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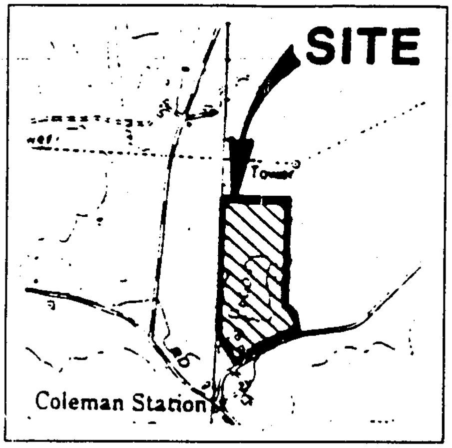

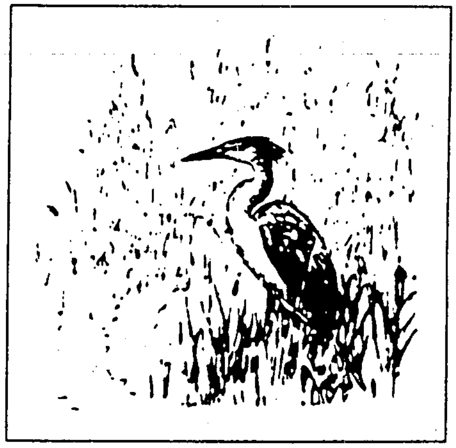

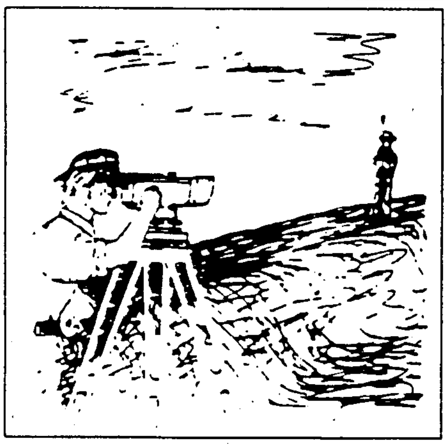

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Final Feasibility Study at the NORTH EAST LANDFILL

Town of North East, New York

June 1995

URS Consultants, Inc.
282 Delaware Ave.
Buffalo, New York 14202

FINAL
FEASIBILITY STUDY AT THE
NORTH EAST LANDFILL SITE
NORTH EAST (T), DUTCHESS (C), NEW YORK
NYSDEC SITE NO 314048
TOWN OF NORTH EAST, NEW YORK

JUNE 1995

PREPARED BY:

URS CONSULTANTS

282 DELAWARE AVENUE

BUFFALO, NEW YORK 14202

STATE OF NEW YORK
JAMES A. LANZO
No. 65478
LICENSED PROFESSIONAL ENGINEER

X

TABLE E-1

LIST OF RECOMMENDED REMEDIAL TECHNOLOGIES/PROCESS OPTIONS

MEDIA	TECHNOLOGIES AND PROCESS OPTIONS
Soil/Fill	No Action Access Restrictions Part 360 Cap Soil Vapor Extraction with Air Sparging
Sediments	No Action Monitoring Sediment Removal/Onsite Disposal/Wetland Restoration
Groundwater	No Action Deed Restrictions Monitoring Groundwater Collection Trench With Geomembrane Lining Onsite Treatment of Collected Water, Discharge to Surface Water
Air	No Action Access Restrictions Monitoring Passive Gas Collection/Venting (Add individual carbon treatment units at vents if necessary)

EXECUTIVE SUMMARY

URS Consultants, Inc. conducted a Feasibility Study (FS) of the Town of North East Landfill site, located in Dutchess County, New York. The purpose of this FS was to develop, screen, and evaluate potential alternatives for the closure and remediation of this inactive hazardous waste site. These alternatives address contamination identified and characterized in the Remedial Investigation (RI) Report (URS, 1994) and supplemented in this FS Report for the site. Based on site characterization information, media addressed in this FS Report include soil/fill, sediments, groundwater, and air. Remedial action objectives were developed for the protection of human health and the environment for each of the following media as follows:

Soil/Fill

- Provide protection to human health and the environment from landfill soil/fill.

Sediments

- Provide protection against environmental exposure resulting from erosion of landfill soil/fill to sediments.
- Reduce potential adverse impacts on fish and wildlife posed by contaminated sediments northeast of the site.

Groundwater

- Reduce concentrations of contaminants migrating from the landfill through the shallow water table aquifer to Standards, Criteria and Guidance (SCGs) for organics and to background levels for metals.

Air

- Provide adequate protection from landfill gas emissions.

Following the establishment of remedial action objectives and a determination of the extent of remediation required for each media, remedial technologies and process options potentially applicable for use at the site were identified. Identified technologies and process options then were screened on the basis of their effectiveness, implementability, and relative cost, with effectiveness being the primary screening criteria. The end result of this screening was a list, by media, of recommended remedial technologies and process options as shown on Table E-1.

Recommended technologies and process options subsequently were assembled in various combinations forming site-wide remedial alternatives. Six remedial alternatives were developed for the site. The six alternatives and their principal components are shown on Table E-2. Each of the remedial alternatives was then analyzed in detail using the following USEPA evaluation criteria: Overall Protection of Human Health and the Environment, Compliance with SCGs, Long-Term Effectiveness and Permanence, Reduction of Toxicity, Mobility or Volume, Short-Term Effectiveness, Implementability, and Cost. Two other evaluation criteria, State and Community Acceptance, will be considered before selection of a remedy.

Following the detailed analysis of alternatives, where each alternative was evaluated against each of the criteria, a comparative analysis was performed. A cost summary of the alternatives, including the capital and operation and maintenance (O&M) costs, and total present worth, is shown on Table E-3. Alternative 3, which includes installation of a Part 360 cap, removal/onsite placement of contaminated sediments, wetland restoration, access restrictions and monitoring is recommended because it satisfies NYSDEC Part 375 and USEPA threshold criteria that require protection of human health and the environment and is compliant with SCGs at potential future downgradient groundwater receptors. Further, it is recommended with respect to USEPA primary balancing criteria which consider overall effectiveness, implementability, and cost. A final remedy will be selected by the NYSDEC after review of public comments and consultation with appropriate agencies. The remedy subsequently will be included in NYSDEC's Record of Decision (ROD) for the site.

TABLE E-2
LIST OF REMEDIAL ALTERNATIVES

ALTERNATIVE	COMPONENTS
1	No Action
2	Fencing, Deed Restrictions, Monitoring
3	Deed Restrictions, Monitoring, Part 360 Cap, Sediment Remediation
4	Deed Restrictions, Monitoring, Part 360 Cap, Sediment Remediation, Soil Vapor Extraction with Air Sparging
5	Deed Restrictions, Monitoring, Part 360 Cap, Sediment Remediation, Localized Groundwater Collection with Onsite Treatment and Discharge to Surface Water
6	Deed Restrictions, Monitoring, Part 360 Cap, Sediment Remediation, Downgradient Perimeter Groundwater Collection with Onsite Treatment and Discharge to Surface Water

TABLE E-3
COST SUMMARY OF REMEDIAL ALTERNATIVES

ALTERNATIVE NUMBER	1	2	3	4	5	6
CAPITAL COST						
Posting and Fencing		$73,300	$73,300	$73,300	$73,300	$73,300
Deed Restrictions		$2,000	$2,000	$2,000	$2,000	$2,000
Part 360 Cap			$3,959,400	$3,959,400	$3,959,400	$3,959,400
Soil Vapor Extraction and Air Sparging				$1,039,000		
Groundwater Collection Trench					$845,000	$1,977,000
Groundwater Treatment System					$413,000	$1,183,000
Sediment Remediation			$28,100	$28,100	$28,100	$28,100
TOTAL CAPITAL COST	$0	$75,300	$4,062,800	$5,101,800	$5,320,800	$7,222,800
ANNUAL O&M COSTS						
Fence Inspection & Maintenance		$2,800	$2,800	$2,800	$2,800	$2,800
Monitoring		$89,600	$30,700	$30,700	$30,700	$30,700
Cap			$5,200	$5,200	$5,200	$5,200
Collection Trench					$1,680	$1,680
Groundwater Treatment					$134,400	$319,200
Soil Vapor Extraction and Air Sparging (each of 3 yrs.)				$154,200		
TOTAL ANNUAL O&M	$0	$92,400	$38,700	$38,700	$174,780	$359,580
Present Worth of O&M	$0	$1,271,424	$532,512	$995,112	$2,404,973	$4,947,821
Total Present Worth (Capital and O&M)	$0	$1,346,724	$4,595,300	$6,096,900	$7,726,000	$12,170,621

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NORTH EAST LANDFILL
FEASIBILITY STUDY

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APPENDICES

LIST OF FIGURES

(Figures are located at the end of each section.)

(Plates are located at the end of the FS Report.)

LIST OF TABLES

(Tables are located at the end of each section.)

LIST OF ACRONYMS

AGM	Alternate Grading Material
BOD	Biological Oxygen Demand
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
C & D	Construction and Demolition
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
CWA	Clean Water Act
DCA	1,1-dichloroethane
FS	Feasibility Study
gpm	gallons per minute
HASP	Health and Safety Plan
HDPE	High Density Polyethylene
HRA	Health Risk Assessment
LEL	Lower Explosive Limit
MCL	Maximum Contaminant Levels
MCLG	Maximum Contaminant Level Goals
MEK	Methyl ethyl ketone
MIBK	Methyl isobutyl ketone
NCP	National Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O & M	Operation and Maintenance
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PID	Photoionization Detector
POP	Program Operations Plan
POTW	Publicly-Owned Treatment Works
ppb	parts per billion
ppm	parts per million
PRAP	Proposed Remedial Action Plan
PVC	polyvinyl chloride
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
RI	Remedial Investigation
SCG	Standards, Criteria and Guidance
SDWA	Safe Drinking Water Act
SITE	Superfund Innovative Technologies Evaluation
SVOCs	Semi-Volatile Organic Compounds
TAGM	Technical and Administrative Guidance Memorandum
TAL	Target Analyte List
TBC	To Be Considered
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TPH	Total Petroleum Hydrocarbons
USEPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds

NORTHEAST LANDFILL FEASIBILITY STUDY

1.0 INTRODUCTION

1.1 Purpose and Organization of the Report

The purpose of the North East Landfill Feasibility Study (FS) was to develop, screen, and evaluate remedial alternatives that address contamination and associated risks identified and characterized in the Remedial Investigation (RI) Report for the site. This work assignment was conducted in accordance with the United States Environmental Protection Agency (USEPA) guidelines set forth in "Guidance for Conducting Remedial Investigation and Feasibility Studies under CERCLA" (USEPA, 1988), "Conducting Remedial Investigation/Feasibility Studies for CERCLA Municipal Landfill Sites" (USEPA, 1991), 6 NYCRR Part 375 "Inactive Hazardous Waste Disposal Site Remedial Program", and New York State Department of Environmental Conservation (NYSDEC) Technical and Administrative Guidance Memorandum (TAGM) "Selection of Remedial Actions at Inactive Hazardous Waste Disposal Sites" (NYSDEC, 1990). NYSDEC has supported this investigation by providing technical oversight and through access to Environmental Quality Bond Act funding.

The FS Report is organized as follows:

Executive Summary - This provides a summary of information presented in the Feasibility Study Report.

Section 1 - This section provides a summary of information presented in the RI Report (URS, 1994) and supplemental data pertaining to sediment sampling and analysis performed during the FS. Development of site-specific remedial action objectives and potentially applicable remedial alternatives are based on this information.

Section 2 - Remedial action objectives, as well as general response actions to satisfy these objectives, are presented in this section for each medium of interest. Potentially applicable remedial technologies are identified, screened, and evaluated according to USEPA guidance.

Screening and evaluation eliminates those technologies and process options not technically feasible, non-implementable, or too costly and allows, if possible, for the recommendation of a single process that is representative of each technology.

Section 3 - This section presents discussions on the post screening technology evaluations performed which include: the proposed subgrade for a cap, waste consolidation, infiltration analysis and groundwater flow calculations, contaminant transport calculations, analysis of groundwater treatment/disposal options, and identification of appropriate and applicable Standards, Criteria, and Guidance (SCGs).

Section 4 - This section includes an estimate of capital and operation and maintenance costs for each technology and remedial process option retained for further study.

Section 5 - Remedial process options are combined into remedial alternatives that meet the site-specific remedial action objectives. The alternatives are described and subjected to a detailed analysis against the USEPA evaluation criteria. They then are compared against each other relative to these same criteria.

Section 6 - This section presents a recommended alternative and its conceptual design, and identification of proposed pre-design studies.

1.2 Site Description and History

The North East Landfill is located north of Regan Road and east of the former railroad spur at Coleman Station in the Town of North East, Dutchess County, New York (Figure 1-1). The surrounding countryside is sparsely populated rural farmland. The site property is approximately 20 acres in size. Landfill activities previously were carried out over what is presently a relatively flat-topped, 14.1-acre mound which was filled from a former gravel pit. The site is depicted on Figure 1-2. The landfill surface is vegetated with field grass and small trees. Uncovered refuse can be found at locations on and around the fill; however, during the RI, the landfill generally was found to be covered with up to 12 inches of material. No leachate seeps were observed onsite during the RI. A few empty 55-gallon drums can be found in the central portion of the site and a roll-off bin from a former recycling collection center is located onsite near the locked entrance to the landfill. A shed utilized by the Town Highway Department is currently the only permanent building onsite.

The site is located adjacent to the floodplain of Webatuck Creek. Thickly vegetated, low-lying wet areas border most of the relatively steep north and east slopes of the fill. An abandoned Conrail right-of-way, which forms a local topographic high point, and private residential property border the west side of the site. Along the southern perimeter of the site is Reagan Road and a steep cut-bank from the former gravel pit. Unnamed tributaries direct drainage from the landfill to Webatuck Creek approximately 2,000 feet east of the site. Webatuck Creek lies in the Ten Mile River drainage basin which discharges to the Housatonic River in Connecticut.

Wetland habitats in the vicinity of the landfill have been confirmed to contain the bog turtle, a New York State protected species.

The landfill was opened in 1963 and operated originally as a municipal and commercial landfill authorized for restricted burning of paper and wood. Refuse was reported to have been dumped on the north end of the site and was periodically covered with sand and gravel from the site using a bulldozer and payloader. Readily-combustible materials were burned onsite to reduce volume throughout its history.

