Lump Sum	$135,000	$135,000
Buy/Build Leachate Discharge Lines	2400	LF	$8.00	$19,200
Miscellaneous appurtenances (controls, piping, etc)	Lump Sum	Lump Sum	$12,000	$12,000
OTHER COSTS				
Site Fencing	6,200	LF	$10	$62,000
Miscellaneous Site Improvements	Lump Sum	Lump Sum	$25,000	$25,000
Safety Program	Lump Sum	Lump Sum	$72,750	$72,750
Dust Control	Lump Sum	Lump Sum	$10,000	$10,000
Off-Site Drainage Control	Lump Sum	Lump Sum	$5,000	$5,000
Equipment Decontamination	Lump Sum	Lump Sum	$6,000	$6,000
Mobilization/Demobilization	Lump Sum	Lump Sum	$54,000	$54,000
		Estimated Direct Capital Cost		$2,233,000

INDIRECT CAPITAL COSTS

Contingency Allowance (25%)	$558,250
Engineering Fees (15%)	$334,950
Legal Fees (5%)	$111,650
Estimated Indirect Capital Cost	$1,004,850
TOTAL ESTIMATED CAPITAL COST	$3,237,850

TABLE 10

TOWN OF CONKLIN LANDFILLS SITE

Cost Estimate - Alternative 5
Multi-Media Cap On Both Landfills
Extract Ground Water And Treat Off-Site

ANNUAL OPERATING AND MAINTENANCE COSTS

Item	Quantity	Units	Unit Cost	Total Cost	
Five-Year Review	Lump Sum	Lump Sum	$10,000	$10,000	
Ground Water Pumping System	Lump Sum	Lump Sum	$13,000	$13,000	
Ground Water Treatment at POTW	7,360,000	gal	$0.07	$515,200	
Leachate Treatment at POTW	Variable	gal	$0.07	$11,100	
Ground Water Sampling	8	mandays	$350	$2,800	
Sample Analysis	24	samples	$110	$2,640	
Site Mowing	26	mandays	$250	$6,500	
Site Inspection	8	mandays	$280	$2,240	
Miscellaneous Site Work	36	mandays	$250	$9,000	
Site Work Materials	Lump Sum	Lump Sum	$2,000	$2,000	
Insurance @ 1% of Direct Capital Cost	Lump Sum	Lump Sum	$22,330	$22,330	
Reserve Fund @ 1% of Direct Capital Cost	Lump Sum	Lump Sum	$22,330	$22,330	
		Estimated Annual Operating and Maintenance Costs		$619,140	
	PRESENT WORTH OF ANNUAL OPERATING & MAINTENANCE COST (i=5%)			$4,685,827	Best Case
				$7,655,367	Worst Case
		REMEDIAL ALTERNATIVE 5 TOTAL ESTIMATED COST		$7,923,677	Best Case
				$10,893,217	Worst Case

NOTE: "Best Case" refers to clean-up of ground water in 7 to 9 years.
"Worst Case" refers to clean-up of ground water in 14 to 24 years.

Cost information sources include:
R.S. Means Co., Inc., 1989. Building Construction Cost Data - 1990.
O'Brien & Gere Engineers, Inc. - Professional Experience
Frontier Chemical Waste Process, Inc.

TABLE 11

TOWN OF CONKLIN LANDFILLS SITE

Cost Estimate - Alternative 6
Consolidation of Lower Landfill With Upper Landfill
Multi-Media Cap On Upper Landfill

DIRECT CAPITAL COSTS

Item	Quantity	Units	Unit Cost	Total Cost
SITE PREPARATION				
Clearing and Grubbing Landfill Areas	8.4	Acres	$5,000	$42,000
Miscellaneous Site Grading	30,000	CY	$5	$150,000
CONSOLIDATION OF LOWER LANDFILL WITH UPPER LANDFILL				
Excavation of Lower Landfill Material	32,500	CY	$10	$325,000
TCLP Analysis of Waste Material	10	samples	$1,300	$13,000
Dewatering - Transport and Disposal of Water	200,000	gal	$0.35	$70,000
Transportation of Material to Upper Landfill	32,500	CY	$2.50	$81,250
Grading of Material at Upper Landfill	34	Day	$500	$17,000
Compaction of Material at Upper Landfill	32,500	CY	$1.00	$32,500
Buy/Haul/Place Daily Cover at Upper Landfill	4,100	CY	$10	$41,000
Buy/Haul/Place Fill at Lower Landfill	16,000	CY	$10	$160,000
CAP MATERIALS AND INSTALLATION				
Buy/Haul/Place 1 ft. Gas Venting Layer	9,500	CY	$25	$237,500
Buy/Place Filter Fabric (underlying FML - 10 oz.)	282,000	SF	$0.30	$84,600
Buy/Place 40 mil VLDPE Flexible Membrane Liner	282,000	SF	$0.45	$126,900
Buy/Place Filter Fabric (overlying FML - 10 oz.)	282,000	SF	$0.30	$84,600
Buy/Place Geogrids (Tensar UX1600 - 2 layers)	75,000	SF	$1.05	$78,750
Buy/Place Filter Fabric Layer	282,000	SF	$0.30	$84,600
Buy/Haul/Place Barrier Protection Layer	19,000	CY	$12	$228,000
Buy/Haul/Place Topsoil	5,200	CY	$17	$88,400
Buy/Place Seed, Fertilizer, and Mulch	31,300	SY	$1	$31,300
Buy/Place Gas Vents	6	Each	$500	$3,000
Proof Rolling	5.9	Acres	$1,000	$5,900
Cap Quality Assurance/Quality Control	Lump Sum	Lump Sum	$105,000	$105,000
Buy/Install Leachate Collection System	Lump Sum	Lump Sum	$45,000	$45,000
LEACHATE TREATMENT SYSTEM				
Buy/Install Equipment Building	Lump Sum	Lump Sum	$25,000	$25,000
Buy/Install Leachate Pretreatment System	Lump Sum	Lump Sum	$54,000	$54,000
Buy/Install Leachate Air Stripping System	Lump Sum	Lump Sum	$32,000	$32,000
OTHER COSTS				
Site Fencing	2,050	LF	$10	$20,500
Miscellaneous Site Improvements	Lump Sum	Lump Sum	$25,000	$25,000
Safety Program	Lump Sum	Lump Sum	$237,438	$237,438
Dust Control	Lump Sum	Lump Sum	$10,000	$10,000
Off-Site Drainage Control	Lump Sum	Lump Sum	$5,000	$5,000
Equipment Decontamination	Lump Sum	Lump Sum	$15,000	$15,000
Mobilization/Demobilization	Lump Sum	Lump Sum	$62,000	$62,000
		Estimated Direct Capital Cost		$2,621,238

INDIRECT CAPITAL COSTS

Contingency Allowance (25%)	$655,309
Engineering Fees (15%)	$393,186
Legal Fees (5%)	$131,062
Estimated Indirect Capital Cost	$1,179,557
TOTAL ESTIMATED CAPITAL COST	$3,800,794

TABLE 11

TOWN OF CONKLIN LANDFILLS SITE

Cost Estimate - Alternative 6
Consolidation of Lower Landfill With Upper Landfill
Multi-Media Cap On Upper Landfill

ANNUAL OPERATING AND MAINTENANCE COSTS

Item	Quantity	Units	Unit Cost	Total Cost
Operate Leachate Treatment System	Lump Sum	Lump Sum	$1,800	$1,800
Leachate Treatment System Maintenance	12	mandays	$250	$3,000
Five-Year Review	Lump Sum	Lump Sum	$10,000	$10,000
Leachate Treatment Sample Analysis	100	samples	$110	$11,000
Groundwater Sampling	8	mandays	$350	$2,800
Sample Analysis	24	samples	$110	$2,640
Site Mowing	26	mandays	$250	$6,500
Site Inspection	8	mandays	$280	$2,240
Miscellaneous Site Work	24	mandays	$250	$6,000
Site Work Materials	Lump Sum	Lump Sum	$2,000	$2,000
Insurance @ 1% of Direct Capital Cost	Lump Sum	Lump Sum	$26,212	$26,212
Reserve Fund @ 1% of Direct Capital Cost	Lump Sum	Lump Sum	$26,212	$26,212
			Estimated Annual Operating and Maintenance Costs	$100,405
	PRESENT WORTH OF ANNUAL OPERATING & MAINTENANCE COST (i=5%)			$1,417,522
			REMEDIAL ALTERNATIVE 6 TOTAL ESTIMATED COST	$5,218,316

Cost information sources include:
R.S. Means Co., Inc., 1989. Building Construction Cost Data - 1990.
O'Brien & Gere Engineers, Inc. - Professional Experience
Dorr-Oliver Inc.

TABLE 12

TOWN OF CONKLIN LANDFILLS SITE
SCREENING OF ALTERNATIVES

Alternative	Effectiveness	Implementability	Cost	Screening Decision
1	Reduces concentration of constituent of concern in ground water through natural degradation. Long-term effectiveness is somewhat unknown as the potential for migration of constituents of concern from landfill materials to ground water would still exist.	There would be no construction or operation associated with implementation of this alternative. Ground water monitoring would be a reliable method of tracking aquifer conditions.	Total present worth cost is estimated at $111,000	Retained for further consideration as required by the NCP.
2	Protects human health and the environment through capping of landfill materials and collection/treatment of leachate. Collection of leachate would be through either leachate wells or leachate collection trenches. Leachate wells more be more effective in collecting built-up leachate. Treatment of leachate is provided through either air stripping or discharge/ treatment at a POTW. Both are effective treatment methods. Ground water is remediated through natural degradation. Remedial objectives would be achieve1 in approximately 7 to 9 years.	The activities associated with this alternative are readily implementable standard procedures. Leachate wells would be more easily implemented then collection trenches. Off-site treatment would be more easily implemented then on-site treatment. Treatability studies may be required for on-site air stripping of leachate. Maintenance and monitoring would be readily implemented.	Total present worth cost estimated at: $4,559,000 (Option A) $4,352,000 (Option B) $4,644,000 (Option C) $4,423,000 (Option D)	Retained for further consideration.
3	Protects human health and the environment through capping of landfill materials and collection/treatment of leachate and ground water. Treatment is provided through air stripping. Remedial objectives would be achieved in approximately 7 to 9 years.	The activities associated with this alternative are readily implementable standard procedures. Treatability studies may be required for the treatment of leachate and ground water. Maintenance and monitoring would be readily implemented.	Total present worth cost estimated at: $4,859,000 (Best Case) $4,934,000 (Worst Case)	Retained for further consideration.

TABLE 12

TOWN OF CONKLIN LANDFILLS SITE
SCREENING OF ALTERNATIVES

Alternative	Effectiveness	Implementability	Cost	Screening Decision
4	Protects human health and the environment through capping of landfill materials and collection/treatment of leachate and ground water. Treatment is provided through air stripping. Remedial objectives would be achieved in approximately 7 to 9 years.	The activities associated with this alternative are readily implementable standard procedures. Treatability studies may be required for the treatment of leachate and ground water. Maintenance and monitoring would be readily implemented.	Total present worth cost estimated at: $5,114,000 (Best Case) $5,344,000 (Worst Case)	Retained for further consideration.
5	Protects human health and the environment through capping of landfill materials and collection/off-site treatment at a POTW. Remedial objectives would be achieved in approximately 7 to 9 years.	The activities associated with this alternative are readily implementable standard procedures. Significant treatment capacity is needed. Maintenance and monitoring would be readily implemented.	Total present worth cost estimated at: $7,924,000 (Best Case) $10,893,000 (Worst Case)	Screened out. Provides same level of effectiveness as other alternatives while costing much more.
6	Protects human health and the environment through capping of landfill materials and collection/treatment of leachate. Treatment of leachate is provided through air stripping. Ground water is remediated through natural degradation. Remedial objectives would be achieved in approximately 7 to 9 years.	While the activities associated with this action are readily implementable standard procedures, the implementability is compromised by the inherent risks to the site environment and workers during excavation of the Lower Landfill material.	Total present worth cost estimated at $5,218,000.	Screened out. Compromised implementability precludes this alternative from further consideration.