From January 1969 to December 1971, documentation indicates that the site received waste solvents from the Keuffel & Esser (K&E) Taconic Products Plant located in Millerton, New York. K&E manufactured drafting supplies in Millerton from 1952 until the plant was closed in December 1991. K&E reports indicate that during the years of operation, the company generated approximately 1,000 gallons per week of a flammable mixture of solvents believed to contain acetone, ethyl acetate, isobutyl alcohol, methanol, methyl ethyl ketone (MEK), methyl isobutyl ketone (MIBK), and toluene. K&E employees have indicated that from January 1969 to December 1971, K&E arranged with local haulers to transport this waste to the North East Landfill. Two non-local contractors reported to have been employed by K&E for transportation and offsite disposal of waste were Marisol Chemical of Middlesex, New Jersey, a licensed industrial waste hauler, and unlicensed R&R Sanitation Services, Inc., of Dover, New Jersey. Based on interviews with former Town and K&E personnel, the waste solvents were used primarily as an accelerant for the burning which took place in the northern portion of the site (Figure 1-2). A former landfill employee indicated that, on a trial basis, solvents were poured into trenches in the south-central portion of the site, but that practice continued for only a short period. The landfill was closed in 1989.

1.3 Hydrogeologic Characterization

The surface of the landfill has an irregular but relatively flat construction with no surface water drainage network for transporting water off the central portion of the landfill. Consequently, most precipitation pools on the surface and either infiltrates or evaporates. The majority of precipitation which falls on the north, west, and east slopes of the landfill likely flows overland to the adjacent state-regulated Wetland MT-26.

Groundwater in the shallow water-table aquifer is recharged from southwest of the site and by infiltration through the landfill. Groundwater flows in a generally northeast direction and discharges into Wetland MT-26. Groundwater mounding is evident as shown on Figures 1-3 and 1-4, and is most pronounced in the eastern portion of the landfill where lower permeability soils are encountered. The mounding causes a radial flow pattern to develop in the eastern and central portions of the landfill. As shown in the two geologic cross-sections of the landfill (Figures 1-5 and 1-6), wastes, for the most part, were deposited above the water table. However while not shown on the cross-sections, wastes were found to be approximately 4 1/2 feet below the water table across the eastern portion of the landfill in the vicinity of boring B-2. Groundwater flow in the deeper overburden and bedrock aquifers is directed toward the northeast as shown on Figures 1-7 and 1-8. (Flow patterns for the intermediate and bedrock aquifers were similar for water level measurements taken on 11/29/93 and 5/23/94; therefore, only 5/23/94 information is shown.) Relatively strong upward vertical hydraulic gradients in the deeper overburden and bedrock aquifers northeast of the site indicate that this area is under discharge conditions.

Hydraulic conductivities in the shallow water table aquifer decrease from west to east across the site and a clayey, sandy silt aquitard separates the landfill from the underlying bedrock. The presence of the aquitard and the strong upward vertical hydraulic gradients in the eastern portion of the site appear to limit the potential for downward migration of site contaminants. Artesian conditions were observed at two locations along the eastern perimeter of the landfill. The aquifer discharge conditions at the adjacent wetland also limit the potential for horizontal migration of site contaminants.

1.4 Nature and Extent of Contamination

Contamination of the surface/subsurface soil and fill, groundwater, surface water, sediments, and air at the site is discussed in detail in Section 4 of the RI Report (URS, 1994) and is summarized in this section. Supplemental sediment sampling and analysis results are discussed in 1.4.4.

1.4.1 Air

A soil gas survey conducted over an extensive grid network of the landfill indicates that many of the chemical constituents associated with industrial waste disposal at the site are still present in soil pore space above the water table over a large portion of the landfill. The highest concentrations of these constituents were observed at the former burn pit and sludge burial areas (see Figure 1-2 for locations). The capacity for gaseous contaminants to migrate offsite in soil is restricted by hydric soil conditions to the east and north, and by topographical features to the west and south. Actual landfill gas emission rates for chemical constituents were measured using an emission isolation flux box and modeled to predict ambient air concentrations at the site. The predicted emissions rate potential and ambient concentrations are within acceptable limits as defined in NYSDEC's "Air Guide-1" for each of the constituents detected in the samples. These data indicate that the landfill does not adversely impact air quality above the landfill or beyond its perimeters.

1.4.2 Surface Soil and Subsurface Soil/Fill

Shallow soil borings and surficial soil samples did not indicate the presence of volatile organics compounds (VOCs). This implies that VOCs from the upper zone of the waste have been leached or volatilized from the shallow landfill soils. These compounds apparently are now most concentrated as gas in the landfill soil pore space and in deeper soils near the water table surface. Pesticides and elevated concentrations of metals were detected in landfill soils. The metals appear to have affected sediment quality in a localized area northeast of the landfill. Subsurface soil samples obtained at perimeter monitoring well locations contained a few organic compounds at relatively low concentrations suggesting that soils beyond the fill area of the site have not been significantly impacted by the landfill.

1.4.3 Groundwater

VOCs exceeded NYSDEC Standards, Criteria and Guidance (SCGs) during the first round of sampling, and more so during the second round. VOCs exceeding SCGs include vinyl chloride, acetone, chloroethane, 1,1-dichloroethane, 1,2-dichloroethene, MEK, 1,2-dichloropropane, MIBK, toluene, ethyl benzene, styrene, and xylene. Second round groundwater sampling data indicate that organic contaminant concentrations increased with the raised groundwater table associated with springtime hydrologic conditions. The increased area of the groundwater mound below the landfill measured during the second round suggests that contaminants have dispersed over a wider area in the second round samples. Pesticides not attributable to the landfill exceeded SCGs in samples collected from background overburden wells and the sidegradient bedrock well. Metals SCGs were exceeded at numerous sample locations both upgradient and downgradient of the landfill, indicating a regional groundwater condition. Elevated concentrations of lead and manganese were observed in downgradient monitoring wells which may be due to the landfill. The hydrogeological conditions present in the vicinity of the landfill limit the potential for horizontal and vertical migration of contaminants in groundwater.

Sampling of nearby residential wells by the NYS Department of Health (NYSDOH) shows no indication of the presence of site contaminants.

1.4.4 Surface Water/Sediment

Surface water data suggest that organic compounds associated with the landfill are not affecting surface water adjacent to the site. Relatively high concentrations of metals are discharged to surface water at spring (artesian) locations east of the landfill. These metals, however, are largely attributed to regional groundwater conditions. In addition to the samples collected during the RI, sediment samples were collected during the FS in December 1994 to better define the extent of metals-contaminated sediments in the northeastern corner of the landfill site. Four sediment samples (SED-8 through SED-11) were collected from the locations shown on Figure 1-2 and Plate 1, in accordance with procedures established during the RI, and analyzed for metals by Energy and Environment Engineering (E^3I) laboratory, a certified laboratory for NYSDEC Analytical Services Protocol. All QA/QC procedures specified in the URS Quality Assurance Project Plan were followed. All laboratory data were validated by URS before acceptance. The data usability report is included in Appendix A. Sediment screening SCGs similar to those used in the RI (NYSDEC Fish & Wildlife document entitled "Technical Guidance for Screening Contaminated Sediments" dated November, 1993) were compared against the analytical data. Analytical data and SCG exceedances are shown on Table 1-1. Eighteen of the twenty-three metals analyzed for were detected in the FS sediment samples. With the exception of selenium, all metals detected in these FS samples were also detected in the RI sediment samples. Exceedances of low effect level SCGs were found for arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, and zinc. Exceedances of severe effect level SCGs were found for arsenic, cadmium, iron, manganese, and mercury.

In summary, elevated metals concentrations were evident in the sediment samples collected during the RI and FS near the spring northeast of the landfill. The highest concentrations of metals were detected in sample locations SED-1, SED-7, SED-8 and SED-9. Landfill soil erosion and shallow groundwater discharge are contributing to this condition as evidenced by the orange iron staining near the spring.

1.5 Contaminant Fate and Transport

The migration pathways available to contaminants at the North East Landfill site are determined by the physical characteristics of the site, the nature of the contaminants disposed of at the site and their distribution in the various media which compose the site.

A major migration pathway for VOCs in soils at this site is volatilization from the soil and subsequent migration through the air in soil pore spaces or the atmosphere. Infiltrating precipitation, which leaches soluble compounds from the soil, serves as a secondary pathway for VOCs. In this process, compounds with moderate water solubilities that are present in the soil are dissolved by infiltration and transported through the vadose zone to the groundwater system. Polycyclic aromatic hydrocarbons (PAHs), pesticides, and metals in soil have low solubilities and have a tendency to adhere to soil particles. Consequently, they would be transported mechanically by wind and surface water erosion more so than through groundwater.

Once contaminants have entered the groundwater system, dissolution, adsorption, and biodegradation are the primary controlling transport mechanisms. Volatilization of groundwater contaminants also could be a pathway once groundwater discharges to the adjacent surface water body. Within the surface water system, contaminants biodegrade, dilute, disperse, flocculate, precipitate, and adsorb to sediments.

Contaminants detected in the surface soil at North East Landfill include one pesticide (endrin) and metals. VOCs which may have been present likely were removed by processes of volatilization and dissolution. Endrin and metals are anticipated to be fixed to soil particles and transported mainly by mechanical processes. Contaminants detected in subsurface soil/fill at the site include VOCs, semi-volatile organic compounds (SVOCs), pesticides, and metals. The primary migration pathways for VOCs are through biodegradation, volatilization and leaching. SVOCs will tend to persist for an extended period until local microbial populations can adapt and utilize them. Pesticides are probably not being vertically transported and will remain in the soil until they biodegrade. In general, metals detected at the site are sorbed onto subsurface soils and subject to mechanical transport by infiltrating precipitation and soil erosion.

Contaminants detected in surface water samples include one VOC (2-butanone), one SVOC [bis(2-ethylhexyl)phthalate] and metals. 2-butanone may volatilize but probably will persist until local microbiota adapt to and degrade it, or it becomes diluted to below detection limits. Bis(2-ethylhexyl)phthalate generally persists in the environment because it is resistant to biodegradation, hydrolysis, and volatilization. Metals present are subject to a number of processes, but generally will persist in natural aqueous environments and adsorb to sediments.

Sediment contamination is partially a product of landfill erosion and shallow groundwater discharge. Methylene chloride was the only VOC detected in the sediments. Two SVOCs [fluoranthene and bis(2-ethylhexyl)phthalate] were encountered in the sediment samples. These compounds are relatively immobile and likely will persist in the sediment until they biodegrade. Two pesticides (4,4'-DDE, and endrin) were detected in the sediments adjacent to the site. These pesticides adsorb relatively strongly to soil particles and they would be anticipated to persist in sediments at those locations. Twenty of the 23 metals analyzed were detected in the sediments. Alluvial soils and silty sediments present in the northeastern portion of the site have a high sorption capacity for many metals. Metals are relatively immobile thereby causing the high sediment metals concentrations observed at sample locations SED-1, SED-7, SED-8, and SED-9.

The VOCs detected in the groundwater reflected those found in the subsurface soils. Apparently, VOCs in the subsurface soils primarily were solubilized and transported with the groundwater. The site analytical data indicate minimal impact on groundwater with respect to SVOCs (no SCG exceedances) and no impact on groundwater with respect to pesticides. Most metals are naturally occurring in groundwater. At North East Landfill, 22 of 23 metals analyzed were detected in the groundwater samples.

1.6 Human Health Risk Assessment

A human health risk assessment was performed for trespassers on the site and for offsite residents in the immediate area. It was assumed that deed restrictions and a landfill cap would be implemented onsite. The chemicals of potential concern identified from media collected at the site were categorized by their relative health risk, i.e., either carcinogenic or noncarcinogenic. Noncarcinogenic chemicals further were subdivided into chronic and subchronic categories.

Exposure scenarios were modeled for onsite and offsite receptors in accordance with USEPA guidance documents. The total calculated site-wide hazard indices for all site-attributable contaminants fall within NYSDOH's range of acceptable values for both carcinogenic and non-carcinogenic chemicals.

An unacceptable level of risk is predicted for the ingestion of beryllium detected in groundwater. However, the landfill does not appear to be a source for this metal. Based on these results, the site-related chemical constituents do not pose an unacceptable threat to the human population.

1.7 Fish and Wildlife Impact Analysis

A Fish and Wildlife Impact Analysis was conducted in accordance with NYSDEC Division of Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites. A sensitive environment, Wetland MT-26, is situated adjacent to, and hydraulically downgradient from the site. A sighting of the bog turtle identified as endangered by New York State has been documented in this wetland approximately 1/4 mile east of the site. A toxic effects analysis was conducted for landfill contaminants in surface water and sediments. Applicable ecological risk assessment tables for the supplemental sediment data are provided in Appendix A. Results of the analysis indicated that the concentrations of either arsenic or manganese in sediments in a localized area northeast of the landfill, at sediment sampling locations SED-1, SED-7, and SED-9, pose a potential toxicological risk for the indicator species (meadow jumping mouse) common to this habitat. The metals concentrations, however, did not pose an unacceptable toxicological risk to the bog turtle or any of the other indicator species which were investigated.