TABLE 13

TOWN OF CONKLIN LANDFILLS SITE
POTENTIAL CHEMICAL AND LOCATION SPECIFIC ARARs

POTENTIAL CHEMICAL SPECIFIC ARARs

MEDIA	REQUIREMENTS	CITATION
Ground Water	Ground water must meet NYS Class GA ground water standards. These standards are the most stringent of:	6 NYCRR Part 703
	- Standards for Class GA Ground Water	6 NYCRR Part 703.5
	- NYS MCLs for Public Water Supplies	10 NYCRR Subpart 5-1
	- MCLs listed in the Safe Drinking Water Act	40 CFR Part 141
	- Standards for Sources Of Water Supply	10 NYCRR Part 170

POTENTIAL LOCATION SPECIFIC ARARs

AREA	REQUIREMENTS	CITATION
Wetlands	Actions occuring in a designated freshwater wetland or adjacent to a designated freshwater wetland (within 100 feet) must be approved and permitted by the New York State Department of Environmental Conservation or its designee. Typically, activities occuring adjacent to freshwater wetlands must meet the following three compatibility tests: 1) activity would be compatible with presevation, protection and conservation of the wetland and its benefits; 2) activity would result in no more than insubstantial degradation to, or loss of, any part of the wetland; and 3) activity would be compatible with the public health and welfare.	6 NYCRR Part 663

TABLE 14

TOWN OF CONKLIN LANDFILLS SITE
POTENTIAL ACTION SPECIFIC ARARs

ACTION	REQUIREMENTS	CITATION
Capping In Place - Municipal Waste	At a minimum, a cap must consist of a layered system with: - The bottom layer being a gas venting layer consisting of a 12 inch layer of soil with a minimum permeability of 1×10^{-3} cm/inch. One 6 inch gas venting pipe is also required for each acre of landfill. - A barrier soil layer with a compacted thickness of 18 inches and a maximum permeability of 1×10^{-7} cm/sec. Alternatively, a flexible membrane liner (FML) being 40 mil thick and a maximum permeability of 1×10^{-12} cm/sec may be used instead. - A 24 inch barrier protection layer consisting of soil. - A 6 inch topsoil layer	6 NYCRR Part 360 - 2.15
	Site air quality during remedial activities must meet the National Ambient Air Quality Standards (NAAQS) for Particulate Matter	40 CFR Part 136
Surface Water Discharge	Effluent from ground water and/or leachate treatment plant must meet the standards outlined in State Pollutant Discharge Elimination System (SPDES) program	6 NYCRR Parts 750-758
	Surface water body which recieves discharges from ground water and/or leachate treatment plant must maintain Ambient Water Quality Standards (AWQS) (Class D).	6 NYCRR Part 701
Ground Water Monitoring	Guidelines for establishing analytical test procedures for constituents of concern.	40 CFR Part 136
Air Emissions	All treatment process air discharges must meet general air cleaning guidelines and chemical-specific Ambient Guideline Concentrations (AGCs).	6 NYCRR Part 212 New York State Air Guide-1

TABLE 15

TOWN OF CONKLIN LANDFILLS SITE
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

	Alternative 1 No action. Ground water monitoring.	Alternative 2 Capping, leachate collection/treatment, deed restrictions, and ground water monitoring.	Alternative 3 Capping, leachate collection, ground water extraction, air stripping of ground water and leachate, discharge, deed restrictions, and ground water monitoring.	Alternative 4 Capping, leachate collection, ground water extraction, chemical oxidation of ground water and leachate, discharge, deed restrictions, and ground water monitoring.
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT				
Protection of Human Health	Potential would remain for migration of constituents of concern from landfill materials to ground water.	Capping and leachate collection/treatment would eliminate potential for leaching of constituents of concern from landfill materials to ground water. Concentrations of constituents of concern in ground water would be reduced through natural attenuation processes. Deed restrictions would prohibit human consumption of ground water. Possibility of leachate leaking from transfer lines could be minimized through proper QA/QC during construction.	Capping and leachate collection/treatment would eliminate potential for leaching of constituents of concern from landfill materials to ground water. Constituents of concern in ground water would be removed through extraction and stripping. Deed restrictions would prohibit human consumption of ground water.	Capping and leachate collection/treatment would eliminate potential for leaching of constituents of concern from landfill materials to ground water. Constituents of concern in ground water would be removed through extraction and chemical oxidation. Deed restrictions would prohibit human consumption of ground water.
Protection of Environment	Potential would remain for migration of constituents of concern from landfill materials to ground water. Natural attenuation would likely reduce ground water concentrations of constituents of concern.	Capping and leachate collection would eliminate potential for leaching of constituents of concern from landfill materials to ground water. Constituents of concern removed from leachate through treatment. Natural attenuation would likely reduce ground water concentrations of constituents of concern. Possibility of leachate leaking from transfer lines could be minimized through proper QA/QC during construction.	Capping and leachate collection would eliminate potential for leaching of constituents of concern from landfill materials to ground water. Constituents of concern removed from ground water through extraction and treatment.	Capping and leachate collection would eliminate potential for leaching of constituents of concern from landfill materials to ground water. Constituents of concern removed from ground water through extraction and treatment.

TABLE 15

TOWN OF CONKLIN LANDFILLS SITE
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

	Alternative 1 No action. Ground water monitoring.	**Alternative 2** Capping, leachate collection/treatment, deed restrictions, and ground water monitoring.	**Alternative 3** Capping, leachate collection, ground water extraction, air stripping of ground water and leachate, discharge, deed restrictions, and ground water monitoring.	**Alternative 4** Capping, leachate collection, ground water extraction, chemical oxidation of ground water and leachate, discharge, deed restrictions, and ground water monitoring.
COMPLIANCE WITH ARARs				
Chemical-Specific ARARs	Would comply with Class GA ground water standards over time.	Would likely comply with Class GA ground water standards over time. Would comply with air quality standards. Would comply with surface water standards.	Would comply with ground water standards at site boundary following implementation of extraction system. Would comply with air quality standards. Would comply with surface water standards.	Would comply with ground water standards at site boundary following implementation of extraction system. Would comply with air quality standards. Would comply with surface water standards.
Action-Specific ARARs	Would comply with analytical requirements of 40 CFR 136.	Would comply with analytical requirements of 40 CFR 136. Would comply with Part 360 landfill closure requirements. Would comply with OSHA requirements. Would comply with SPDES requirements. Would comply with air emissions requirements.	Would comply with analytical requirements of 40 CFR 136. Would comply with Part 360 landfill closure requirements. Would comply with OSHA requirements. Would comply with SPDES requirements. Would comply with air emissions requirements.	Would comply with analytical requirements of 40 CFR 136. Would comply with Part 360 landfill closure requirements. Would comply with OSHA requirements. Would comply with SPDES requirements.
Location-Specific ARARs	None	Would comply with 6 NYCRR Part 663 Freshwater Wetlands requirements.	Would comply with 6 NYCRR Part 663 Freshwater Wetlands requirements.	Would comply with 6 NYCRR Part 663 Freshwater Wetlands requirements.

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TOWN OF CONKLIN LANDFILLS SITE
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

	Alternative 1 No action. Ground water monitoring.	Alternative 2 Capping, leachate collection/treatment, deed restrictions, and ground water monitoring.	Alternative 3 Capping, leachate collection, ground water extraction, air stripping of ground water and leachate, discharge, deed restrictions, and ground water monitoring.	Alternative 4 Capping, leachate collection, ground water extraction, chemical oxidation of ground water and leachate, discharge, deed restrictions, and ground water monitoring.
LONG-TERM EFFECTIVENESS AND PERMANENCE				
Magnitude of Residual Risk	Potential would remain for migration of constituents of concern from landfill materials to ground water. Concentrations of constituents of concern in ground water would likely decrease to below Class GA standards through natural attenuation.	Capping and leachate collection would minimize potential for migration of constituents of concern from landfill materials to ground water. Concentrations of constituents of concern in ground water would likely decrease to below Class GA standards through natural attenuation. Constituents in leachate would be treated through either air stripping or treatment at a POTW.	Capping and leachate collection would minimize potential for migration of constituents of concern from landfill materials to ground water. Concentrations of constituents of concern in ground water would likely decrease to below Class GA standards through extraction and treatment of ground water exceeding Class GA standards.	Capping and leachate collection would minimize potential for migration of constituents of concern from landfill materials to ground water. Concentrations of constituents of concern in ground water would likely decrease to below Class GA standards through extraction and treatment of ground water exceeding Class GA standards.
Adequacy and Reliability of Controls	Ground water monitoring is an adequate and reliable method of tracking conditions in the aquifer.	Capping and leachate collection are adequate and reliable containment measures, with appropriate maintenance, for prevention of migration of constituents of concern from landfill materials. Air stripping, if chosen, is proven in effectiveness and reliability. Deed restrictions are adequate and reliable in restricting well development and activities impacting cap integrity. Ground water monitoring is an adequate and reliable method of tracking conditions in the aquifer.	Capping and leachate collection are adequate and reliable containment measures, with appropriate maintenance, for prevention of migration of constituents of concern from landfill materials. Extraction is an adequate and reliable collection method. Air stripping is proven in effectiveness and reliability. Deed restrictions are adequate and reliable in restricting well development and activities impacting cap integrity. Ground water monitoring is an adequate and reliable method of tracking conditions in the aquifer.	Capping and leachate collection are adequate and reliable containment measures, with appropriate maintenance, for prevention of migration of constituents of concern from landfill materials. Extraction is an adequate and reliable collection method. Chemical oxidation expected to be effective and reliable. Deed restrictions are adequate and reliable in restricting well development and activities impacting cap integrity. Ground water monitoring is an adequate and reliable method of tracking conditions in the aquifer.

TABLE 15

TOWN OF CONKLIN LANDFILLS SITE
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

	Alternative 1 No action. Ground water monitoring.	Alternative 2 Capping, leachate collection/treatment, deed restrictions, and ground water monitoring.	Alternative 3 Capping, leachate collection, ground water extraction, air stripping of ground water and leachate, discharge, deed restrictions, and ground water monitoring.	Alternative 4 Capping, leachate collection, ground water extraction, chemical oxidation of ground water and leachate, discharge, deed restrictions, and ground water monitoring.
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT				
Treatment Process Used and Materials Treated	None.	Either air stripping or treatment at a POTW for collected leachate.	Air stripping of ground water and leachate.	Precipitation and chemical oxidation of ground water and leachate.
Amount of Hazardous Materials Destroyed or Treated	None.	Nearly complete removal of organics through either air stripping or POTW treatment of leachate.	Nearly complete destruction of volatile organics in ground water and leachate.	Nearly complete removal of metals and destruction of organics in ground water and leachate.
Degree of Expected Reduction of Toxicity, Mobility, or Volume	None due to treatment. Reduction in ground water toxicity due to natural attenuation. May not be maintained if further leaching of constituents from the landfill occur.	Reduction in ground water toxicity due to natural attenuation, and reduction in mobility of constituents in landfill materials due to capping. Reduction in leachate toxicity through either to air stripping or POTW treatment of constituents of concern in leachate.	Reduction in ground water toxicity due to air stripping. Reduction in mobility of constituents of concern in landfill materials due to capping.	Reduction in ground water toxicity due to precipitation and chemical oxidation. Reduction in mobility of constituents of concern in landfill materials due to capping.
Degree to Which Treatment is Irreversible	No treatment.	Both air stripping and treatment at a POTW of leachate constituents is irreversible.	Air stripping is completely irreversible.	Chemical oxidation is completely irreversible.
Type and Quantity of Residuals Remaining After Treatment	No treatment.	If air stripping is used, sludge from iron and manganese pretreatment system will remain. If POTW treatment is used, sludge from that process will also remain. Due to flow rate variability, it is impossible to estimate the amount of sludge produced. The sludge produced will likely pass the TCLP test.	Sludge from iron and manganese pretreatment system will remain. Due to leachate flow rate variability, it is impossible to estimate the quantity of sludge produced. The sludge produced will likely pass the TCLP test.	Sludge from precipitation of iron and manganese will be produced. Due to leachate flow rate variability, it is impossible to estimate the quantity of sludge produced. The sludge produced will likely pass the TCLP test.
Statutory Preference for Treatment	Does not satisfy.	Satisfies with leachate treatment.	Satisfies with leachate and ground water treatment.	Satisfies with leachate and ground water treatment.