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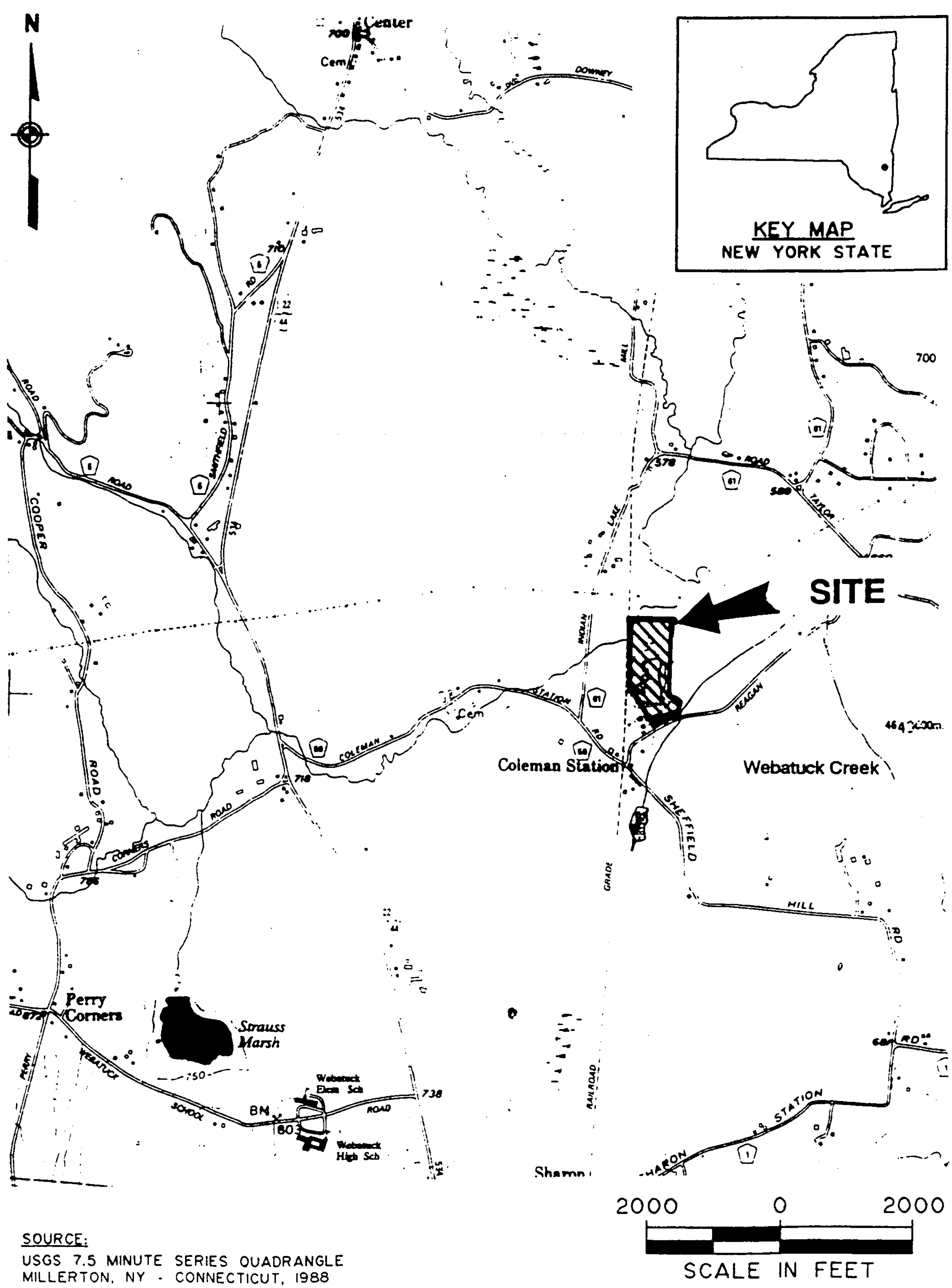


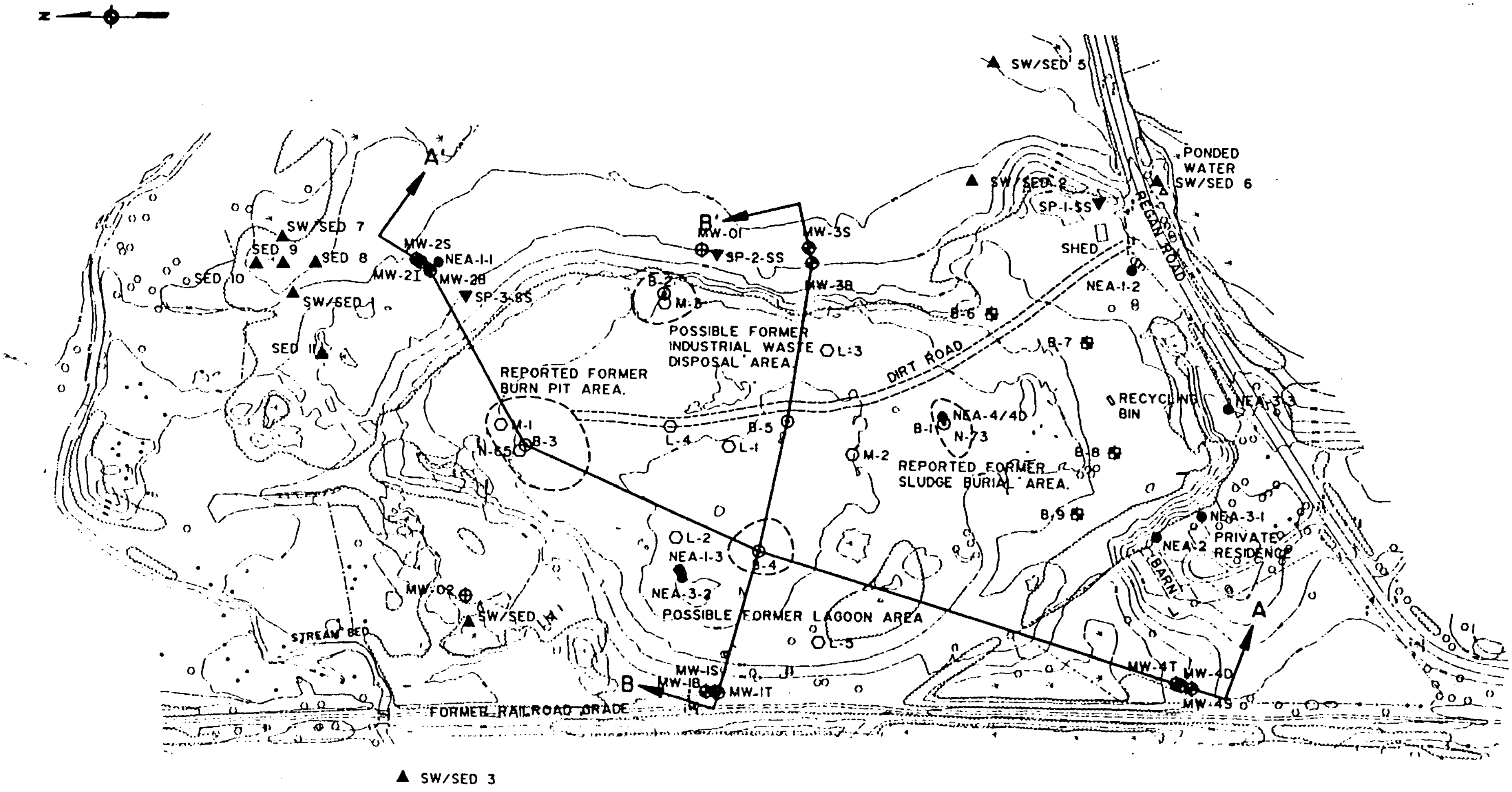
SOURCE:
USGS 7.5 MINUTE SERIES QUADRANGLE
MILLERTON, NY - CONNECTICUT, 1988

URS CONSULTANTS, INC.

NORTH EAST LANDFILL
SITE LOCATION MAP

FIGURE 1-1

AH-6380 FS



NOTES

1. BASE MAPPING WAS PREPARED BY AIR SURVEY CORP., RESTON, VA. USING AERIAL PHOTOGRAPHY TAKEN APRIL 14, 1993. GROUND CONTROL WAS BY URS.
2. PROJECT VERTICAL CONTROL IS BASED UPON NATIONAL GEODETIC VERTICAL DATUM OF 1929 AS ESTABLISHED ON USGS MONUMENT "ALBANY 573" ELEV. 575.540.

LEGEND

- RI MONITORING WELL (1993)
- RI PIEZOMETER (1993)
- RI SOIL BORING (1994)
- AMBIENT AIR SAMPLE LOCATION
- GAS EMISSIONS SAMPLE POINTS
- NYSDEC PHASE II MONITORING WELL (1984)
- SURFACE/WATER SEDIMENT SAMPLE (1993, 1994)
- SURFACE SOIL SAMPLE POINTS

150 0 150
SCALE IN FEET

CONTOUR INTERVAL = 5 FEET

NORTH EAST LANDFILL SITE PLAN, CROSS-SECTION AND SAMPLE LOCATIONS

URS CONSULTANTS, INC.

FIGURE 1-2

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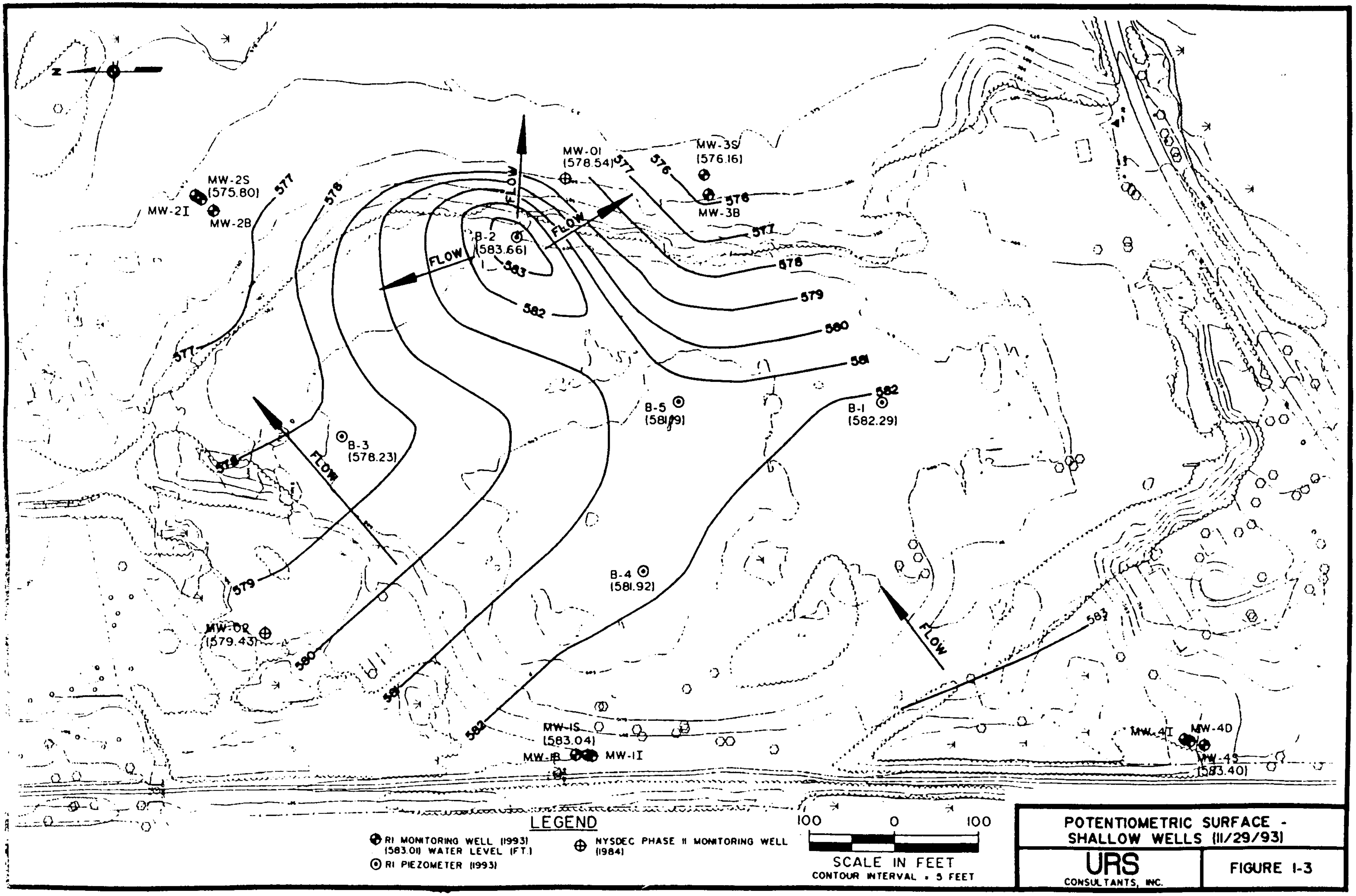
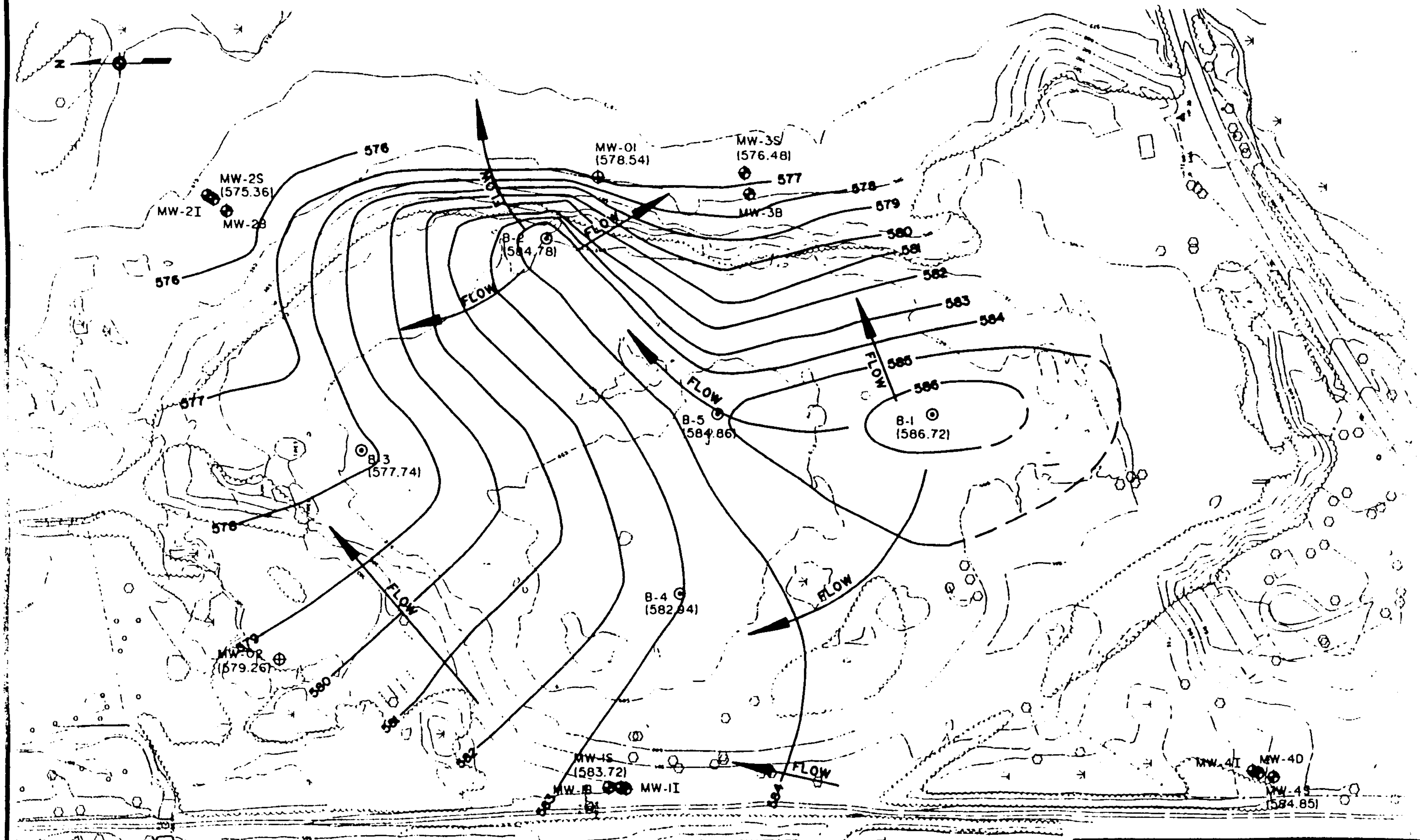


POTENTIOMETRIC SURFACE - SHALLOW WELLS (11/29/93)

URS CONSULTANTS, INC.

FIGURE 1-3



LEGEND

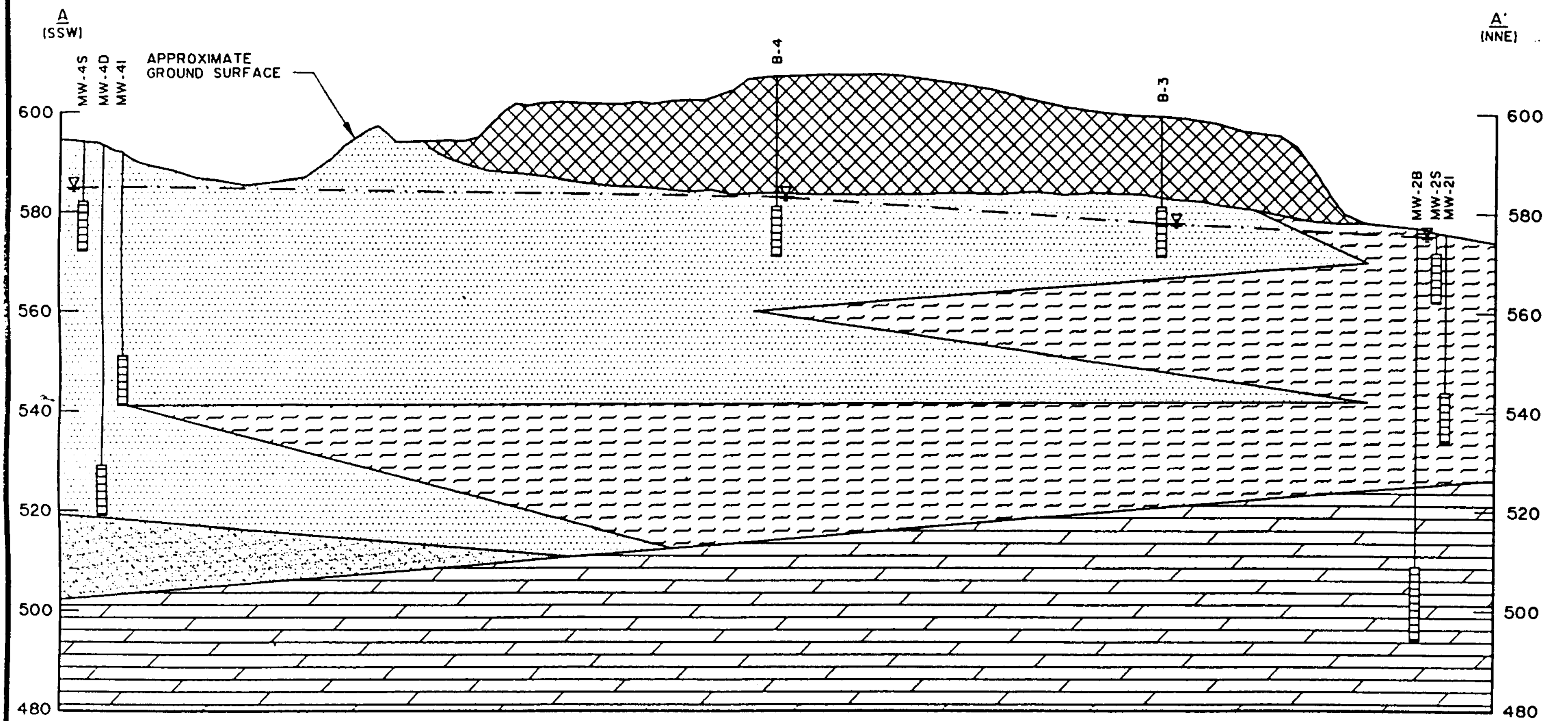
⊕ RI MONITORING WELL (1993)
(583.72) WATER LEVEL (FT.)
⊙ RI PIEZOMETER (1993)
⊕ NYSDEC PHASE II MONITORING WELL (1984)

100 0 100
SCALE IN FEET
CONTOUR INTERVAL = 5 FEET

POTENTIOMETRIC SURFACE - SHALLOW WELLS (5/23/94)

URS CONSULTANTS, INC.

FIGURE 1-4



LEGEND

MW-4S — MONITORING / PIEZOMETER NUMBER

POTENTIOMETRIC SURFACE (5/23/94) OF SHALLOW WATER TABLE AQUIFER

SCREENED INTERVAL

FILL

CLAYEY , SANDY SILT (ML/SM) - GRAY STRATIFIED SILT WITH CLAY OR SAND

SAND AND GRAVEL (SM/GM/SW/GW) GRAY AND BROWN, VARIABLE TEXTURE GENERALLY NOT STRATIFIED.

SILT AND GRAVEL (GM) GRAY DENSE TILL

BEDROCK - STOCKBRIDGE GROUP LIMESTONE AND MARBLE HIGHLY FRACTURED.

20 0 20
VERT. SCALE IN FEET

100 0 100
HORIZ. SCALE IN FEET

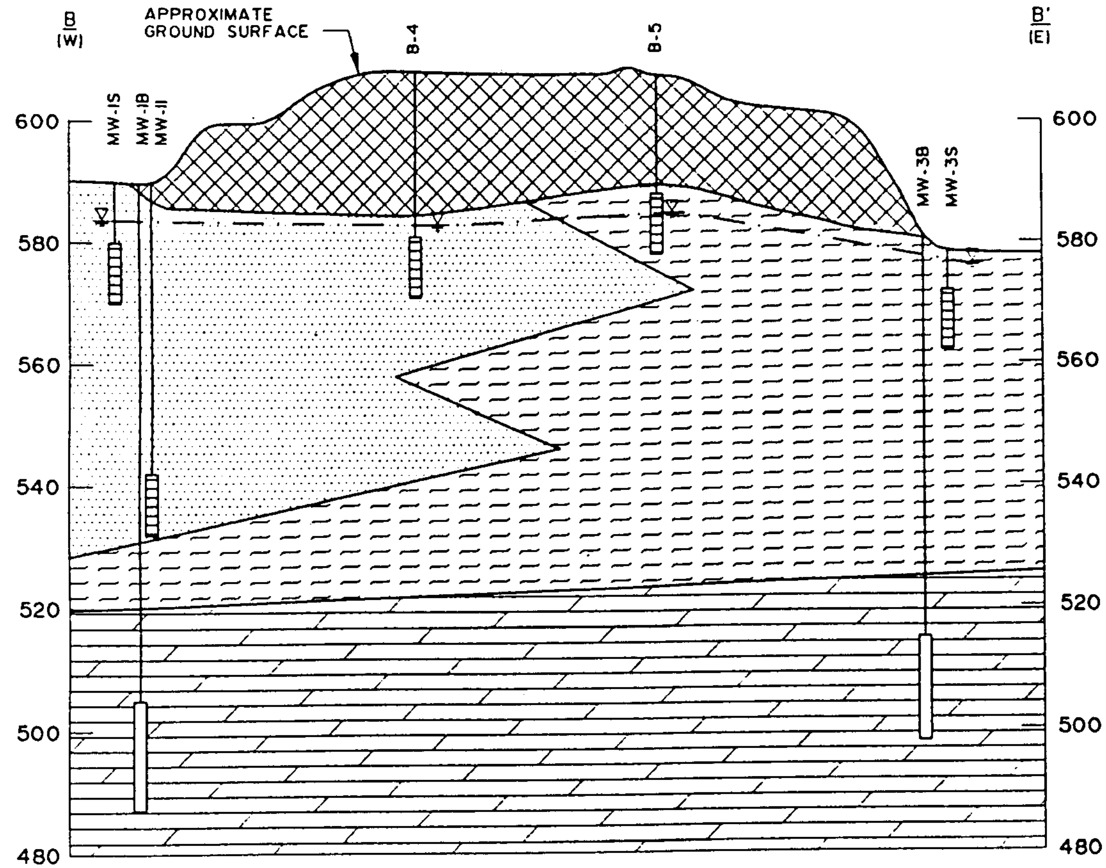
NOTES:

1. CROSS-SECTION LOCATIONS ARE SHOWN ON FIGURE 1-2.
2. VERTICAL DATUM BASED ON NGVD 1929
3. GEOLOGIC CONDITIONS SHOWN ARE REPRESENTATIVE OF CONDITIONS ENCOUTERED AT EACH BORING LOCATION TO THE DEPTH DRILLED. EXTRAPOLATIONS BETWEEN BORINGS HAVE BEEN INTERPRETED USING STANDARD ACCEPTED GEOLOGIC PRACTICES AND PRINCIPLES. ACTUAL CONDITIONS MAY VARY BETWEEN BORINGS FROM THOSE SHOWN.

GEOLOGIC CROSS SECTION A-A'

URS CONSULTANTS, INC.

FIGURE 1-5



LEGEND

MW-4S MONITORING / PIEZOMETER NUMBER

POTENTIOMETRIC SURFACE (5/23/94) OF SHALLOW WATER TABLE AQUIFER

SCREENED INTERVAL (OVERBURDEN WELL)

SCREENED INTERVAL (OVERBURDEN WELL)

FILL

CLAYEY, SANDY SILT (ML/SM) - GRAY STRATIFIED SILT WITH CLAY OR SAND

SAND AND GRAVEL (SM/GM/SW/GW) GRAY AND BROWN, VARIABLE TEXTURE GENERALLY NOT STRATIFIED.

BEDROCK - STOCKBRIDGE GROUP LIMESTONE AND MARBLE-HIGHLY FRACTURED.

NOTES:

1. CROSS-SECTION LOCATIONS ARE SHOWN ON FIGURE I-2.
2. VERTICAL DATUM BASED ON NGVD 1929
3. GEOLOGIC CONDITIONS SHOWN ARE REPRESENTATIVE OF CONDITIONS ENCOUTERED AT EACH BORING LOCATION TO THE DEPTH DRILLED. EXTRAPOLATIONS BETWEEN BORINGS HAVE BEEN INTERPRETED USING STANDARD ACCEPTED GEOLOGIC PRACTICES AND PRINCIPLES. ACTUAL CONDITIONS MAY VARY BETWEEN BORINGS FROM THOSE SHOWN.

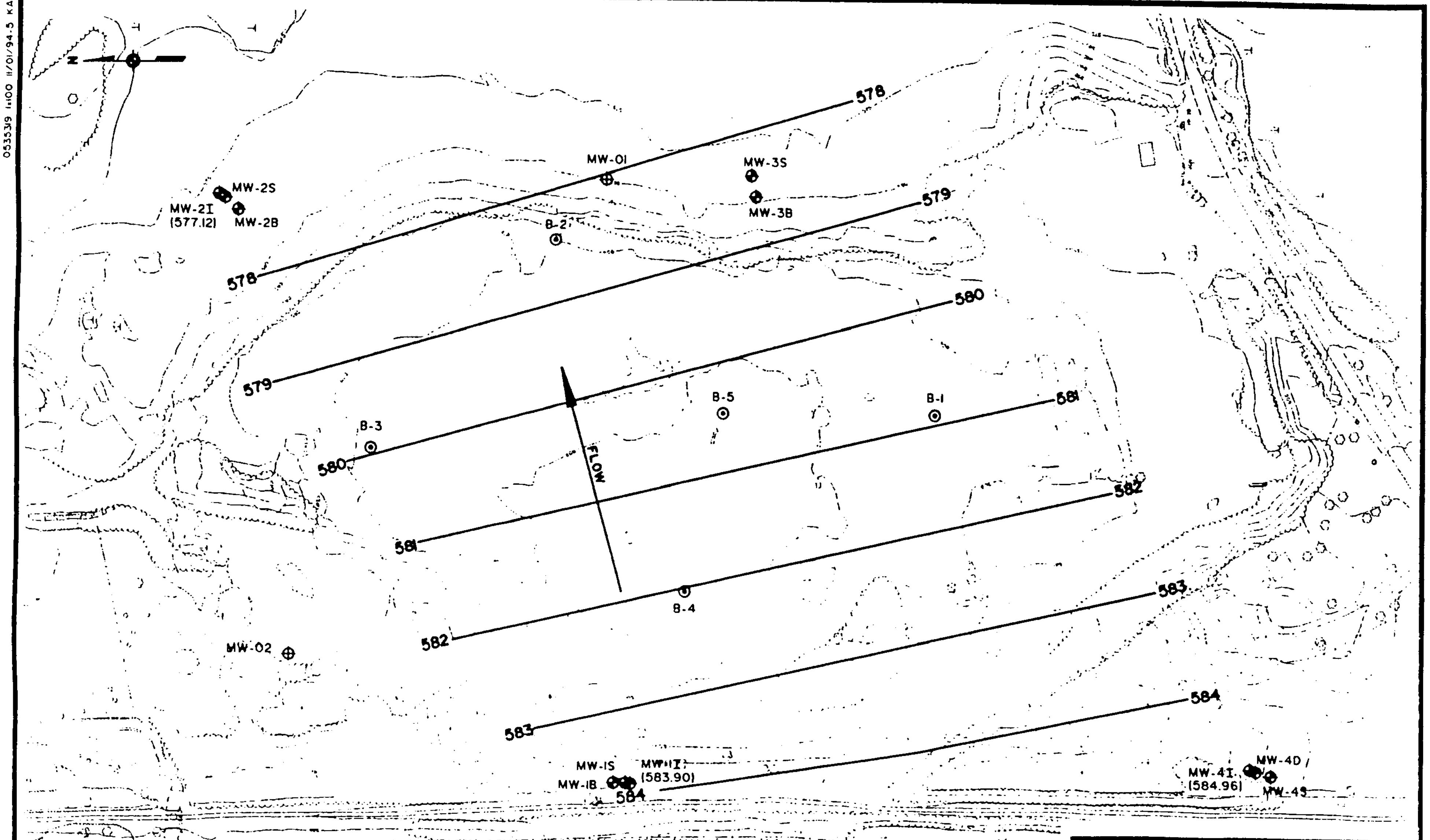
GEOLOGIC CROSS SECTION B-B'

URS CONSULTANTS, INC.