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TOWN OF CONKLIN LANDFILLS SITE
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

	Alternative 1 No action. Ground water monitoring.	**Alternative 2** Capping, leachate collection/treatment, deed restrictions, and ground water monitoring.	**Alternative 3** Capping, leachate collection, ground water extraction, air stripping of ground water and leachate, discharge, deed restrictions, and ground water monitoring.	**Alternative 4** Capping, leachate collection, ground water extraction, chemical oxidation of ground water and leachate, discharge, deed restrictions, and ground water monitoring.
SHORT-TERM EFFECTIVENESS				
Protection of Community During Remedial Actions	Potential would exist for migration of constituents of concern from landfill materials to ground water. Potential would exist for potable well installation without restriction.	No significant short-term impacts.	No significant short-term impacts.	No significant short-term impacts.
Protection of Workers During Remedial Actions	Appropriate protective equipment would be used during monitoring activities.	Appropriate protective equipment would be used during remedial activities.	Appropriate protective equipment would be used during remedial activities.	Appropriate protective equipment would be used during remedial activities.
Environmental Impacts	Potential would exist for migration of constituents of concern from landfill materials to ground water.	Contaminant transport during construction would be minimized through appropriate methods such as dust control.	Contaminant transport during construction would be minimized through appropriate methods such as dust control. Aquifer drawdown during ground water extraction.	Contaminant transport during construction would be minimized through appropriate methods such as dust control. Aquifer drawdown during ground water extraction.
Time Until Remedial Action Objectives Are Achieved	Class GA ground water standards would likely be attained in 7 to 9 years through natural attenuation. Prevention of migration of constituents of concern from landfill materials to ground water would not be achieved.	Class GA ground water standards would likely be attained in 7 to 9 years through natural attenuation. Prevention of migration of constituents of concern from landfill materials to ground water would be expected within 2 years with cap and leachate collection system installation.	Class GA ground water standards would likely be attained within approximately 7 to 9 years through extraction and treatment. This estimate assumes ongoing degradative processes are not impacted by pumping. If these processes are impacted, ground water clean-up could take as long as 14 to 24 years.Prevention of migration of constituents of concern from landfill materials to ground water would be expected within 2 years with cap and leachate collection system installation.	Class GA ground water standards would likely be attained within 7 to 9 years through extraction and treatment. This estimate assumes ongoing degradative processes are not impacted by pumping. If these processes are impacted, ground water clean-up could take as long as 14 to 24 years. Prevention of migration of constituents of concern from landfill materials to ground water would be expected within 2 years with cap and leachate collection system installation.

TABLE 15

TOWN OF CONKLIN LANDFILLS SITE
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

	Alternative 1 No action. Ground water monitoring.	Alternative 2 Capping, leachate collection/treatment, deed restrictions, and ground water monitoring.	Alternative 3 Capping, leachate collection, ground water extraction, air stripping of ground water and leachate, discharge, deed restrictions, and ground water monitoring.	Alternative 4 Capping, leachate collection, ground water extraction, chemical oxidation of ground water and leachate, discharge, deed restrictions, and ground water monitoring.
IMPLEMENTABILITY				
Ability to Construct and Operate the Technology	No construction or operation.	Cap readily constructed. Leachate wells more easily constructed than collection trenches. Likewise, off-site POTW treatment would be more easily implemented then an on-site air stripping system.	Cap readily constructed. Leachate collection system readily constructed and maintained. Extraction well system and air stripper readily installed and operated.	Cap readily constructed. Leachate collection system readily constructed and maintained. Extraction well system, precipitation system, and chemical oxidation system readily installed and operated.
Reliability of Technology	Ground water monitoring reliable.	Capping and leachate wells or collection trenches are reliable. Air stripping and POTW treatment are reliable.	Capping, leachate collection, extraction, precipitation, and air stripping reliable.	Capping, leachate collection, extraction, precipitation, and chemical oxidation reliable.
Ease of Undertaking Additional Remedial Actions, if Necessary	FS/ROD process may need to be repeated if ground water monitoring indicates further action required.	Ground water extraction/ treatment system could be readily installed, if ground water monitoring indicates further action is required. Air stripping system operation readily extended.	Extraction system readily extended if necessary. Air stripper system operation readily extended.	Extraction system readily extended if necessary. Chemical oxidation system operation readily extended.
Ability to Monitor Effectiveness of Remedy	Ground water monitoring would indicate changes in aquifer.	Ground water monitoring would indicate changes in aquifer. Discharge monitoring would indicate effectiveness of leachate treatment.	Ground water monitoring would indicate effectiveness of extraction system. Discharge monitoring would indicate effectiveness of treatment.	Ground water monitoring would indicate effectiveness of extraction system. Discharge monitoring would indicate effectiveness of treatment.
Coordination With Other Agencies	None necessary.	Coordination with local government necessary to implement deed restrictions.	Coordination with local government necessary to implement deed restrictions.	Coordination with local government necessary to implement deed restrictions.
Availability of Offsite Treatment, Storage, and Disposal Services and Capacity	None required.	Disposal for pretreatment sludge should be readily available.	Disposal facility for pretreatment sludge should be readily available.	None required.

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Availability of Necessary Equipment, Specialists, and Materials	Sampling equipment, sampling personnel, and analytical laboratory readily available.	Sampling equipment, sampling personnel, analytical laboratory, construction equipment, cap materials, and air stripping equipment expected to be readily available.	Sampling equipment, sampling personnel, analytical laboratory, construction equipment, cap materials, drillers, and air stripping equipment expected to be readily available.	Sampling equipment, sampling personnel, analytical laboratory, construction equipment, cap materials, drillers, chemicals, and oxidation apparatus expected to be readily available.
Availability of Prospective Technologies	None required.	Capping and air stripping technologies readily available.	Capping and air stripping technologies readily available.	Capping and chemical oxidation technologies readily available.
COST				
Capital Costs	None	$3,257,000 (Option A) $3,146,000 (Option B) $3,327,000 (Option C) $3,204,000 (Option D)	$3,392,000	$3,481,000
Operation and Maintenance Costs	$15,400	$92,900 (Option A) $86,700 (Option B) $93,900 (Option C) $87,500 (Option D)	$111,000	$138,000
Total Present Worth Cost	$111,400	$4,559,000 (Option A) $4,352,000 (Option B) $4,644,000 (Option C) $4,423,000 (Option D)	$4,859,000 (Best Case) $4,935,000 (Worst Case)	$5,114,000 (Best Case) $5,344,000 (Worst Case)
STATE ACCEPTANCE	To be documented in the Record of Decision (ROD).			
COMMUNITY ACCEPTANCE	To be assessed following the public comment period and documented in the ROD.			

TABLE 16
TOWN OF CONKLIN
GROUND WATER MONITORING WELL DATA

WELL NO.	GRADE ELEVATION	TOP OF STEEL CASING ELEVATION	TOP OF PVC CASING ELEVATION	WELL DEPTH BELOW GRADE	GROUND WATER ELEVATION DATA 8/16/83	11/9/83	12/20/84	1/30/86 -2/3/86	12/1/86	1/20/88	3/28/88	4/12/88	6/20/90
1	944.40	947.41	947.30	60.0	937.34	933.79	943.16	942.73	943.32	941.31	-	942.41	932.32
2	914.80	916.16	915.93	45.0	891.37	890.56	909.84	896.30	896.30	-	896.54	895.56	-
3	891.82	892.12	891.88	20.0	881.21	879.57	885.60	885.54	-	-	-	885.54	-
4	890.90	893.58	893.42	20.0	881.85	881.80	886.80	887.42	887.55	886.92	-	886.76	886.03
5	860.31	860.31	860.24	33.5	853.25	852.17	853.86	855.71	-	854.69	-	855.14	852.55
6	868.80	868.82	868.59	17.9	861.97	860.57	865.59	866.10	-	-- replaced by Well 6R --			
6R	863.04	866.04	865.94	14.0	-	-	-	-	-	856.03	865.83	853.39	-
7	865.20	868.37	868.27	25.0	853.54	852.02	856.22	859.16	859.16	855.99	-	856.91	-
8	860.20	860.24	860.08	18.0	853.34	851.60	853.89	855.26	-	854.77	855.23	855.14	854.41
9	861.30	864.21	864.11	18.0	853.31	851.66	854.66	855.25	856.88	854.74	-	855.21	854.23
10	863.80	863.76	863.47	18.0	853.69	851.76	855.29	856.71	-	855.92	-	856.16	855.14
11	896.20	898.97	898.82	30.5	882.31	881.82	890.77	886.69	887.34	889.94	-	886.95	885.17
12	898.60	901.62	901.51	16.0	-	-	889.17	889.53	889.43	889.19	-	888.68	887.08
13	865.70	868.62	868.55	15.0	853.94	-	860.07	-	861.78	-	859.85	859.2	-
14	914.80	917.25	917.14	15.0	908.45	-	-	-	912.03	910.48	911.8	912.2	-
15	873.80	876.62	876.49	18.0	859.76	-	-	-	865.04	-	863.17	863.09	-
16	-	-	-	2.5	-	-	-	-	-	-	-	-	-
17	948.46	950.89	950.38	30.0	-	-	947.06	-	-	-	-	947.05	-
18	861.00	863.37	862.74	15.0	-	-	859.97	860.70	861.54	-	-	859	-
19	912.39	914.94	914.61	31.5	-	-	908.89	-	-	-	-	-	-
20	898.77	898.77	898.77	31.5	-	-	885.70	887.46	887.46	-	-	890.33	-
21	-	875.06	874.76	20.0	-	-	-	871.84	872.43	872.19	872.82	872.51	-
22	-	885.41	885.02	22.0	-	-	-	877.99	880.48	880.04	880.54	879.88	-
36	941.87	944.57	944.15	14.0	-	-	-	-	-	940.51	940.94	940.23	-
37	906.88	909.36	909.01	25.0	-	-	-	-	-	899.69	900.91	903.16	-
38D	886.29	888.94	888.61	35.0	-	-	-	-	-	883.35	884.22	883.31	881.92
38S	886.83	889.73	889.49	14.0	-	-	-	-	-	-	885.29	884.2	883.21

ALL ELEVATIONS GIVEN IN FT. ABOVE MEAN SEA LEVEL. WELL DEPTHS BELOW GRADE GIVEN IN FT.
Wells 1-15 were installed prior to 8/16/83; Wells 16-20 were installed prior to 12/20/84.
Wells 21-22 were installed 1/27/86; Wells 36-38S were installed 12/15/87 - 12/22/87.

TABLE 17

GROUNDWATER - UPPER LANDFILL
SELECTED INORGANIC AND INDICATOR PARAMETER ANALYSES

PARAMETER, units Standard- See Exhibit B	Date	Well Number 1 Bkgd	2	3	4	11	12	22	36 Bkgd	37	38D	38S
Arsenic, mg/l	8/83	<0.01	<0.01	<0.01	<0.01	<0.01	--	--	--	--	--	--
NY Class GA Grndwater	11/83	<0.01	0.06	0.02	<0.01	0.06	--	--	--	--	--	--
Std = 0.025 mg/l	1/84	--	0.01	<0.01	<0.01	<0.01	--	--	--	--	--	--
Arsenic-F, mg/l	1/86	<0.001	--	<0.001	<0.001	0.002	--	<0.001	--	--	--	--
	4/86	--	--	--	--	--	--	0.006	--	--	--	--
	1/88	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	6/90	<0.003	--	--	<0.003	0.0167	<0.003	--	--	--	0.0085	<0.003
Cadmium, mg/l	8/83	<0.01	<0.01	0.015	<0.01	--	--	--	--	--	--	--
NY/FED Std= 0.01 mg/l	11/83	<0.01	<0.01	<0.01	<0.01	--	--	--	--	--	--	--
	6/90	<0.003	--	--	<0.003	0.0121	<0.003	--	--	--	<0.003	<0.003
Iron, mg/l	8/83	1.8	<0.01	<0.01	0.05	<0.01	--	--	--	--	--	--
NY/FED Std= 0.3 mg/l	11/83	<0.01	0.38	<0.01	0.01	2.20	--	--	--	--	--	--
Iron-F, mg/l	11/84	--	--	--	--	--	--	--	--	--	--	--
	1/86	<0.01	--	<0.01	0.05	0.95	0.12	0.29*	--	--	--	--
	4/86	--	--	--	--	--	--	0.10	--	--	--	--
	1/88	0.351	--	1.48	<0.10	2.26	0.442	<0.10	<0.10	0.974	0.184	2.17
Manganese, mg/l	8/83	0.18	0.31	0.40	0.33	4.40	--	--	--	--	--	--
NY/FED Std= 0.3 mg/l	11/83	0.02	1.9	1.3	<0.01	11	--	--	--	--	--	--
Manganese-F, mg/l	11/84	--	--	--	--	--	--	--	--	--	--	--
	1/86	<0.01	--	0.09	0.07	5.78	1.28	0.045*	--	--	--	--
	4/86	--	--	--	--	--	--	0.03	--	--	--	--
	1/88	0.052	--	2.3	0.098	4.23	4.66	0.018	0.163	0.038	0.205	1.95
pH, s.u.	8/83	7.8	7.5	6.7	7.0	7.1	--	--	--	--	--	--
NY/FED Std= 6.5-8.5 SU	11/83	8.3	7.6	7.8	8.2	7.7	--	--	--	--	--	--
	11/84	--	--	--	--	--	--	--	--	--	--	--
	1/86	6.7	--	5.8	6.3	6	5.9	6.1*	--	--	--	--
	4/86	--	--	--	--	--	--	6.2	--	--	--	--
	1/88	6.8	--	6.9	6	6.1	7	5.2	7.4	9.3	6.6	6.2
	6/90	8.7	--	--	8.7	7.9	8.8	--	--	--	8.2	8.6
Conductivity, umhos/cm	8/83	330	310	200	160	750	--	--	--	--	--	--
	11/83	319	420	212	160	995	--	--	--	--	--	--
	11/84	--	--	--	--	--	--	--	--	--	--	--
	1/86	200	--	280	95	960	95	60*	--	--	--	--
	4/86	--	--	--	--	--	--	80	--	--	--	--
	1/88	125	--	130	120	550	200	90	195	290	300	110
	6/90	170	--	--	120	610	450	--	--	--	370	80
TOC, mg/l	8/83	--	--	--	--	--	--	--	--	--	--	--
	11/83	8	390	59	1	280	--	--	--	--	--	--
	11/84	--	--	--	--	--	--	--	--	--	--	--
	1/86	9	--	6	1	<10	10	16*	--	--	--	--
	4/86	--	--	--	--	--	--	6	--	--	--	--

(*) Average of two sample analyses.