FIGURE I-6

CC-2770 FS

35316 ..00 2/1/95-5



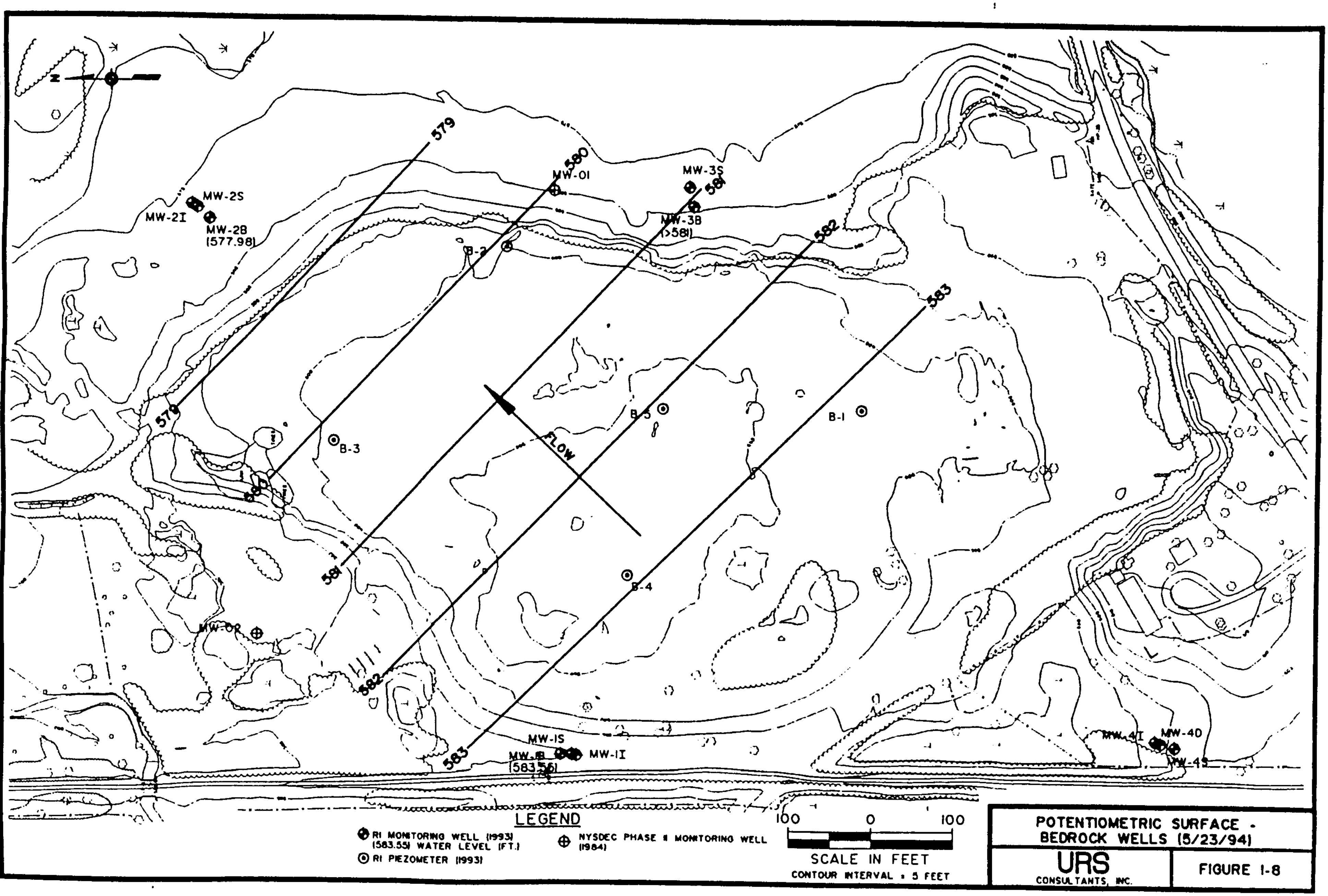
POTENTIOMETRIC SURFACE - INTERMEDIATE WELLS (5/23/94)

URS CONSULTANTS, INC.

FIGURE 1-7

053539 1:100 11/01/94.5 KAH

CC 3107 FS



POTENTIOMETRIC SURFACE - BEDROCK WELLS (5/23/94)

URS CONSULTANTS, INC.

FIGURE 1-8

0535319 1:100 10/28/94-4 FAO

CC 3108 FS

TABLE 1-1
FS SEDIMENT SAMPLING ANALYTICAL RESULTS

Sample I.D.			SED 8	SED 9	SED 10	SED 11
Date Sampled			12/22/94	12/22/94	12/22/94	12/22/94
	SCG					
Compound	Low	Severe				
Aluminum			40200 J	3580 J	10500 J	10200 J
Antimony	2	25				
Arsenic	6	33	26.5 J	545 J	14.8 J	7.1 J
Barium			292 J	1910 J	162 J	37.9 J
Beryllium						
Cadmium	0.6	9		12.8 J		3.2 J
Calcium			19900 J	45800 J	27200 J	31900 J
Chromium	26	110	46.2 J		11.5 J	13.7 J
Cobalt			29.1 J	51.7 J	15.3 J	10.7 J
Copper	16	110	61.4 J		17.6 J	25.4 J
Iron	20000	40000	76000 J	165000 J	27600 J	20000 J
Lead	31	110	59.1 J	8.2 J	47.1 J	41.7 J
Magnesium			23800 J	5860 J	6910 J	19600 J
Manganese	460	1100	3950 J	23600 J	2940 J	221 J
Mercury	0.15	1.3	3.0 J	0.47 J	0.87 J	0.34 J
Nickel	16	50		41.4 J	28.1 J	21.9 J
Potassium			2510 J			702 J
Selenium			7.2 J		5.2 J	0.63 J
Silver	1	2.2				
Sodium						
Thallium						
Vanadium			50 J	17.5 J	15.9 J	15.4 J
Zinc	120	270	209 J	56.2 J	109 J	130 J

Only detected results reported.

All results reported in mg/kg.

J-values are estimated due to % moisture being >50%.

- Sample exceeds SCG.

- Sample exceeds severe effect level SCG

2.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

2.1 Introduction

The identification of remedial technologies and process options described in this section consists of: establishing remedial action objectives; identifying general response actions to satisfy these objectives; and identifying and screening specific remedial technologies and process options that fall within the general response categories.

Identification and screening of remedial technologies and process options is done using a three-step approach as suggested by the USEPA (USEPA, 1988). In the first step, potentially applicable remedial technologies and process options, which meet the remedial action objectives developed for the site, are identified. In the second step, the number of potential technology types and process options is reduced through an initial screening of the options with respect to technical implementability. The third step evaluates the technologies and process options with respect to effectiveness, implementability, and relative cost.

2.2 Remedial Action Objectives

The following discussion presents remedial action objectives for the North East Landfill site. These objectives provide the basis for selecting appropriate technologies and for developing remedial alternatives for the site.

Remedial action objectives, which are medium-specific, are established to protect human health and the environment. Media considered in this FS include landfill soil/fill, surface water, sediments, groundwater, and air. The development of the remedial action objectives is based on the human health risk assessment (HRA), fish and wildlife impact analysis for surface water/ sediments, and a comparison of contaminant concentrations detected with chemical-specific SCGs, since these are the basis for measuring the potential impact of the landfill on human health and the environment. Medium-specific remedial objectives for the site are presented below.

Soil/Fill

Organic contaminants were detected in the landfill soils and in the soil pore space above the groundwater table. Elevated concentrations of metals also were detected in the soil/fill at the landfill. The potential health risk posed by the landfill was not quantified, as an underlying assumption of the RI was that a landfill cap and deed restrictions against intrusive activities would be implemented across the site. A landfill cap and deed restrictions would be protective of human health and the environment, and reduce erosion of contaminants to adjacent sediments. The following remedial action objective has been developed for soil/fill:

- Provide protection to human health and the environment from landfill soil/fill.

Surface Water

Analytical data from the RI indicate that the landfill is not adversely impacting surface water adjacent to the site. Further, results of the Fish and Wildlife Impact Analysis indicate that there is not likely to be any impact occurring to aquatic resources from surface water. Therefore, no remedial action objective has been developed for surface water.

Sediments

The sediment analytical data suggests a relatively minor impact from the landfill with respect to organic compounds. Elevated metals concentrations, particularly for contaminants exceeding the severe effect level SCGs, were evident in the sediment samples collected near an observed spring northeast of the landfill (SED-1, SED-7, SED-8, SED-9). Results of the Fish and Wildlife Impact Analysis indicate a potential adverse impact to one local indicator species, the jumping mouse, from metals detected at sediment sample locations SED-1, SED-7, and SED-9. The following remedial action objectives have been developed for sediments:

- Provide protection against environmental exposure resulting from erosion of landfill soil/fill to sediments.

- Reduce potential adverse impacts on fish and wildlife posed by contaminated sediments northeast of the site.

Groundwater

Due to the hydrogeologic conditions present at the site, the landfill does not appear to be adversely impacting the lower portion of the water table or the bedrock aquifers. Waste in the eastern portion of the landfill is situated below the water table during springtime conditions. Groundwater data indicate that the landfill is releasing VOCs and a few metals to the shallow water table aquifer east of the site, at concentrations which appear to increase with the rising springtime water table. Results of the HRA indicate that only beryllium, which is not attributable to the landfill, poses a potential human health risk to downgradient groundwater receptors. Residential well sampling during the RI showed no indication of site contaminants. The following remedial action objective has been developed for groundwater:

- Reduce concentrations of contaminants migrating from the landfill through the shallow water table aquifer to SCGs for organics and to background levels for metals.

Air

Landfill gas emission rates were measured for chemical constituents during the RI and subsequently modeled to predict ambient air concentrations at the site. The predicted emissions rate potential and ambient concentrations are within acceptable NYSDEC limits. The data indicate that the landfill does not adversely impact air quality above the landfill or beyond its perimeters. Once the landfill is capped, however, air emissions may be concentrated at onsite locations where they will be allowed to vent. Therefore, the following remedial action objective has been developed for air:

- Protect human health and the environment from landfill gas emissions.

2.3 General Response Actions

2.3.1 Response Categories

General response actions are broad response categories capable of satisfying the remedial action objectives for the site. Like remedial action objectives, general response actions are medium specific. For landfill soil/fill, sediments, groundwater, and air, remedial technologies and process options will be grouped and evaluated by the following general response action categories:

- No Action - A no-action response provides a baseline for comparison with other alternatives. The National Contingency Plan (NCP) requires that the No-Action alternative be evaluated as part of the FS process.

- Institutional Actions - Institutional actions refer to measures, taken by government or private parties, whose purpose is not to clean up or contain site contaminants by active remedial measures, but rather to reduce human exposure and health risk by limiting public access to, and monitoring the concentrations of, those contaminants.

- Containment - Containment measures are those remedial actions whose purpose is to contain and/or isolate contaminants onsite. These measures prevent migration from, or direct human exposure to, contaminated media without treating, disturbing, or removing the contamination from the site.

- Treatment/Disposal - Treatment and disposal measures include technologies whose purpose is to reduce the toxicity, mobility, or volume of onsite contaminants by directly altering, isolating, or destroying those contaminants.

2.3.2 Extent of Remediation

This section includes an estimate of the area and/or volumes to which general response actions might be applied for each media of interest.

Soil/Fill

Remediation of the landfill with a cap will cover the approximately 15 acres identified in the RI as being within the limits of waste. This area is shown on Plate 1 as the interpreted edge of landfill as based on test pit results.

The extent of VOC-contaminated soils acting as the source of shallow groundwater contamination was estimated based on the analytical data results, soil boring logs, and results of the landfill gas emission sampling that were performed during the RI. Both shallow (0-10-foot) and deep (10-20-foot) soil sample results were reviewed. Surficial soil samples and soil boring samples, the majority of which were shallow, did not indicate the presence of VOCs. Of the two deep soil boring samples collected (B-4 and B-5), B-5 (taken at a 19- to 21-foot depth) showed the presence of higher levels of VOCs. Analytical results from sample B-4, collected from a depth of 15 to 17 feet, showed low levels of VOCs. PID readings at the 17-foot depth in B-3 indicated the presence of VOCs. This indicates that VOCs are no longer present in the shallow soils, but are present in some areas of the deeper soils, say between the depth of 10 to 20 feet.

In order to determine the areal extent of VOC-contaminated soils, landfill gas emission sampling results across the entire landfill were reviewed. Landfill gas emission sample results presented on Figure 4-2 of the RI show VOCs detected in the vicinity of borings B-1, B-2, and B-3. The area encircling the locations where higher levels of VOCs were detected in either soils or landfill emissions is shown on Figure 2-1. The extent of VOC-contaminated soil for the purpose of FS is estimated to be in the lower half of the waste, between the depth of 10-20 feet, over an areal extent of approximately 5.5 acres.

Sediments

Sediments northeast of the landfill near the observed spring in the area of samples SED-1, SED-7, and SED-9 have been identified to have the potential to adversely impact environmental resources through exposure to metals contamination. These sample locations are shown within the limits of Wetland MT-26 on Plate 1. Remediation proposed in a wetland should be limited and performed so as to minimize any adverse impacts which may occur during remedial activities.

Results of the RI/FS indicate that the spring is contributing to metals contamination of the sediments as evidenced by the orange (iron) staining. Therefore, it is assumed that sediment contamination begins at the spring (SED-1) and flows to the wetland (SED-7), potentially impacting an area eighty feet wide by one hundred feet long. This area encompasses SED-1, SED-7, SED-8, and SED-9 which exceed the severe effect level SCGs and poses a potential environmental risk. In general, potential fish and wildlife impacts would be limited to the top one foot of sediments. Therefore, it is assumed that sediment remediation will include an area 80 feet by 100 feet (0.2 acres), by a one-foot depth, or a volume of approximately 300 cubic yards (cy).

Groundwater

Contamination of the shallow water table has been identified along the east and north of the landfill between perimeter monitoring well locations MW-01 and MW-02, a distance of approximately 1,200 lineal feet. The majority of contaminants detected were VOCs detected in MW-01 (to the east of the landfill) during springtime high water table conditions, but were not detected at comparable levels in MW-3S located approximately 150 feet away. These observations indicate that the VOCs found at depth in the landfill are being flushed out from the landfill soils under high water table conditions in a localized area.

Air

Landfill gas emissions resulting from existing conditions at the landfill were discussed in the RI and summarized in Section 1.4.1. Landfill gas emissions under future capped conditions are subject to the type of landfill cap and gas collection system constructed. Further, gas emissions will change over time due to the various degradation rates of the wastes present. Therefore, gas emission rates have not be estimated here. However, conservative assumptions will be used in this FS as necessary.

2.4 Identification and Initial Screening of Remedial Technologies and Process Options

Remedial objectives, general response actions, technologies types, and process options for each medium of interest (soil/fill, sediments, groundwater, air) are presented in Table 2-1. The description of these technology types, process options, and the rationale for selection is discussed in this section. This section also includes the first step of the selection process where the number of technology types and process options are reduced by screening the options with respect to their technical implementability. This evaluation is based on information obtained from the RI site characterization which identified contaminant types and concentrations, and physical characteristics (e.g., geology, hydrogeology) of the site. This initial screening is summarized in Table 2-2 for each medium of interest.

2.4.1 Soil/Fill

A. No Action - "No Action" is included as required by the National Contingency Plan (40 CFR 300).

B. Access Restrictions - Posting, fencing, and deed restrictions prohibiting intrusive activities at the site would reduce the potential human health risk by preventing contact with or ingestion of contaminated soil/fill.

C. Capping - Capping would be protective of human health and the environment. Capping options include:

- Double barrier cap (two low permeability layers)
- Single barrier (Part 360) cap (one low permeability layer)

Both capping options would include grading, vegetative cover, surface water drainage, and gas collection as part of the design, and long term monitoring to assess the continued effectiveness of the remediation. Both of these capping options are technically implementable.

D. Excavation/Treatment - Excavation of the landfill wastes with subsequent above-ground treatment or offsite disposal in a secure permitted landfill facility is not considered implementable due to the relatively large volume of waste present.

E. In-situ Treatment - Below grade treatment of unsaturated deeper VOC-contaminated soils without excavation could reduce the concentrations of organics available to be leached and flushed out to the shallow water table aquifer. Biological (bioventing, bioreclamation), chemical (soil washing, solvent extraction), physical (soil vapor extraction), and thermal (low temperature thermal desorption, steam stripping, radio frequency heat process) treatment technologies potentially would be implementable.

2.4.2 Sediments

A. No Action - "No Action" is included as required by the National Contingency Plan (40 CFR 300).

B. Access Restrictions - Limited access restrictions, in the form of posting and fencing to prohibit access to contaminated sediment areas, would minimize the potential for human, but not fish and wildlife, contact with contaminated sediments.

C. Monitoring - Sediment monitoring (through sampling and analysis) could be used to evaluate potential risks from contact with sediments.

D. Capping - Capping the landfill would eliminate further erosion of contaminated landfill soil/fill and aid in the reduction of contaminant migration to the sediments.

E. Removal - Removing the contaminated sediments is technically implementable. Material could be placed onsite under the landfill cap, disposed of at an offsite facility, or treated onsite as discussed below.

F. Treatment - Above-ground treatment technologies (biological, chemical, physical, thermal) could be applicable to contaminated sediments. In-situ treatment technologies are not considered implementable due to the relatively shallow depth (1 foot) and small volume proposed for remediation.

2.4.3 Groundwater

A. No Action - "No Action" is included as required by the National Contingency Plan (40 CFR 300).

B. Deed Restrictions - Deed restrictions prohibiting use of groundwater at the site could be implemented to protect human health.

C. Monitoring - Groundwater monitoring could be performed in order to determine whether contaminants were migrating from the landfill at levels which exceeded SCGs, and to evaluate risks to human health and the environment.

D. Collection - In order to reduce the offsite migration of groundwater, a collection trench, extraction wells or well points could be constructed along the downgradient perimeter of the landfill.

E. Containment - The installation of vertical barriers along proposed areas of groundwater collection, such as slurry walls, sheet piling, or geomembrane lining of a trench, would be technically implementable and may be desirable to reduce the inflow of "clean" water into the collection system.

F. Groundwater Treatment/Disposal - Once collected, groundwater would have to be either treated or disposed of. Water potentially could be transported offsite for disposal/treatment at the nearest Publicly-Owned Treatment Works (POTW), (identified in Section 3.3.4), or pretreated onsite and transported offsite for disposal/treatment at the POTW. Water also could be treated onsite to meet the appropriate standards and discharged to either groundwater or surface water.

Groundwater treatment/disposal, or in-situ treatment process such as air sparging, could be implemented at the site in conjunction with soil vapor extraction in order to expedite the cleanup process and remove VOCs present in soils and waste below the water table.

2.4.4 Air

A. No Action - "No Action" is included as required by the National Contingency Plan (40 CFR 300).

B. Access Restrictions - Access restrictions in the form of posting, fencing or deed restrictions to prohibit access onsite would provide protection to human health but not to the environment. Access restrictions do not address potential risks from offsite migration of landfill gas.

C. Monitoring - Air monitoring could be used to evaluate future human and environmental health risk, and to evaluate the effectiveness of other remedial measures.

D. Collection/Treatment - The present landfill cover allows gas to vent diffusely across the landfill surface. If a cap is placed over the landfill, vertical gas migration will be reduced; therefore, migration of landfill gas must be addressed. Options for gas handling combine technologies and process options for collection and treatment and include: 1) passive collection and venting to the atmosphere; 2) active collection and venting to atmosphere; 3) active collection with treatment (flaring); and 4) active collection and methane recovery for either onsite or offsite use. All four options are technically implementable.

2.5 Evaluation of Remedial Technologies and Process Options

The purpose of this section is to further screen the remedial technologies and process options which were identified in Section 2.4 as technically implementable and potentially applicable at the North East Landfill site. The second stage of the screening process involves an evaluation on the basis of effectiveness, implementability, and relative cost. Technologies will be described prior to screening. Table 2-2 identifies those technologies and process options which were screened out, as well as those which were retained for use in the development of remedial alternatives for the site. Effectiveness is considered to be the most important screening criteria at this stage.

The evaluation of effectiveness focuses on: meeting remedial action objectives; the potential effectiveness in handling the estimated areas or volumes of media; the potential impacts on human health and the environment during the construction and implementation phase; and the estimated success and reliability when applied to the contaminants and conditions at the site.

The evaluation of implementability will address both administrative and technical considerations (i.e., constructability).

Costs will be discussed as being relatively high, moderate, low, or negligible from both a capital and O&M standpoint.

2.5.1 Soil/Fill

A. No Action

Description: No action includes no remedial measures at the site.

Effectiveness: No action would not be effective in meeting the remedial action objective at the site for soil/fill.

Implementability: No action is implemented easily since there is no construction. Administrative implementability is difficult since no action is generally unacceptable to regulatory agencies.

Cost: No action has no cost associated with it.

Summary: No action will be retained for use in the development of alternatives as required by 40 CFR 300.

B. Access Restrictions

Description: Access restrictions for soil/fill include posting and fencing around the perimeter of the landfill, and deed restrictions on the site prohibiting intrusive activities.

Effectiveness: Posting, fencing, and deed restrictions prohibiting intrusive activities at the site would be effective in reducing the potential for individuals to come into contact with contaminated soil/fill, and be protective of a landfill cap.

Implementability: As there are no proposed plans for use of the site, access restrictions do not conflict with the future use of the landfill; therefore, implementation likely would not be difficult.

Cost: This has a low capital and O&M cost.

Summary: Access restrictions are retained for use in the development of alternatives.

C. Capping

Description: Both a double barrier cap and single barrier (Part 360) cap would include, from top to bottom, a vegetative cover, topsoil, a barrier protection layer, a barrier layer, a gas collection layer, and grading fill on top of the landfill waste. A double barrier cap also includes a second barrier layer on top of the gas collection layer.

Effectiveness: Either a double barrier or single barrier cap on the landfill, which is properly engineered and maintained, would be protective of human health and the environment. The cap would be designed and graded to enhance and divert surface water runoff, thereby reducing erosion. The cap also would reduce infiltration into the landfill, subsequently reducing leachate generation. The two capping options are equally effective in protecting human health and the environment and eliminating erosion of contaminated soil/fill, but vary in their ability to reduce infiltration. A double barrier cap virtually would eliminate infiltration to the landfill, while a single barrier cap would still substantially reduce infiltration. A quantitative analysis of infiltration reduction following cap implementation is presented in Section 3.2.

Implementability: Because of its various components, a double barrier cap would be more difficult to construct and maintain compared to a single barrier cap. The future use of the site would be limited in order to protect the integrity of the two barrier layers.

A single barrier cap would be moderately difficult to construct and maintain. The future use of the site would be limited in order to protect the integrity of the barrier layer.

Cost: The capital and O&M costs for landfill caps are moderate; however, in general, the cost of a double barrier cap is higher than a single barrier cap.

Summary: Recommendation of a capping option will be presented following the groundwater analyses in Section 3.

D. Bioventing

Description: Bioventing utilizes forced aeration via air injection wells to introduce oxygen into the soil to stimulate biological activity and promote natural bioremediation of the organic contaminants. Bioventing systems are designed to enhance biodegradation while minimizing volatile emissions such that off-gas treatment is not required. Bioventing systems generally include a series of blowers and air injection wells and typically are less costly than other treatment technologies. This method is considered to be effective in permanently reducing the toxicity and volume of contaminated soils to an acceptable level and is technically implementable.

Effectiveness: Though bioventing has been found to be effective in remediating diesel and jet fuel-contaminated sites, it may not be effective in treating the contaminants that are present at the North East Landfill site, the majority of which are VOCs. Because VOC contamination is volatile and does not adsorb as readily to soil as other contaminants, it is possible that bioventing could promote the migration of contaminants away from the site through volatilization or groundwater before biodegradation processes are complete. Metal contaminants as well as certain organic contaminants, also can inhibit the biological process.

Implementability: Biological treatment processes are becoming more common and may be administratively and technically implementable. Biodegradation occurs over a long time frame, and therefore the implementation period would be relatively extensive.

Cost: Capital and O&M costs for bioventing are estimated to be moderate.

Summary: Due to the unknown effectiveness of bioventing on the VOCs present in the landfill, and the possibility that bioventing could promote the migration of contaminants away from the site (through volatilization or the groundwater) before biodegradation processes are complete, bioventing will not be carried forward into the development of alternatives.

E . Bioreclamation

Description: Bioreclamation utilizes a flushing solution enriched with microorganisms/nutrients which is injected upgradient of the contaminated soil zone via injection wells or trenches, flushed through the contaminated zone, and extracted downgradient. The system forms a closed loop. Bioreclamation can be used in either the saturated or the unsaturated zones.

Effectiveness: Bioreclamation is dependent upon the development of suitable bacterial populations, sufficient nutrients and energy, and favorable environmental factors such as pH, temperature, and moisture content. Effective bioreclamation depends on the proper distribution of additives and is not effective in soils with low permeability. As with bioventing, the presence of metal contaminants as well as certain organic contaminants, can inhibit the biological process.

Implementability: Biological treatment processes are becoming more common and may be administratively and technically implementable. Biodegradation occurs over a long time frame, and therefore the implementation period would be relatively extensive.

Cost: Capital and O&M costs for bioreclamation are estimated to be moderate.

Summary: Due to the ineffectiveness of bioreclamation in low permeability soils, and the generally long implementation time estimated for bioreclamation processes, this technology will not be carried forward into the development of alternatives.

F. Soil Washing

Description: The soil washing process uses water injected upgradient of the landfill to separate the water-soluble contaminants from the soil. Water then is collected downgradient of the landfill and treated to applicable standards prior to discharge.

Effectiveness: Soil washing rates are limited by the diffusion and desorption rate of the contaminants in the soil and it generally is more effective in permeable soils as opposed to the relatively impermeable soils present beneath the eastern portion of the landfill. The site hydrogeology must be well defined in order to assure that the flushed contaminants are recaptured.

Implementability: Soil washing is implementable at the site, but due to the low permeability of soils, the implementation period would be relatively extensive.

Costs: Capital and O&M costs for soil washing are estimated to be moderate.

Summary: Due to the low permeability of soils, the implementation period would be relatively long; therefore, soil washing will not be carried into the development of alternatives.

G. Solvent Extraction

Description: Solvent extraction is similar to soil washing with the exception that chemical solvents are added prior to injection to enable non-water soluble contaminants to separate from the soil.

Effectiveness: In general, solvent extraction is more effective than the soil washing process; however at this site, the majority of the VOCs present are already water soluble. Therefore the additional effectiveness is not needed to remediate VOC-contaminated soils.

Implementability: Solvent extraction is technically implementable, with the drawbacks mentioned above under the soil washing process. The addition of chemical solvents, which would make their way into the groundwater, is not always administratively implementable.

Costs: Capital and O&M costs for solvent extraction are estimated to be moderate, but higher than for soil washing due to the added costs of solvents.

Summary: Solvent extraction is not carried forward to the development of alternatives for reasons similar to those for soil washing, as well as the fact that the addition of chemical solvents is not always administratively implementable.

H. Soil Vapor Extraction

Description: Soil vapor extraction systems involve the extraction of air containing VOCs from unsaturated soils. Clean air can be injected into the contaminated soils to accelerate or enhance the process. A vacuum blower(s) and pipe manifold is used to extract the soil vapor through a series of properly placed wells or trenches. The established air flows are a function of the equipment used and soil porosity, air permeability, and moisture content. Relatively small quantities of liquid condensate normally are encountered in the air stream and may require some treatment prior to discharge or disposal at an offsite facility. The off-gas from the system would require treatment for removal of organics prior to its discharge to the atmosphere. Available processes include thermal treatment and vapor phase carbon adsorption.

Effectiveness: Soil vapor extraction processes have proven to be an effective method of handling volatile organic compounds in soils at hazardous waste sites, and are probably the most commonly used in-situ remedial technology. A pilot-scale test would have to be performed to determine the effectiveness for the contaminants and the soil characteristics.

Implementability: Soil vapor extraction would be implemented on the unsaturated zone. This technology has been effectively demonstrated on similar sites and therefore should receive administrative approval.

Cost: Capital and O&M costs for soil vapor extraction are estimated to be moderate.

Summary: Soil vapor extraction has been demonstrated on similar sites to be an effective in-situ soil treatment technology for the unsaturated zone and therefore will be carried forward to the development of alternatives.

I. In-Situ Low Temperature Thermal Desorption

Description: In-situ low temperature thermal desorption is similar to soil vapor extraction except that hot air is injected into the subsurface prior to soil vaporextraction in order to increase the rate of volatilization of the VOCs.

Effectiveness: This treatment technology is expected to be effective in remediating VOC-contaminated soils in the unsaturated zone; however, a pilot-scale test would need to be performed. It is not known whether the added effectiveness of this technology over soil vapor extraction is necessary. Soil vapor extraction alone may be sufficient for the remediation of VOC-contaminated soil at the site.

Implementability: Similar to soil vapor extraction, low temperature thermal desorption should be technically and administratively implementable.

Cost: Capital and O&M costs for low temperature thermal desorption are estimated to be moderate, but would be higher than for soil vapor extraction due to the energy requirements to heat and inject air.

Summary: Low temperature thermal desorption would provide additional removal of VOCs from contaminated soil over soil vapor extraction. A pilot-scale test would have to be performed in order to determine if this higher cost technology would be necessary. For the purposes of the FS, this technology will not be carried forward, as the VOC contaminants present in the unsaturated zone should be effectively collected by soil vapor extraction. If an in-situ soil treatment technology is included as the recommended alternative for the site, this technology should be further considered in the Design Phase.

J. Steam Stripping

Description: Steam stripping is similar to soil vapor extraction and low temperature thermal desorption except that steam, instead of air, is injected into the subsurface to increase the rate of volatilization of VOCs.

Effectiveness: Steam stripping would be effective in remediating the VOC - contaminated soils at the site with the possible exception of some water soluble VOCs (e.g., ketones) and SVOCs. Instead of volatilizing, the steam may induce such contaminants to leach downward to the water table and migrate through groundwater.

Implementability: This technology would be technically and administratively implementable.

Cost: Capital and O&M costs for steam stripping are estimated to be moderate to high due to the energy requirements to produce and inject stream.

Summary: Steam stripping would provide additional removal of VOCs from the contaminated soil over soil vapor extraction with the possible exception of water soluble VOCs and SVOCs. Pilot-scale testing would be required to determine if this would be more successful than soil vapor extraction or low temperature thermal desorption. For the purpose of this FS, it is assumed that soil vapor extraction would provide adequate removal, and steam stripping will not be carried further.