TABLE 18

GROUNDWATER - LOWER LANDFILL
SELECTED INORGANIC AND INDICATOR PARAMETER ANALYSES

PARAMETER, units Standard- See Exhibit B	Date	Well Number 5	6	7	8	9	10	18	21
Arsenic, mg/l	8/83	0.020	<0.01	<0.01	<0.01	<0.01	<0.01	--	--
NY Class GA Grndwater	9-11/83	0.01	0.08	0.07	0.08	<0.01	<0.01	--	--
Std = 0.025 mg/l	1984	<0.01	0.01	0.01	0.01	--	<0.01	<0.01	--
Arsenic-F, mg/l	1/86	<0.001	--	--	0.002	<0.001	<0.001	0.001	0.0012*
	4/86	--	--	--	--	--	--	--	<0.001
	1/88	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01*	<0.01
	6/90	0.0045	--	--	<0.003	0.0111	<0.003	--	--
Cadmium, mg/l	8/83	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	--	--
NY/FED Std= 0.01 mg/l	11/83	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	--	--
	6/90	<0.003	--	--	<0.003	0.003	<0.003	--	--
Iron, mg/l	8/83	<0.01	2.4	<0.01	<0.01	<0.01	<0.01	--	--
NY/FED Std= 0.3 mg/l	11/83	0.02	38	7.80	10	0.03	0.07	--	--
Iron-F, mg/l	11/84	--	--	--	--	--	--	2.7	--
	1/86	0.05	--	--	5.7	<0.01	<0.01	0.86	1.09*
	4/86	--	--	--	--	--	--	--	0.61
	1/88	1.36	0.947	4.03	4.51	<0.10	<0.10	20.7*	8.06
Manganese, mg/l	8/83	1.40	2.80	4.10	4.40	1.70	3.30	--	--
NY/FED Std= 0.3 mg/l	11/83	1.9	4.1	4.3	4.8	2	2.3	--	--
Manganese-F, mg/l	11/84	--	--	--	--	--	--	4.1	--
	1/86	0.26	--	--	1.59	1.74	3.14	2.94	1.68*
	4/86	--	--	--	--	--	--	--	1.01
	1/88	3.32	3.67	2.77	1.33	1.14	4.78	5.72*	1.98
pH, s.u.	8/83	7.1	5.9	6.2	6.2	6.2	6.8	--	--
NY/FED Std= 6.5-8.5 SU	11/83	8.3	6.6	7.1	7.1	7	7.5	--	--
	11/84	--	--	--	--	--	--	6.2	--
	1/86	6.3	--	--	6.5	5.8	6.7	5.8	5.7*
	4/86	--	--	--	--	--	--	--	6.0
	1/88	5.7	7.4	7.1	5.8	7.2	7.1	6.7	7.5
	6/90	8.1	--	--	8	8.3	8.4	--	--
Conductivity, umhos/cm	8/83	190	140	90	90	90	100	--	--
	11/83	161	115	94	84	100	106	--	--
	11/84	--	--	--	--	--	--	170	--
	1/86	75	--	--	75	65	85	85	90*
	4/86	--	--	--	--	--	--	--	80
	1/88	110	90	80	95	80	100	170	80
	6/90	100	--	--	90	80	270	--	--
TOC, mg/l	8/83	--	--	--	--	--	--	--	--
	11/83	14	19	4	4	2	3	--	--
	11/84	--	--	--	--	--	--	139	--
	1/86	9	--	--	2	1	<1	12	91*
	4/86	--	--	--	--	--	--	--	6

(*) Average of two sample analyses.

TABLE 19

GROUNDWATER - LOWER LANDFILL
PURGEABLE PRIORITY POLLUTANTS ANALYSES SUMMARY

Well Number:	5*	6**	7***	8***	8(R)	9*	9(R)	10*	10(R)	18+	18(Dup)	21+	Blank	Blank	Blank	Blank	Blank
Sample Date:	1/88	1/88	1/88	1/88	6/90	1/88	6/90	1/88	6/90	1/88	1/88	1/88	1/88	6/90	6/90	6/90	6/90
														VBLK01	VBLK23	VBLK36	VBLK84
PARAMETER (Standard -See Exhibit B-)				Concentrations expressed as ug/l (ppb)													
1 Chloromethane (5 ug/l)	<1	<10	<10	<1	<10	<10	<10	<10	<10	<10A.	<10A	<10	<10	<10	<10	<10	<10
2 Bromomethane (5 ug/l)	<1	<10	<10	<1	<10	<10	<10	<10	<10	<10A	<10A	<10	<10	<10	<10	<10	<10
3 Vinyl Chloride (5 ug/l#)	<1	<10	<10	<1	<10	<10	<10	<10	<10	<10A	<10A	<10	<10	<10	<10	<10	<10
4 Chloroethane (5 ug/l)	<1	<10	<10	<1	<10	<10	<10	<10	<10	<10A	<10A	<10	<10	<10	<10	<10	<10
5 Methylene Chloride (50 ug/l)	<1	<5	<5	<1	<5	<5	3(J)	<5	<5	<5A	<5A	<5	<5	3(J)	<5	6	4(J)
6 Acetone (50 ug/l)		<10	<10		<10	<10	13	<10	11	<10A	<10A	<10	<10	8(J)	<10	<10	<10
7 Carbon Disulfide		<5	<5		<5	<5	<5	<5	<5	<5A	<5A	<5	<5	<5	<5	<5	<5
8 1,1-Dichloroethene (5 ug/l)	<1	<5	<5	<1	<5	<5	<5	<5	<5	<5A	<5A	<5	<5	<5	<5	<5	<5
9 1,1-Dichloroethane (5 ug/l)	<1	<5	<5	<1	<5	<5	<5	<5	<5	<5A	<5A	<5	<5	<5	<5	<5	<5
10 1,2-Dichloroethene (5 ug/l total)	<1	<5	<5	<1	<5	<5	<5	<5	<5	<5A	<5A	<5	<5	<5	<5	<5	<5
11 Chloroform (100 ug/l##)	<1	<5	<5	<1	<5	<5	<5	<5	<5	<5A	<5A	<5	1J	<5	<5	<5	<5
12 1,2-Dichloroethane (5 ug/l)	<1	<5	<5	<1	<5	<5	<5	<5	<5	<5A	<5A	<5	<5	<5	<5	<5	<5
13 2-Butanone (50 ug/l)		<10	<10		<10	<10	<10	<10	<10	<10A	3JA	<10	4J	7(J)	<5	<5	<5
14 1,1,1-Trichloroethane (5 ug/l)	<1	<5	<5	<1	<5	<5	<5	<5	<5	<5A	<5A	<5	<5	<5	<5	<5	<5
15 Carbon Tetrachloride	<1	<5	<5	<1	<5	<5	<5	<5	<5	<5A	<5A	<5	<5	<5	<5	<5	<5
16 Vinyl Acetate (50 ug/l)		<10	<10		<10	<10	<10	<10	<10	<10A	<10A	<10	<10	<10	<10	<10	<10
17 Bromodichloromethane (100 ug/l##)	<1	<5	<5	<1	<5	<5	<5	<5	<5	<5A	<5A	<5	<5	<5	<5	<5	<5
18 1,2-Dichloropropane (5 ug/l)	<1	<5	<5	<1	<5	<5	<5	<5	<5	<5A	<5A	<5	<5	<5	<5	<5	<5
19 c-1,3-Dichloropropene (5 ug/l)	<1	<5	<5	<1	<5	<5	<5	<5	<5	<5A	<5A	<5	<5	<5	<5	<5	<5
20 Trichloroethene (10 ug/l#)	<1	<5	<5	<1	<5	<5	<5	<5	<5	<5A	<5A	<5	<5	<5	<5	<5	<5
21 Dibromochloromethane (100 ug/l##)	<1	<5	<5	<1	<5	<5	<5	<5	<5	<5A	<5A	<5	<5	<5	<5	<5	<5
22 1,1,2-Trichloroethane (5 ug/l)	<1	<5	<5	<1	<5	<5	<5	<5	<5	<5A	<5A	<5	<5	<5	<5	<5	<5
23 Benzene (5 ug/l#)	<1	<5	<5(6)	<1(	<5	<5	<5	<5	<5	<5A	<5A	<5	<5	<5	<5	<5	<5
24 t-1,3-Dichloropropene (5 ug/l)	<1	<5	<5	<1	<5	<5	<5	<5	<5	<5A	<5A	<5	<5	<5	<5	<5	<5
25 2-Chloroethylvinylether (5 ug/l)	<10			<10													
26 Bromoform (100 ug/l##)	<10	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
27 4-Methyl-2-Pentanone (50 ug/l)		<10	<10		<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
28 2-Hexanone (50 ug/l)		<10	<10		<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
29 Tetrachloroethene (5 ug/l)	<1	<5	<5	<1	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
30 1,1,2,2-Tetrachloroethane(5 ug/l)	<1	<5	<5	<1	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
31 Toluene (5 ug/l)	<1	<5	<5	<1	<5	<5	<5	<5	<5	2J	<5	<5	<5	<5	<5	<5	<5
32 Chlorobenzene (5 ug/l)	<1	<5	<5	<1	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
33 Ethylbenzene (5 ug/l)	<1	<5	<5	<1	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
34 Styrene (5 ug/l)		<5	<5		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
35 Total Xylenes (5 ug/l)	<1	<5	<5	<1	<5	<5	<5	<5	<5	3J	<5	<5	<5	<5	<5	<5	<5

Previous analytical results, if different, are noted in brackets.

(-) NYSDOH Proposed Standards Limiting Organic Chemical Contamination in Drinking Water, unless noted.

(#) NYS Water Quality Standards for Class GA Waters

(##) NYS/FED MCL for sum of Total Trihalomethanes

(*) Previous sampling results from 8/83, 11/83 and 1/86 confirm the above results for 1/88.

(**) Previous sampling results from 8/83 and 11/83 confirm the above results for 1/88.

(***) Previous sampling results from 8/83 and 11/83 confirm the above results for 1/88, except for benzene.

(+) Previous sampling results from 1/86 confirm the above results for 1/88.

R Repeat analysis was performed as orginal did not meet spike recovery requirements for 1,2 Dichloroethane. Repeat results are reported.

A Holding time exceeded for analysis.

J Concentration detected is below detection limit.

K Surrogate % recovery outside QC/limits.