K. Ràdio Frequency Heat Process

Description: Radio frequency heating is an in-situ treatment process that uses electromagnetic energy to heat soil to enhance the volatilization and removal of organic contamination. It can be combined with soil vapor extraction methods to remove and treat the off-gases.

Effectiveness: This technology is in the demonstration phase of the Superfund Innovative Technology Evaluation (SITE) Program and has not yet been determined to be effective on a full-scale remediation project.

Implementability: The technical and administrative implementability of this technology are not known because the technology is still in the demonstration phase.

Cost: Capital and O&M costs for the radio frequency heat process are estimated to be moderate, but are expected to be greater than for soil vapor extraction alone.

Summary: Due to the uncertainties associated with the radio frequency heat process, this technology will not be carried forward to the development of alternatives.

2.5.2 Sediments

A. No Action

Description: No action includes no remedial measures at the site.

Effectiveness: No action would not be effective in meeting the remedial action objectives for sediments at the site.

Implementability: No action is easily implemented since there is no construction. Administrative implementability is difficult since no action generally is unacceptable to the regulatory agencies.

Cost: There is no cost associated with this technology.

Summary: No action will be retained for use in the development of alternatives, as required by 40 CFR 300.

B. Access Restrictions

Description: Access restrictions for sediments include posting and fencing around the localized area of contaminated sediments.

Effectiveness: Access restrictions, such as posting and fencing, do not address the potential for ecological (fish and wildlife) risk.

Implementability: Posting and fencing of areas surrounding contaminated sediments would be in the wetlands, and may not be administratively implementable.

Cost: The cost for implementation of this technology is low.

Summary: Access restrictions are not effective in addressing the potential for environmental exposure to contaminated sediments; therefore, they will not be retained for use in the development of alternatives.

C. Monitoring

Description: Sediment monitoring would include the sampling and analysis of sediments around the perimeter of the landfill.

Effectiveness: Monitoring would not be effective in meeting the remedial action objectives. It would, however, help to define whether the conditions at the site currently, and in the future, pose any potential human and ecological risks and to evaluate the effectiveness of other remedial measures.

Implementability: Monitoring is both technically and administratively implementable.

Cost: The capital and O&M costs of monitoring sediments would be low.

Summary: Monitoring will be retained for use in the development of an institutional action alternative, as suggested by the NCP and the USEPA guidance documents.

D. Capping

Description: See capping under Soil/Fill in Section 2.5.1.

Effectiveness: Capping of the landfill will eliminate further erosion of contaminated soil/fill to sediments, but would not fully eliminate the localized sediment contamination and associated potential ecological impacts.

Implementability: Implementability of the landfill cap option is discussed in Section 2.5.1.

Cost: The relative costs of landfill caps is discussed in Section 2.5.1.

Summary: A landfill cap would be effective in meeting the remedial action objective for providing protection against erosion of landfill soil/fill to nearby sediments. However, it is already being retained to address soil/fill; therefore, it will not be used as a technology for sediments in the development of alternatives.

E. Treatment/Disposal

Description: Removing contaminated sediments with subsequent treatment or disposal, in the long-term, would be effective in reducing the potential ecological risk; however, it may be detrimental to the environment in the short-term. Once removed, sediments could be disposed of or treated at either onsite or offsite locations. In-situ treatment technologies (biological, chemical, physical, thermal processes) are also considered. Following sediment removal, the wetland would have to be restored.

Effectiveness: Sediments would have to be treated or disposed of either onsite or offsite. Onsite disposal under the landfill cap, or offsite disposal in a permitted facility would be effective. The effectiveness of above-ground or in-situ treatment systems is unknown due to the relatively high levels of metals in the sediment samples. Physical treatment processes such as solidification/stabilization and fixation generally are implemented on metals-contaminated materials. Biological, chemical, and thermal treatment processes generally are not effective on metals-contaminated soils/sediments.

Implementability: To prevent short-term impacts on the affected wetland, special mitigative measures and monitoring would be required during remedial activities. Permits would be required for work in wetland areas. Sediment removal would require grading contaminated material onsite or transportation offsite. Disposing of sediments on the landfill under a cap would be the most implementable option. Offsite disposal also would be implementable, though more difficult. On-site treatment implementation is dependent on the type of treatment recommended, but in general would be the most difficult option.

Cost: Removing contaminated sediments would have a low capital cost and no O&M cost. The cost of onsite disposal would be low. Offsite disposal costs would be low to moderate depending on transportation costs to the facility. The cost of onsite treatment would be moderate. There would be no long-term O&M costs associated with disposal or treatment due to the limited quantity of sediments to be remediated.

Summary: Sediment removal with onsite disposal of sediments under the landfill cap will be retained given its effectiveness, relatively low cost, and ease in implementability. Wetland restoration will follow sediment remediation.

2.5.3 Groundwater

A. No Action

Description: No action includes no remedial measures at the site.

Effectiveness: No action would not be effective in meeting the remedial action objective for groundwater at the site.

Implementability: No action is readily implementable since there is no construction. Administrative acceptance of this option is uncertain pending regulatory review.

Cost: No action has no cost associated with it.

Summary: No action will be retained for use in the development of alternatives.

B. Deed Restrictions

Description: Deed restrictions would include prohibiting the use of groundwater at the site.

Effectiveness: Deed restrictions prohibiting use of groundwater at the site would not be effective in meeting the remedial action objective, but could be implemented to protect human health.

Implementability: Deed restrictions prohibiting groundwater use onsite should be implementable.

Cost: This option has a low capital and O&M cost.

Summary: Deed restrictions are retained for use in the development of alternatives.

C. Monitoring

Description: Groundwater monitoring would include sampling and analysis of groundwater upgradient and downgradient of the landfill in existing monitoring wells.

Effectiveness: Groundwater monitoring would not be effective in meeting the remedial action objective. It would, however, help to determine whether offsite migration of contaminated groundwater was continuing to occur at levels which exceeded SCGs, or posed a potential human health or environmental risk.

Implementability: Monitoring is both technically and administratively implementable.

Cost: As existing monitoring wells would be used, there are no capital costs. The O&M cost for groundwater monitoring is moderate.

Summary: Groundwater monitoring will be retained for use in the development of alternatives.

D. Collection

Description: Groundwater in the shallow portion of the water table aquifer could be collected downgradient using a collection trench, or through a series of groundwater extraction wells or well points.

Effectiveness: Collection of shallow groundwater downgradient of the landfill prior to its migration offsite would be effective in meeting the remedial action objective for groundwater. Downgradient extraction wells, well points, or a collection trench would prevent contaminant migration and reduce offsite flow. Due to the relatively low permeability of the clayey, sandy silt layer present along the eastern perimeter of the landfill, numerous extraction wells or well points would be needed to effectively collect groundwater in this area.

Implementability: Due to the relatively shallow depth of groundwater to be remediated, construction of the identified technologies should not be difficult.

Cost: Due to the numerous wells or well points which would be required, the cost of a collection trench is projected to be lower than wells or well points.

Summary: A collection trench designed to collect groundwater from the shallow portion of the water table aquifer is recommended due to its effectiveness, implementability, and relatively lower cost.

E. <u>Containment</u>

Description: Vertical barriers such as a low permeability slurry wall or sheet pile wall (sheet piling) could be located on the downgradient side of a groundwater collection system to reduce the amount of "clean" water that would enter the collection system. A geomembrane liner could be placed on the downgradient side of a collection trench for the same purpose.

Effectiveness: Vertical barriers, such as slurry walls or sheet piling, on the downgradient side of the collection system would have to be partially penetrating because only the shallow portion of the water table aquifer is to be remediated. Such a partially penetrating vertical would not be effective in reducing the inflow of "clean" water, as water would flow back under the barrier. A fully penetrating vertical barrier would extend the full depth of the aquifer, but result in the collection of more groundwater than necessary. Geomembrane lining of the trench would be somewhat effective.

Implementability: Vertical barriers installed to the relatively shallow depths proposed are implementable.

Cost: The cost of slurry walls or sheet piling is estimated to be moderate; sheet piling would be easier to drive resulting in less capital cost. There would be no O&M cost. Geomembrane lining of the trench would have a low capital cost; however, O&M costs associated with maintaining the geomembrane could be high if the trench has to be reconstructed to replace failed geomembrane.

Summary: Due to the ineffectiveness of partially penetrating vertical barriers, geomembrane lining of the collection trench is the recommended containment technology.

F. Treatment/Disposal

Description: Treatment options are dependent on the characteristics and anticipated collection rates for groundwater, and the ultimate discharge location. In general, these include: offsite disposal without treatment, pretreatment with disposal at a POTW, and full treatment options with discharge to groundwater or surface water.

Effectiveness: Collected water either could be disposed of offsite without treatment, or following pretreatment to meet POTW influent standards, or fully treated onsite and discharged to groundwater or surface water. An appropriate treatment process scheme would have to be developed for the pretreatment and treatment options to effectively meet applicable discharge criteria.

Implementability: Each of the treatment/disposal options are implementable, with the exception of offsite disposal without treatment. In general, POTWs have influent standards which have to be met prior to acceptance. Therefore, pretreatment is considered necessary prior to disposal at a POTW.

The closest POTWs are located 20 to 60 miles away, a considerable distance from the site. Offsite transportation of collected water would have to be by tanker truck, as opposed to through a force main connected to the POTW. Discharge criteria to groundwater generally are more stringent than those for surface water; therefore, a groundwater discharge option may be somewhat more difficult to construct, operate, and maintain. Discharge criteria will be evaluated in Section 3.3. Approvals and permits for offsite transportation and onsite treatment, and discharge to either groundwater or surface water generally would be required.

Cost: Costs are dependent on the quantity of water collected, on the discharge limits and on the fees for transportation and acceptance by the POTW, and on the treatment required to meet the discharge limits.

Summary: Recommendation of water treatment/disposal options will be presented following the detailed engineering analysis of these options which is included in Section 3.3. Offsite disposal without pretreatment is eliminated from further consideration.

G. Combined Groundwater Remedial Technologies and Soil Treatment

Groundwater remedial technologies in conjunction with soil technologies were considered to expedite the treatment process. Two technologies - air sparging and groundwater collection and treatment - were considered feasible.

Description: Air sparging involves the injection of air below the water table in order to volatilize the VOCs present and expedite the cleanup process. Off-gases then would be collected and treated with the off-gas from a soil vapor extraction system.

Groundwater collection onsite through extraction wells with subsequent treatment would depress the water table to below the contaminated waste and soil, and facilitate the extraction of soil vapor at greater depths.

Effectiveness: Air sparging would be effective in volatilizing VOCs below the water table but; especially in the vicinity of the wetland, may promote the migration of SVOCs through groundwater rather than collection by the soil vapor extraction system. SVOCs have been adsorbed on waste and soils and are currently immobile as evidenced by the groundwater analytical data.

Depressing the water table with a groundwater collection/treatment system would be effective, but would require a large number of wells in low permeability soils on the eastern side of the landfill.

Implementability: Air sparging and groundwater collection/treatment would be implementable, when used in conjunction with a soil vapor extraction system. Since it is a less complex process, air sparging would be easier to implement.

Cost: The capital and O&M costs of an air sparging system in conjunction with soil vapor extraction would be moderate. The capital and O&M costs of a groundwater collection/treatment system would be higher than air sparging.

Summary: Air sparging is effective, easier to implement, and less costly than groundwater collection/treatment. Air sparging used in conjunction with soil vapor extraction would provide for removal of VOCs from landfill waste and soil above and below the water table and expedite the cleanup process. Thus air sparging in conjunction with soil vapor extraction will be considered in the development of alternatives.

2.5.4 Air

A. No Action

Description: No action includes no remedial measures at the site.

Effectiveness: No action would not be effective in meeting the remedial action objective for air at the site.

Implementability: No action is easily implemented since there is no construction. Administrative acceptance of this option is unfavorable, as a Part 360 cap, considered to be a minimum requirement by the NYSDEC, includes a gas collection layer.

Cost: There is no cost associated with this technology.

Summary: No action will be retained for use in the development of alternatives, as required by 40 CFR 300.

B. Access Restrictions

Description: Access restrictions include posting and fencing of the landfill perimeter in order to limit human exposure. Deed restrictions could be implemented to prevent future development of the site.

Effectiveness: Access restrictions, such as posting, fencing, and deed restrictions would reduce the possibility of human exposure to landfill gas emissions onsite but not offsite. Therefore, access restrictions would satisfy the remedial action objective only on a limited basis.

Implementability: Posting, fencing and restrictions could be constructed and maintained. Deed restrictions can be readily administered.

Cost: The cost for implementation of this technology is low.

Summary: Access restrictions have limited effectiveness. However, they will be retained for use in the development of an institutional action alternative.

C. Monitoring

Description: Air monitoring would include landfill gas emission and ambient air sampling and analysis in order to determine future air quality at the site and in the surrounding area.