TABLE 20

GROUNDWATER - UPPER LANDFILL
PURGEABLE PRIORITY POLLUTANTS ANALYSES SUMMARY

Well Number:	1*	1	2**	3*	4*	4	11	11	11	11	11	12+	12	22+	36	37	38D	38D	38S	38S(R)	Blank	Blank	Blank	Blank	Blank
Sample Date:	1/88 Bkgd	6/90 Bkgd	1983	1/88	1/88	6/90	8/83	11/83	2/86	1/88	6/90	1/88	6/90	1/88	1/88 Bkgd	1/88	1/88	6/90	1/88	6/90	1/88	6/90 VBLK01	6/90 VBLK23	6/90 VBLK36	6/90 VBLK84
PARAMETER (Standard -See Exhibit B¯)							Concentrations expressed as ug/l (ppb)																		
1 Chloromethane (5 ug/l)	<10	<10	<1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
2 Bromomethane (5 ug/l)	<10	<10	<1	<10	<10	<10	<10	2	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
3 Vinyl Chloride (5 ug/l#)	<10	<10	<1	<10	<10	<10	16	1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
4 Chloroethane (5 ug/l)	<10	<10	<1	<10	<10	<10	5	18	63	170	68	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
5 Methylene Chloride (50 ug/l)	<5	5(B)	4(<1)	<5	<5	<5	2	32	1	2	<5	<1	4(B,J)	<1	<1	<1	<1	4(B,J)	<1	3(J)	<5	3(J)	<5	6	4(J)
6 Acetone (50 ug/l)	<10	<10		<10	<10	<10	<10	<10	<10		<10		<10					<10		<10	<10	8(J)	<10	<10	<10
7 Carbon Disulfide	<5	<5		<5	<5	<5	<5	<5	<5		<5		<5					<5		<5	<5	<5	<5	<5	<5
8 1,1-Dichloroethene (5 ug/l)	<5	<5	<1	<5	<5	<5	<5	<5	<5	<1	<5	<1	<5	<1	<1	<1	<1	<5	<1	<5	<5	<5	<5	<5	<5
9 1,1-Dichloroethane (5 ug/l)	<5	<5	<1	<5K	<5K	<5K	26	150	210	44	4(J,X)	<1	<5	<1	<1	<1	<1	<5	<1	<5	<5	<5	<5	<5	<5
10 1,2-Dichloroethene (5 ug/l total)	<5	<5	<1	<5	<5	<5	<5	<5	1	4	<5	<1	<5	<1	<1	<1	<1	<5	<1	<5	<5	<5	<5	<5	<5
11 Chloroform (100 ug/l##)	<5	<5	<1	<5	<5	<5	<5	<5	<5	<1	<5	<1	<5	<1	<1	<1	<1	<5	<1	<5	1J	<5	<5	<5	<5
12 1,2-Dichloroethane (5 ug/l)	<5	<5	<1	<5	<5	<5	<5	3	3	<1	<5	<1	<5	<1	<1	<1	<1	<5	<1	<5	<5	<5	<5	<5	<5
13 2-Butanone (50 ug/l)	<10	<10		<10	<10	<10	<10	<10	<10		<10		<10					<10		<10	4J	7(J)	<5	<5	<5
14 1,1,1-Trichloroethane (5 ug/l)	<5	<5	<1	<5	<5	<5	8	1	9	<1	<5	<1	<5	<1	<1	<1	<1	<5	<1	<5	<5	<5	<5	<5	<5
15 Carbon Tetrachloride	<5	<5	<1	<5	<5	<5	<5	<5	<5	<1	<5	<1	<5	<1	<1	<1	<1	<5	<1	<5	<5	<5	<5	<5	<5
16 Vinyl Acetate (50 ug/l)	<10	<10		<10	<10	<10	<10	<10	<10		<10		<10					<10		<10	<10	<10	<10	<10	<10
17 Bromodichloromethane (100 ug/l##)	<5	<5	<1	<5	<5	<5	<5	<5	<5	<1	<5	<1	<5	<1	<1	<1	<1	<5	<1	<5	<5	<5	<5	<5	<5
18 1,2-Dichloropropane (5 ug/l)	<5	<5	<1	<5	<5	<5	<5	40	43	34	9(X)	<1	<5	<1	<1	<1	<1	<5	<1	<5	<5	<5	<5	<5	<5
19 c-1,3-Dichloropropene (5 ug/l)	<5	<5	<1	<5	<5	<5	<5	<5	<5	<1	<5	<1	<5	<1	<1	<1	<1	<5	<1	<5	<5	<5	<5	<5	<5
20 Trichloroethene (10 ug/l#)	<5	<5	<1	<5	<5	<5	<5	1	2	<1	<5	<1	<5	<1	<1	<1	<1	<5	<1	<5	<5	<5	<5	<5	<5
21 Dibromochloromethane (100 ug/l##)	<5	<5	<1	<5	<5	<5	<5	<5	<5	<1	<5	<1	<5	<1	<1	<1	<1	<5	<1	<5	<5	<5	<5	<5	<5
22 1,1,2-Trichloroethane (5 ug/l)	<5	<5	<1	<5	<5	<5	<5	<5	<5	<1	<5	<1	<5	<1	<1	<1	<1	<5	<1	<5	<5	<5	<5	<5	<5
23 Benzene (5 ug/l#)	<5	<5	2(<1)	<5(1)	<5	<5	<5	3	<5	2	<5	<1	<5	<1	<1	<1	<1	<5	<1	<5	<5	<5	<5	<5	<5
24 t-1,3-Dichloropropene (5 ug/l)	<5	<5	<1	<5	<5	<5	<5	<5	<5	<1	<5	<1	<5	<1	<1	<1	<1	<5	<1	<5	<5	<5	<5	<5	<5
25 2-Chloroethylvinylether (5 ug/l)			<10							<10		<10		<10	<10	<10	<10		<10						
26 Bromoform (100 ug/l##)	<5	<5	<10	<5	<5	<5	<5	<5	<5	<10	<5	<10	<5	<10	<10	<10	<10	<5	<10	<5	<5	<5	<5	<5	<5
27 4-Methyl-2-Pentanone (50 ug/l)	<10	<10	<1	<10	<10	<10	<10	<10	<10		<10		<10					<10		<10	<10	<10	<10	<10	<10
28 2-Hexanone (50 ug/l)	<10	<10	<1	<10	<10	<10	<10	<10	<10		<10		<10					<10		<10	<10	<10	<10	<10	<10
29 Tetrachloroethene (5 ug/l)	<5	<5	<1	<5	<5	<5	<5	<5	<5	<1	<5	<1	<5	<1	<1	<1	<1	<5	<1	<5	<5	<5	<5	<5	<5
30 1,1,2,2-Tetrachloroethane(5 ug/l)	<5	<5	<1	<5	<5	<5	<5	<5	<5	<1	<5	<1	<5	<1	<1	<1	<1	<5	<1	<5	<5	<5	<5	<5	<5
31 Toluene (5 ug/l)	<5	<5	1(2)	<5	<5	<5	<5	110	40	3	<5	<1	<5	<1	<1	<1	2	<5	<1	<5	<5	<5	<5	<5	<5
32 Chlorobenzene (5 ug/l)	<5	<5	<1	<5	<5	<5	<5	<5	<5	<1	<5	<1	<5	<1	<1	<1	<1	<5	<1	<5	<5	<5	<5	<5	<5
33 Ethylbenzene (5 ug/l)	<5	<5	<1	<5	<5	<5	<5	1	<5	<1	<5	<1	<5	<1	<1	<1	<1	<5	<1	<5	<5	<5	<5	<5	<5
34 Styrene (5 ug/l)	<5	<5	<1	<5	<5	<5	<5	<5	<5		<5		<5					<5		<5	<5	<5	<5	<5	<5
35 Total Xylenes (5 ug/l)	<5	<5	<1	<5	<5	<5	<5	11	7	3	7	<1	<5	<1	<1	<1	<1	<5	<1	<5	<5	<5	<5	<5	<5

Previous analytical results, if different, are noted in brackets.

(¯) NYSDOH Proposed Standards Limiting Organic Chemical Contamination in Drinking Water, unless otherwise noted.

(#) NYS Water Quality Standards for Class GA Waters

(##) NYS/FED MCL for sum of Total Trihalomethanes

(*) Previous sampling results from 8/83, 11/83 and 1/86 confirm the above results for 1/88.

(**) Results presented are based on two sampling events (8/83 and 11/83).

(+) Previous sampling results from 1/86 confirm the above results for 1/88.

R Repeat analysis was performed as original did not meet spike recovery requirements for 1,2 Dichloroethane. Repeat results are reported.

A Holding time exceeded for analysis.

J Concentration detected is below detection limit.

K Surrogate % recovery outside QC/limits.

B Constituent found in the blank.

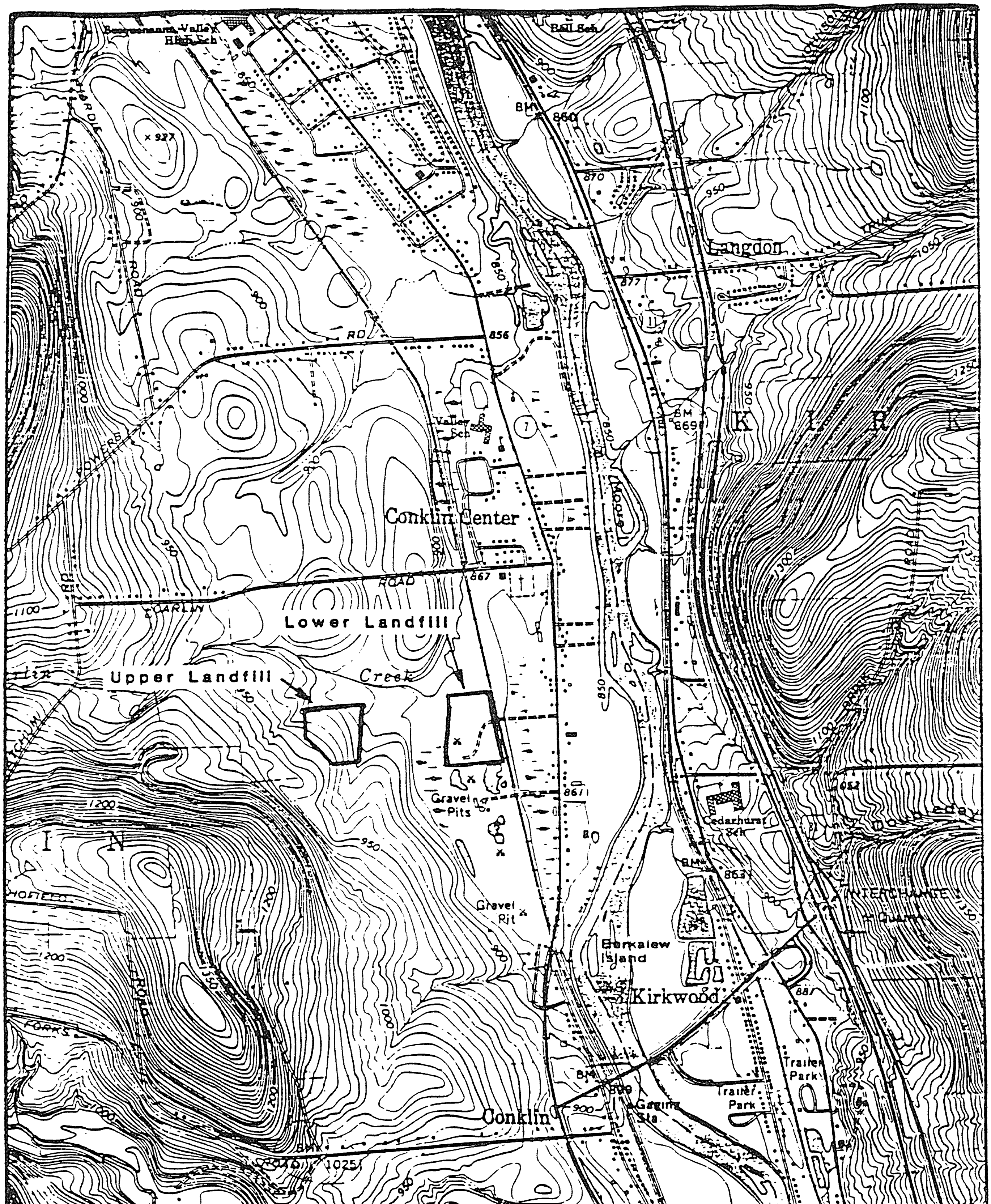
X Mass Spectrum data does not meet EPA CLP criteria but compound presence is strongly suspected.

Revised 12/13/90

Figures

O'BRIEN & GERE

FIGURE 1



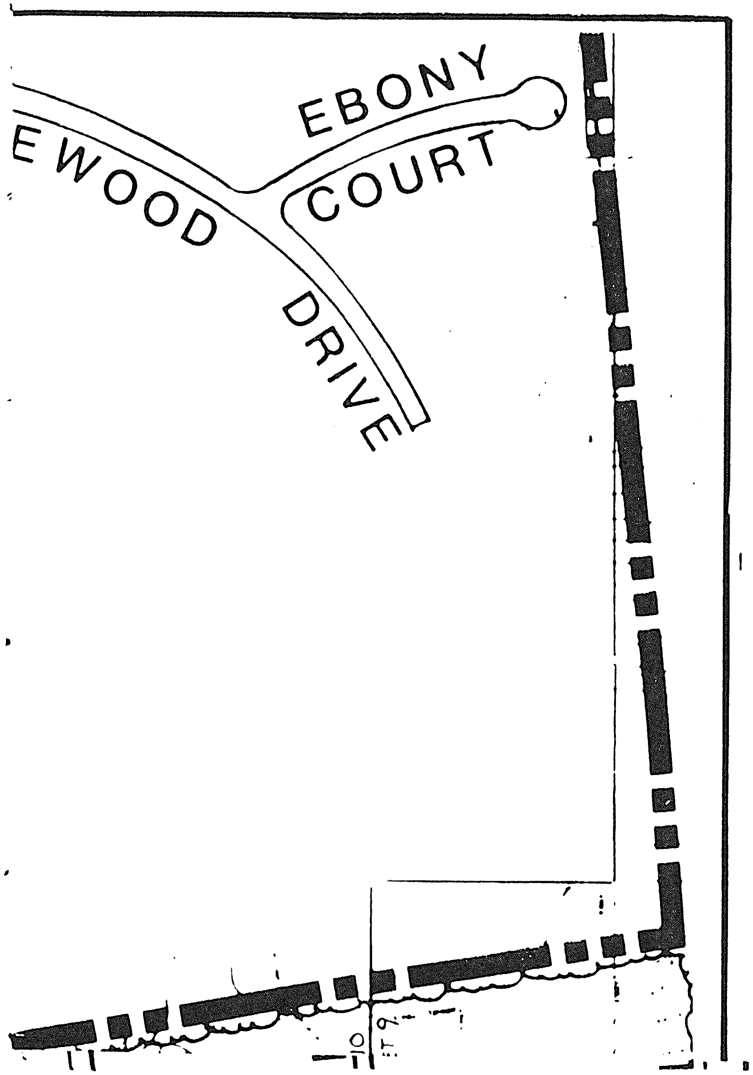
2000' 0' 2000' 4000'

North

From USGS Binghamton East Quadrangle (1968)

Feasibility Study Town Of Conklin Landfills Site	LOCATION MAP

O'BRIEN & GERE



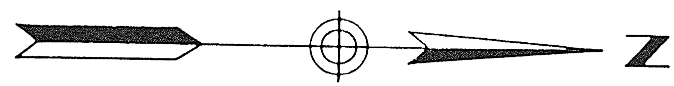


FIGURE 2

TOWN OF CONKLIN LANDFILLS
FEASIBILITY STUDY

SITE PLAN

FIGURE 3

HYDROGEOLOGIC CROSS SECTION
TOWN OF CONKLIN
UPPER & LOWER LANDFILLS

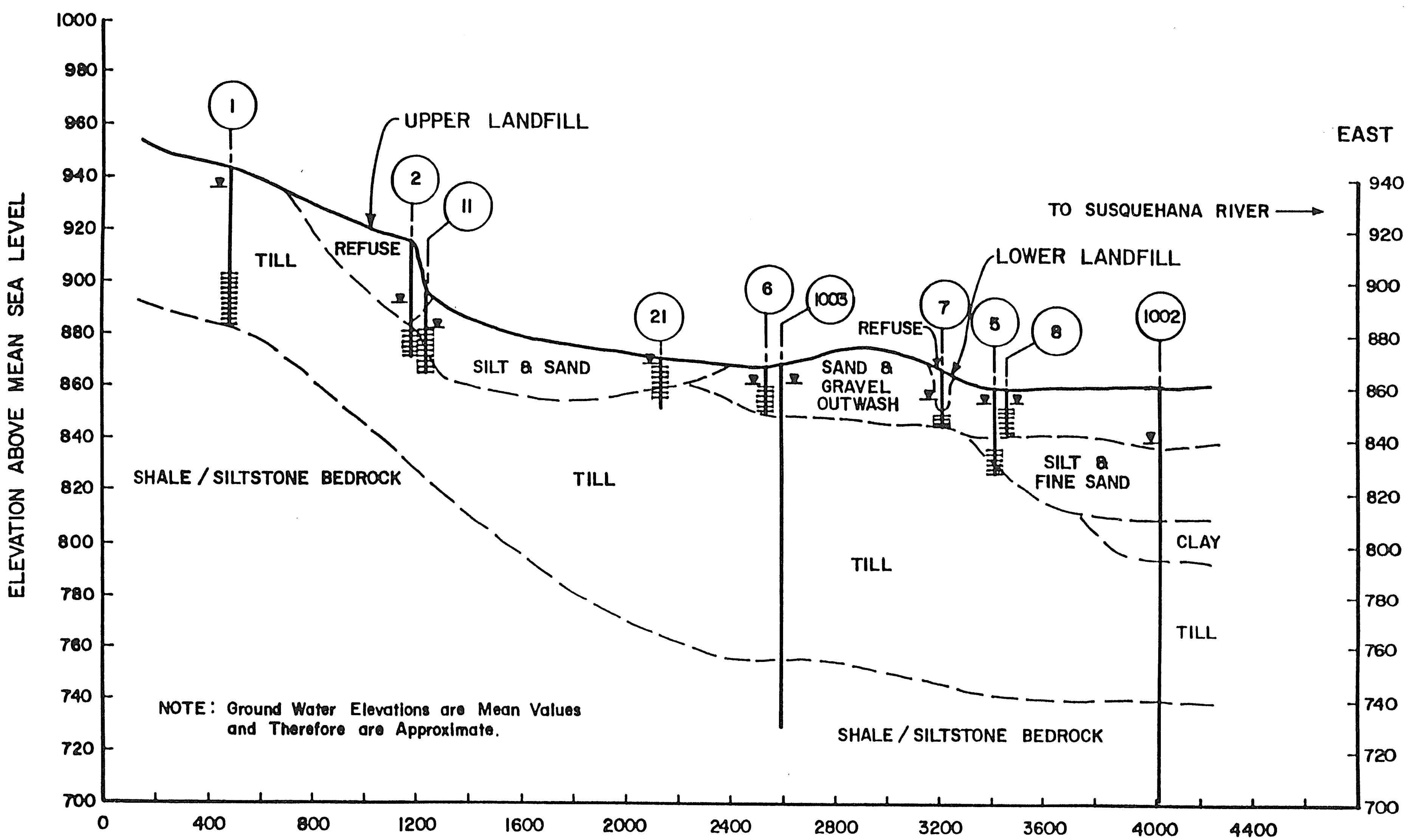
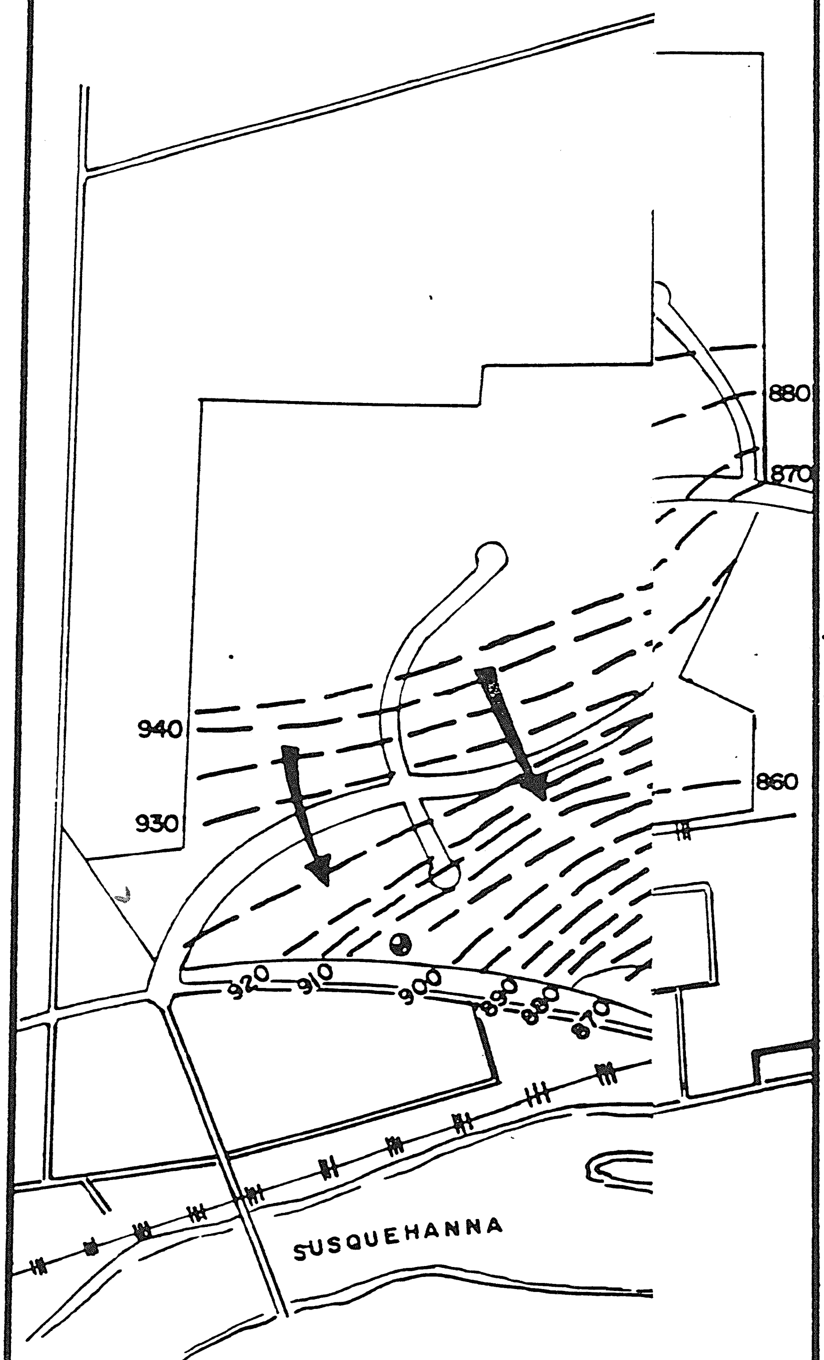


FIGURE 4



GROUNDWATER ELEVATION MAP

LEGEND

- GROUNDWATER MONITORING WEL
- LEACHATE / METHANE GAS MONITORING WELL
- WELLS BY OTHERS
- GROUNDWATER EQUIPOTENTIAL LINE (DEC. 20, 1984)
- GROUNDWATER FLOW DIRECTION
- APPROXIMATE LIMITS OF FILL

SCALE IN FEET

400 0 400 800

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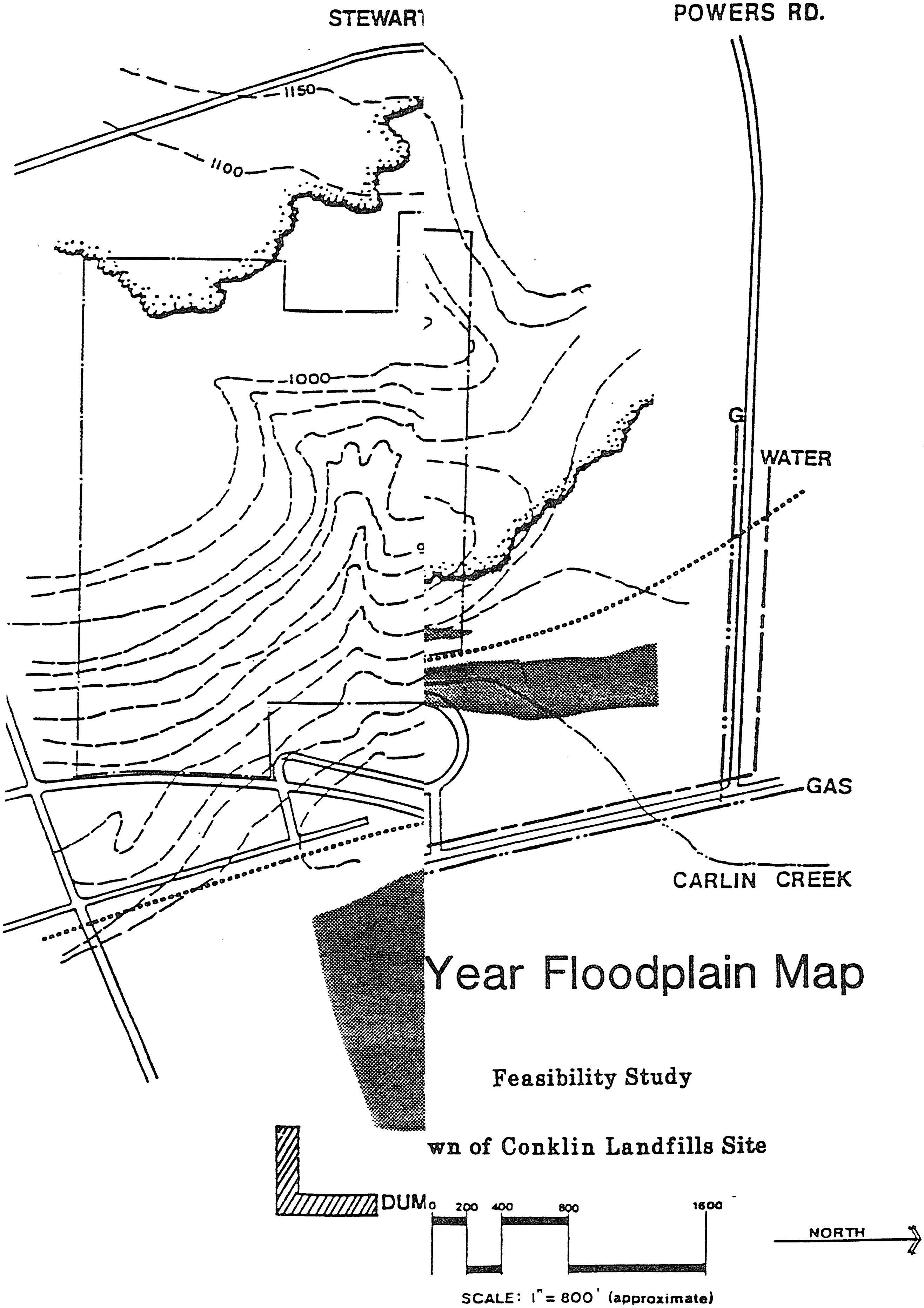
FIGURE 5

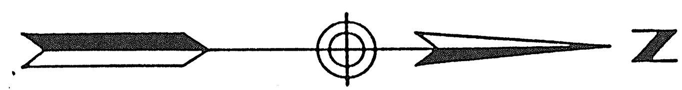


Year Floodplain Map

Feasibility Study

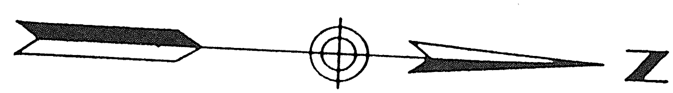
wn of Conklin Landfills Site

FIGURE 6



TOWN OF CONKLIN LANDFILLS
FEASIBILITY STUDY

FIGURE 7



TOWN OF CONKLIN LANDFILLS
FEASIBILITY STUDY

Appendices

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APPENDIX A

CHLOROETHANE DEGRADATION

Chloroethane is the primary constituent of concern in ground water at the Town of Conklin Landfills Site. Chloroethane is formed through the degradation of trichloroethane (TCA). The anaerobic degradation pathway of TCA is

$$\text{TCA} \longrightarrow \text{1,1-Dichloroethane (DCA)} \longrightarrow \text{Chloroethane} \longrightarrow \text{Ethanol} \longrightarrow CO_2$$

and involves both abiotic and biotic processes (Vogel and McCarty, 1987).

Ground water data from Well #11 demonstrate low concentrations of TCA from 1983 to 1986. These low concentrations are consistent with literature information for TCA degradation, which indicates that the anaerobic degradation half-life of TCA to 1,1-DCA is less than one day (Vogel and McCarty, 1987). Accordingly, it is expected that little TCA would be observed in the aquifer, since any TCA introduced into the ground water would likely be rapidly degraded to 1,1-DCA.

The concentration of 1,1-DCA in Well #11 was 26 ppb during the initial of sampling in August, 1983. The concentration of 1,1-DCA then rose over the next three years to peak at 210 ppb in February, 1986. Since then, the concentration of 1,1-DCA dropped to 44 ppb in January, 1988 and 4 ppb in June, 1990. As would be expected, 1,1-DCA concentrations began to decrease after February, 1986 when TCA was no longer detected in the ground water at Well #11. 1,1-DCA degrades anaerobically to chloroethane (Vogel and McCarty, 1987).

Chloroethane was initially detected at 5 ppb in Well #11 in August, 1983. The concentrations of chloroethane in subsequent samples collected over the next five years increased and peaked at 170 ppb in January, 1988. Since then, the concentration of chloroethane has decreased to 68 ppb in June, 1990. Chloroethane has been shown to abiotically degrade to ethanol. While this cannot be verified due to the fact that ethanol was not analyzed for, the comparison of actual degradation rates and published degradation rates indicate that the process is occurring.

The chloroethane degradation rate was calculated using the following first-order decay equation:

$$\log[A] = \log[A_o] - ((k \times t)/2.30)$$

where [A] = final concentration of chloroethane in June, 1990 (ppb)

$[A_o]$ = initial concentration of chloroethane in Jan. 1988 (170 ppb)

t = elapsed time between initial and final sampling (2.42 years)

k = first-order degradation rate constant ($year^{-1}$)

The rate constant was calculated twice using two different final chloroethane concentrations (78 ppb and 68 ppb). This was because multiple samples were collected and analyzed from Well #11 in June 1990. In addition to the actual sample, a matrix spike (MS) sample and matrix spike duplicate (MSD) sample were collected and separately analyzed prior to spiking. The results for chloroethane in the MS and MSD samples were both 78 ppb. The actual sample was found to contain 68 ppb of chloroethane. Using these two final concentrations, degradation rates were calculated to be 0.32 $year^{-1}$ and 0.38 $year^{-1}$, respectively. The published rate for chloroethane degradation is 0.37 $year^{-1}$ (Vogel and McCarty, 1987).

To predict the time required for chloroethane concentrations to decrease to Class GA ground water standards (5 ppb), the above degradation rates (0.32 and 0.38 $year^{-1}$) and the first order decay equation were used. Using a final concentration value of 5.0 ppb and the appropriate initial concentration (78 ppb and 68 ppb), the approximate time required to achieve Class GA ground water standards for chloroethane was calculated to be between 7 and 9 years.

Future ground water monitoring will serve to further evaluate the anticipated degradation of chloroethane. If anticipated degradation does not occur, ground water pump and treat options should be reevaluated.

APPENDIX B

GROUND WATER PUMPING RATES AND DURATION

To solve for the required recovery well flow rate, the equation for ground water flow to a single well was used and is as follows:

$$(Q) = \frac{K\,(H^2 - hw^2)}{458 \ln Ro/rw}$$

Where K = hydraulic conductivity (gpd/ft^2)

Q = well yield (gpm)

H = aquifer thickness (ft)

hw = aquifer thickness less the available drawdown (ft)

Ro = radius of influence (ft)

rw = radius of a recovery well (ft)

The assumptions made for this equation were:

K = 34 gpd/ft^2 (from K test of shallow aquifer Well #38S)

H = 22 ft (depth of sand and silt material)

hw = 2 ft (22 ft thick aquifer less 20 feet of drawdown)

Ro = 90 ft (assuming the plume width is 180 ft, half the distance from Well #3 to Well #4)

Using these values in the above equation, the flow rate is calculated:

$$= \frac{34(22^2 - 2^2)}{458 \ln 90/0.5}$$

$$= 7 \text{ GPM}$$

To find the actual radius of influence for each recovery well, the equation used was:

$$\text{Radius of Inflow} = \frac{Q}{2 \times K \times hi}$$

Where Q = well yield, 7 gpm (10,080 gpd)

K = hydraulic conductivity 34 gpd/ft^2 (See above)

b = aquifer thickness = 22 ft (See above)

i = hydraulic gradient = 0.070 (from Figure 4-Ground Water Elevation Map)

$$\text{Radius of Inflow} = \frac{10{,}080}{(2)(34 \text{ gpd/ft}^2)(22 \text{ ft})(0.070)}$$

$$= 96 \text{ feet}$$

Using the above assumptions, one well pumping an average flow of 7 gpm will effectively contain the plume. Due to variability in aquifer properties and the lack of information concerning the actual plume width, assume two recovery wells will be used instead of one.

To solve for the time required for pumping, the velocity of volatile organic compounds (VOCs) within the ground water under the landfill must be known. This is found using

$$V = \frac{Ki}{Rn}$$

where V = flow velocity (ft/day)

K = hydraulic conductivity, 0.26 ft/day (average K test of Wells #11 and #2)

i = hydraulic gradient 0.15 (measured from Ground Water Elevation Map and accounting for assumed recovery well drawdown)

R = retardation factor (6.0 to 10 for VOCs)

n = porosity, 0.34 for glacial fill

Therefore

$$V = \frac{0.26 \text{ ft/day} \times 0.15}{6 \text{ to } 10 \times 0.34}$$

V = 0.011 to 0.019 feet/day

Assuming the ground water plume extends half of the distance from Well #11 to Well #2 (approximately 100 ft), the length of time for VOCs to migrate to Well 11 would range from 14 to 24 years.

It should be noted that these calculations do not consider degradative processes acting upon the constituents of concern in the ground water. These processes will likely reduce the time required for pumping to achieve the remedial objectives. As calculated above, ground water at the assumed upgradient boundary of the plume would remain in the aquifer for 14 to 24 years during the pumping scenario. Degradation processes, in the absence of pumping, are expected to reduce concentrations of constituents of concern to Class GA standards in approximately 7 to 9 years (Appendix A). If the hydraulic stresses/changes caused by pumping do not impact the degradative processes which are occurring without pumping, the time required for remediation of the aquifer through pumping would be approximately 7 to 9 years. If the degradative processes are affected by pumping, such that they are not functional, ground water remediation through pumping would be completed in approximately 14 to 24 years.

APPENDIX C

LEACHATE GENERATION

Evaluation of leachate generation from the Upper and Lower Landfills was conducted using the USEPA *Hydrologic Evaluation of Landfill Performance (HELP) Model Version 2* (USEPA, 1988b). This appendix describes the input data used in the HELP Model simulations, and presents the results of the simulations.

The HELP Model calculates leachate generation from cap design information, climatological data, and soil characteristics. The user may choose to have the climatological and soil data generated by the program itself as the program contains this data for many cities throughout the United States.

Climatological data for the Site were generated synthetically by the HELP Model using mean monthly rainfall and temperature data entered by the user. The mean monthly rainfall and temperature data used were those form the United States Department of Agriculture (USDA) Soil Conservation Service's (SCS) *Soil Survey of Broome County, New York* (USDA SCS, 1971). The mean rainfall and temperature data were based upon a 16-year record measured at the Broome County Airport in Binghamton, New York. The city used for the climatological data synthetic generation routine was Syracuse, New York.

The cap design information used in the HELP Model simulations included:

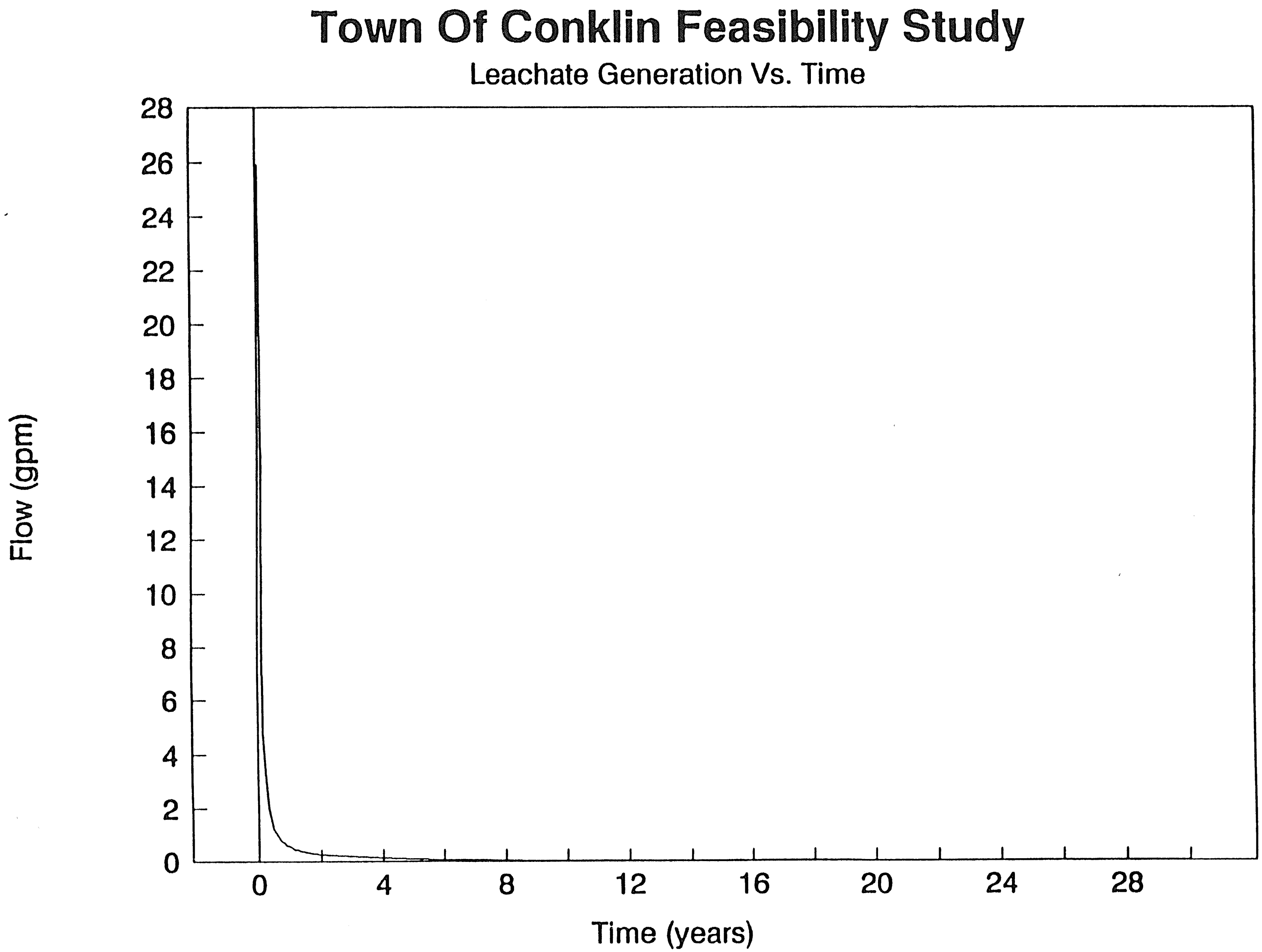
- 6 inch topsoil layer ("Lateral Drainage Layer")
- 24 inch barrier protection layer ("Lateral Drainage Layer")
- 12 inch gas drainage layer overlain by an impermeable FML ("Soil Barrier Layer with an FML")
- 96 inch waste layer ("Vertical Percolation Layer")

All soil water content values were initialized by the program except for the waste material. The soil water content of the waste material was initialized by the user at 90% saturation. The landfills were considered to be currently "inactive" or "closed". The cap drainage gradient used was 4% and the length to the nearest drainage lateral was estimated to be 500 ft. This caused a "worst case" scenario by minimizing drainage from the layers above the FML, thereby creating a hydraulic head above the FML of approximately 30 inches, the maximum which could occur.

The leakage factor used for the FML was 5×10^{-8}. This value was taken from a study of liner performance in which available case histories of liner installation and defect findings were evaluated to arrive at an average defect size and frequency. The study concluded that, if a liner were installed using standard construction techniques and an intensive quality assurance and quality control (QA/QC) program, one to two defects measuring 1 cm^2 each would exist for each acre of liner (USEPA, 1987). The information presented in the study is considered conservative, in that it was developed for liners, rather than caps. Liners would be expected to be under greater loads than caps, and are more frequently subject to contact with aggressive liquids such as leachate, whereas caps are not.

Separate model runs were conducted for each landfill for a 30-year period. Leachate flow rates were calculated using output data from the two model runs and assuming leachate collection would be placed at the same height as the ground water table. The combined leachate flow rates are presented graphically in Figure C-1. The output indicates that initially, the leachate would consist of moisture draining from the landfill material. Over time, the leachate flow rate from the base of the waste would eventually equal the flow rate through the FML. This was estimated by the model to be approximately 2250 gal/year.

FIGURE C-1



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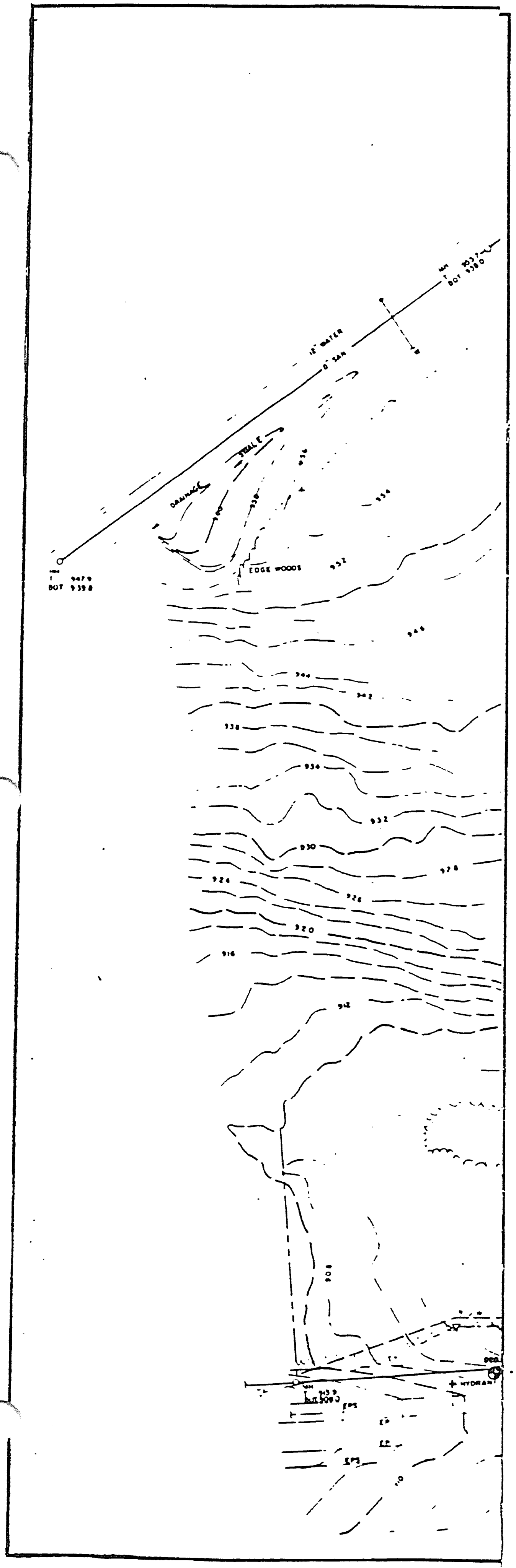
APPENDIX D

METHANE GAS MONITORING

Methane gas monitoring was conducted using a Lower Explosive Limit (LEL) meter to collect readings every 100 ft around the perimeter of each landfill. The readings were collected by inserting a 0.5 inch diameter probe 6 to 12 inches beneath the surface of the soil and collecting an air sample. Sampling locations for the Upper and Lower Landfills are shown in Figures D-1 and D-2, respectively.

No methane gas was detected at either landfill at any sampling point.

FIGURE D-1



TOWN OF CONKLIN LANDFILLS SITE

FEASIBILITY STUDY

LOWER LANDFILL

METHANE GAS SAMPLING LOCATION MAP

LEGEND

- MONITORING WELL LOCATION
- BORING LOCATION
- LEACHATE WELL LOCATION
- LEACHATE SEEP LOCATION
- METHANE SAMPLING LOCATION
- APPROXIMATE LIMITS OF FILL

SCALE

50 0 50 100

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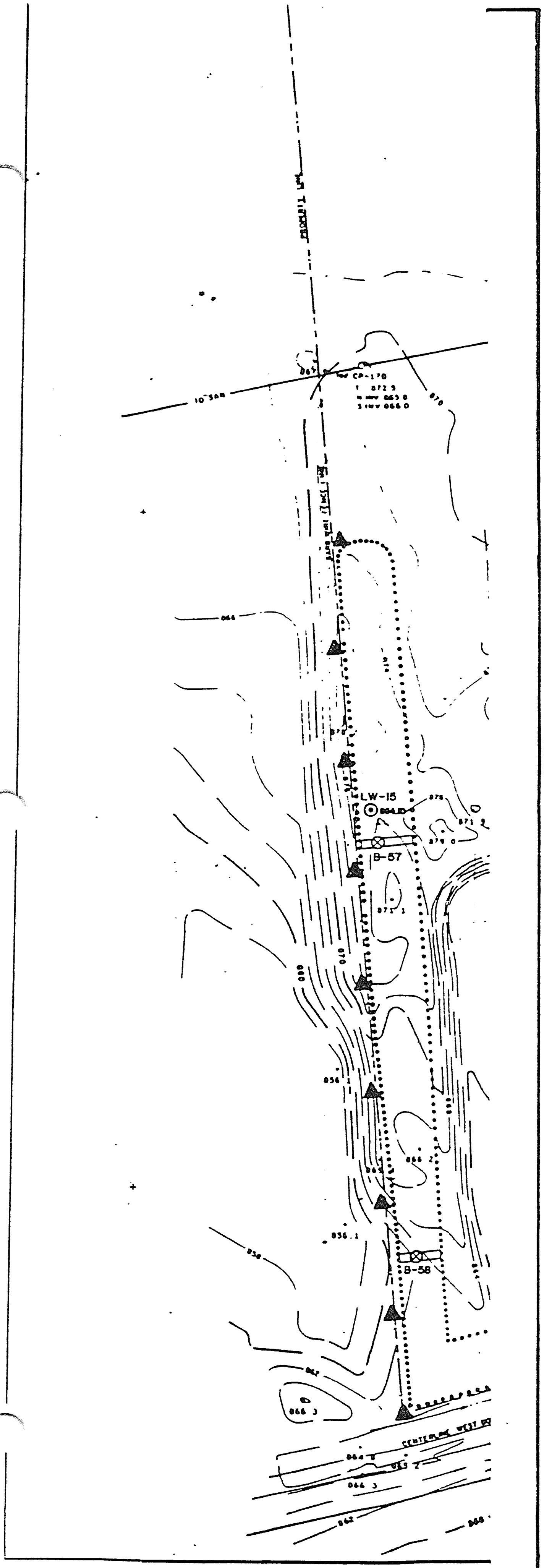
FIGURE D-2



TOWN OF CONKLIN LANDFILLS SITE

FEASIBILITY STUDY

UPPER LANDFILL

METHANE GAS SAMPLING LOCATION MAP

LEGEND

- MONITORING WELL LOCATION
- BORING LOCATION
- LEACHATE WELL LOCATION
- METHANE SAMPLING LOCATION
- APPROXIMATE LIMITS OF FILL
- EXPLORATION TRENCH

SCALE

50 0 50 100

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APPENDIX E

AIR EMISSIONS CALCULATIONS

The first step in evaluating air emissions is determining the total emission rate potential in pounds per hour. This is most easily calculated by summing the expected concentrations from the source and multiplying this sum by the liquid flow rate. As a conservative estimate, constituents found to be non-detectable shall be considered present at the detection limit concentration. The sum of the volatile organic concentrations found in MW #11 in June, 1990 was 278 ppb. Using two recovery wells pumping at 7 gpm each, and assuming 100% transfer from liquid to air during air stripping, the total hourly volatile organic emission potential is

$$14 \text{ gal/min} \times 3.785 \text{ l/gal} \times 60 \text{ min/hr} \times 0.278 \text{ mg/l} \times 1 \text{ lb}/454{,}000 \text{ mg} = 1.95 \times 10^{-3} \text{ lb/hr}$$

For leachate, the sum of the most recent monitoring data for Leachate Wells #13 and #14 are 251 ppb and 2432 ppb, respectively. Conservatively assuming 5 gpm will be recovered from each landfill and 100% transfer of constituents, the total hourly volatile organic emission potential is

$$10 \text{ gal/min} \times 3.785 \text{ l/gal} \times 60 \text{ min/hr} \times 2.683 \text{ mg/l} \times 1 \text{ lb}/454{,}000 \text{ mg} = 1.34 \times 10^{-2} \text{ lb/hr}$$

If both leachate and ground water are treated, the total hourly volatile organic emission potential is

$$1.34 \times 10^{-2} \text{ lb/hr} + 1.95 \times 10^{-3} \text{ lb/hr} = 1.54 \times 10^{-2} \text{ lb/hr}$$

Therefore, the hourly emission potential for treating leachate alone or with ground water is less than 1.0 lb/hr.

To determine if the air stripping emissions would cause exceedences of the Ambient Guideline Concentrations (AGCs), the Stepwise Evaluation of Toxic Contaminants procedure from the New York State Air Guide-1 was used. This procedure is used to evaluate an emissions impact on the surroundings, considering stack height, exhaust temperature, building characteristics, and other important factors. One of the initial screening steps is to determine if the in-stack concentration of a compound, when divided by 100, exceeds the compounds established AGC. If no exceedance occurs, further analysis is not required. Using a predetermined air to water flow ratio, a maximum liquid influent concentration can be calculated from the AGC. Using benzene as an example, if the air to water flow rate ratio equals 30 CFM : 1 gpm and the AGC for benzene equals 100 $\mu g/m^3$, the maximum liquid influent concentration for benzene equals

$$30 \text{ CFM/1 gpm} \times 1 \text{ m}^3/35.3145 \text{ ft}^3 \times 1 \text{ gal}/3.785 \text{ l} = 0.224 \text{ m}^3/\text{l (metric air:water ratio)}$$

$$\text{max.in-stack conc. of benzene} = 100 \times 100 \ \mu g/m^3 = 10{,}000 \ \mu g/m^3$$

$$\text{max. influent liquid conc.} = 10{,}000 \ \mu g/m^3 \times 0.224 \text{ m}^3/\text{l} = 2{,}240 \ \mu g/\text{l}$$

This is far greater than any benzene concentration found on site. This same process can be performed for the constituents observed in the ground water and leachate.

Constituent	AGC (μg/m3)	Max. Liquid Conc. (μg/l)	Max. Conc. At Site (μg/l)
Chloroethane	52,000	1,164,800	68
Toluene	7500	168,000	1400
Benzene	100	2240	32
Chlorobenzene	1167	26,141	150
1,2-Dichloropropane	833*	18,659	20
Total Xylenes	1450	32,480	300
Ethylbenzene	1450	32,480	140
Methylene Chloride	1167	26,141	4

* Proposed AGC, None Currently

Since all site constituents pass this test, no emissions controls are required.