TABLE 2-1
Remedial Action Objectives, General Response Actions, Technology Types, and Process Options for the Development and Screening of Technologies

Environmental Media	Remedial Action Objectives	General Response Actions	Technology Types	Process Options
Soil/Fill	Provide protection to human health and the environment from landfill soil/fill.	No Action	None	None
		Institutional Actions:	Access Restrictions	Posting, Fencing, Deed Restrictions
		Containment Actions:	Capping	Double barrier cap Single barrier (Part 360) cap
		Treatment/Disposal Actions:	Removal/Offsite Treatment	Offsite Facility
			Removal/Above-Ground Treatment	Biological, Chemical, Physical, Thermal
			In-Situ Treatment	Bioventing Bioreclamation Soil Washing Solvent Extraction Soil Vapor Extraction Low Temperature Thermal Desorption Steam Stripping Radio Frequency Heat Process

TABLE 2-1 (Cont'd)

Remedial Action Objectives, General Response Actions, Technology Types, and Process Options for the Development and Screening of Technologies

Environmental Media	Remedial Action Objectives	General Response Actions	Technology Types	Process Options
Sediments	Provide protection against environmental exposure resulting from erosion of landfill soil/fill to sediments.	No Action	None	None
		Institutional Actions:	Access Restrictions Monitoring	Posting, fencing Monitoring Sediments
	Reduce potential adverse impacts on fish and wildlife posed by contaminated sediments northeast of the site	Containment Actions:	Capping	Landfill Cap see Soil/Fill
		Treatment/Disposal Actions:	Removal, placement onsite Removal, disposal offsite	Dragline, Small Backhoe, Manual methods
			Excavation, above-ground treatment	Biological Chemical Physical Thermal
			In situ treatment	Biological Chemical Physical Thermal

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TABLE 2-1 (Cont'd)

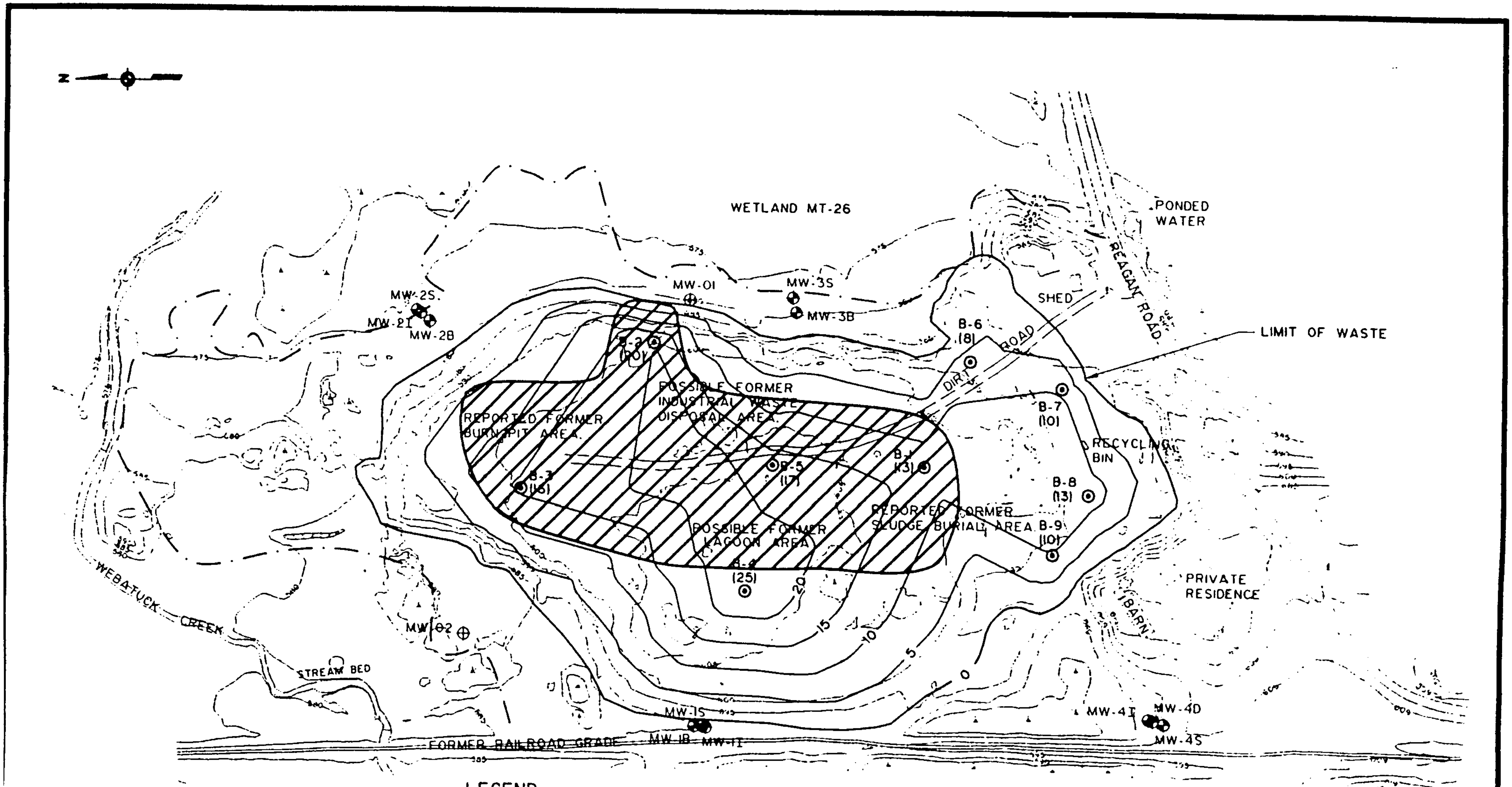
Remedial Action Objectives, General Response Actions, Technology Types, and Process Options for the Development and Screening of Technologies

Environmental Media	Remedial Action Objectives	General Response Actions	Technology Types	Process Options
Groundwater	Reduce concentrations of contaminants migrating from the landfill through the shallow water table aquifer to SCGs for organics and to background levels for metals.	No Action	None	None
		Institutional Actions:	Deed Restrictions Monitoring	Deed Restrictions Monitoring Groundwater
		Containment Actions:	Collection	Downgradient collection trench Downgradient extraction wells Downgradient well points
			Vertical Barriers	Sheet Piling Slurry Wall Geomembrane Lining of trench
		Treatment/Disposal Actions:	Groundwater Treatment/Disposal	Onsite Treatment Discharge to Groundwater Onsite Treatment Discharge to Surface Water Onsite Pretreatment, Discharge to POTW Offsite Disposal/Treatment at POTW Air Sparging

TABLE 2-1 (Cont'd)

Remedial Action Objectives, General Response Actions, Technology Types, and Process Options for the Development and Screening of Technologies

Environmental Media	Remedial Action Objectives	General Response Actions	Technology Types	Process Options
Air	Protect human health and the environment from landfill gas emissions	No Action	None	None
		Institutional Actions:	Access Restrictions Monitoring	Deed restrictions, fencing, posting Monitoring air quality
		Containment Actions:	Passive Collection System Active Collection System	(Process options will be recommended to comply with Part 360 regulations.)
		Treatment/Disposal Actions:	Venting Thermal Treatment Energy Recovery	



LEGEND

⊙	RI PIEZOMETER (1993) OR BORING (1994)
(20)	FILL THICKNESS (FT)
⊕	NYSDEC PHASE II MONITORING WELL (1984)
●	RI MONITORING WELL (1993)
— · —	WETLANDS BOUNDARY
(hatched)	AREA EXTENT OF VOC CONTAMINATED SOILS

150 0 150

SCALE IN FEET

NOTES

1. BASE MAPPING WAS PREPARED BY AIR SURVEY CORP., RESTON, VA. USING AERIAL PHOTOGRAPHY TAKEN APRIL 14, 1993. GROUND CONTROL WAS BY URS.
2. PROJECT VERTICAL CONTROL IS BASED UPON NATIONAL GEODETIC VERTICAL DATUM OF 1929 AS ESTABLISHED ON USGS MONUMENT "ALBANY 573" ELEV. 575.540.

NORTH EAST LANDFILL
AREAL EXTENT OF VOC - CONTAMINATED SOILS

URS CONSULTANTS, INC.

FIGURE 2-1

Effectiveness: Monitoring of landfill gas emissions onsite and at the perimeter would not be effective in meeting the remedial action objective for air. It would, however, help to determine changes in site conditions with time following cap construction.

Implementability: Monitoring is both technically and administratively implementable.

Cost: The capital and O&M costs for landfill gas emissions and ambient air monitoring are low.

Summary: Landfill gas and ambient air monitoring alone will not meet the remedial action objective. However, monitoring is retained for use in an institutional action alternative, as suggested by the NCP and USEPA guidance documents.

D. Gas Containment (Collection)/Treatment

Description: There are four options for gas collection and treatment under a landfill cap and include: 1) passive collection and venting to the atmosphere; 2) active collection and venting to the atmosphere; 3) active collection with treatment (flaring); and 4) active collection and methane recovery for either onsite or offsite use.

Effectiveness: When properly designed and maintained, the active gas collection options would be equally effective in meeting the remedial action objective for air. Options that include treatment (e.g., flaring) or energy recovery are not considered necessary due to the fact that the landfill is not currently having an adverse impact on air quality at the site perimeter. Passive or active collection with venting, when combined with air emissions and perimeter gas monitoring, would be effective in meeting the air remedial action objective. If necessary, the system could be retrofitted (e.g., with carbon treatment units) to meet air emissions standards at individual gas vents.

Implementability: Process options involving active collection, treatment or energy recovery are more difficult to construct than those which include only collection and venting, and would require more maintenance.

Relative Cost: Costs range from low to moderate for these options. Passive collection and venting is the least costly option. Active collection would be slightly more costly. Collection and treatment costs would be higher because of capital and O&M costs associated with treatment. An energy recovery system would have the highest capital and O&M costs, but may have cost-saving benefits in the form of power generation.

Summary: All process options discussed are effective and implementable at the site, but vary in their cost and ability to meet air quality standards. As the landfill is currently not having an adverse impact on air quality, passive collection with venting is the recommended option. Long-term air monitoring will be used to assess the effectiveness of this option. Individual carbon treatment units could be added at the gas vents, if necessary, to comply with air quality standards.

2.6 Summary of Recommended Remedial Technologies and Process Options

Remedial technologies were screened and evaluated in the previous sections. Those determined to be not effective, implementable, or too high in cost were screened out. Those technologies and process options which are retained for further consideration are listed in Table 2-3, along with the media which they address. A post screening evaluation of capping technologies and water treatment/disposal options will be performed in Section 3 to further evaluate their effectiveness individually, and in combination with other technologies.

TABLE 2-2 Screening and Evaluation of Remedial Technologies and Process Options

Soil/Fill

General Response Actions	Remedial Technology	Process Option	Description	Screening Comments
No Action	None	None	No Action.	Required for consideration by NCP.
Institutional Actions	Access Restrictions	Posting, Fencing, Deed restrictions	Posting, fencing, prohibit future intrusive activities.	Potentially applicable.
Containment	Capping	Double barrier cap	Two low permeability layers.	Potentially applicable; to be evaluated in Section 3.
		Single barrier cap (Part 360)	One low permeability layer.	Potentially applicable; to be evaluated in Section 3.
Treatment/Disposal	° Excavation/ Offsite Treatment	° None	Excavated material transported to appropriate offsite treatment facility.	Excavation of large waste quantiities not implementable.
	° Excavation/Above-Ground Treatment	° Biological, Chemical, Physical, Thermal	Excavated material treated onsite in above-ground facility.	Excavation of large waste quantities not implementable.
	In-situ Treatment	Bioventing	Enhanced in-place bio-oxidation of organic contaminants by promoting air flow through soil.	Unknown effectiveness on contaminants present at the site; long time period required.
		Bioreclamation	Application of aerobic or anaerobic bacteria to soil contaminants using groundwater extraction/reinjection system.	Unknown effectiveness on contaminants present at the site; long time period required.
		Soil Washing	Extraction of soil contaminants using water as the washing fluid.	Not effective on all of the contaminants; site hydrology may make containment recapture difficult.
		Solvent Extraction	Extraction of soil contaminants using a chemical solvent.	Not effective on all of the contaminants; site hydrology may make containment recapture difficult.
		Soil Vapor Extraction	Extraction of VOCs using a vacuum system followed by vapor recovery/treatment.	Potentially applicable for VOCs present.
		Low Temperature Thermal Desorption	Extraction of VOCs using hot air injection in conjunction with soil vapor extraction.	Potentially applicable for VOCs present; higher cost than soil vapor extraction.
		Steam Stripping	Extraction of VOCs using steam injection in conjunction with soil vapor extraction.	Potentially applicable for VOCs present; higher cost than soil vapor extraction.
		Radio Frequency Heat Process	Process using electromagnetic energy to heat soil and enhance organic removal by soil vapor extraction.	Potentially applicable for VOCs present; higher cost than soil vapor extraction.

° [hatched box] - Technologies that are screened out due to technical implementability.

[shaded box] - Technologies that are screened out due to effectiveness, implementability and cost.

TABLE 2-2 Screening and Evaluation of Remedial Technologies and Process Options (Continued)

Sediments

General Response Actions	Remedial Technology	Process Option	Description	Screening Comments
No Action	None	None	No Action.	Required for consideration by NCP.
Institutional Actions	Access Restrictions (shaded)	Posting, fencing (shaded)	Limit access to contaminated sediments.	Potentially applicable for human health but not effective for the environment.
	Monitoring	Monitoring Sediments	Continued monitoring.	Potentially applicable.
Containment	Capping	Landfill Cap	See soil/fill technologies.	See soil/fill technologies.
Treatment/Disposal	Removal/Treatment of Sediments	Removal, onsite placement under cap	Removal of contaminated sediments; placement under landfill cap.	Potentially applicable.
		Removal offsite disposal (shaded)	Removal of contaminated sediments; disposal at appropriate offsite facility.	Higher cost option.
		Removal above-ground treatment (shaded)	Removal of contaminated sediments; appropriate above-ground treatment.	Higher cost option; unknown effectiveness.
		° In-situ Treatment (hatched)	In-situ treatment of contaminated sediments.	Not implementable at relatively shallow depth.

° (hatched) - Technologies that are screened out due to technical implementability.

(shaded) - Technologies that are screened out due to effectiveness, implementability and cost.

3.0 POST SCREENING EVALUATIONS

Engineering analyses were performed during the course of the FS in order to further evaluate remedial technologies and process options related to: waste consolidation and site grading, infiltration through landfill caps, groundwater flow and contaminant transport subsequent to landfill capping, and groundwater treatment/disposal. These analyses are discussed in the following sections. Recommendations of technologies and process options to be carried forward to the development of alternatives are presented. A discussion of the Standards, Criteria, and Guidance (SCGs) for the site is provided at the end of the section.

3.1 Engineering Analysis of the Cap Subgrade

Two engineering evaluations of the cap subgrade were performed for the landfill. These include waste consolidation and site grading prior to cap construction. A discussion of these evaluations is presented below.

3.1.1 Waste Consolidation

Based on the fill thickness map developed for the FS and shown on Figure 3-1, a relatively thinner depth of fill is present in the southern portion of the site. In the southern approximately 3 acres of the landfill (south of B-1), fill thickness is on the order of 10-13 feet. Excavation of this waste and consolidation within the remaining acres of the landfill would reduce the area of landfill to be capped, and provide onsite materials which could be used as grading fill under the landfill cap. However, excavation of this approximately 50,000 cy of waste would require mitigative health and safety measures for human health and the environment during excavation activities, and restoration of the excavated area to prevent surface water ponding. An analysis was performed to compare the anticipated costs of waste consolidation versus capping the 3-acre area. Details are presented in Appendix B.1, and show that capping is less costly than waste consolidation due to the cost of excavating waste materials and the cost of restoring the area. Therefore, consolidating waste from the southern portion of the site is not recommended.

As shown on Figure 3-1, assuming the thickness of fill in the northern portion of the site follows the topography of the area, consolidation of waste in the north is not a viable option because of the small area where limited fill is anticipated.

A small area of waste in the southeastern corner of the site appears to extend into the wetland as shown on Plate 1. Consolidation of this area is recommended to allow construction and maintenance of the landfill cap outside the limits of the wetland.

3.1.2 Site Grading

The objectives of preparing the subgrade plan were to: a) reduce infiltration; b) prevent ponding of surface water; c) provide stable landfill cover slopes; d) control surface water runoff and erosion; e) minimize the required quantity of grading fill required, and f) maintain a minimum slope of 4% and maximum slope of 33% in order to conform to Part 360 regulations.

In order to meet the above objectives, the subgrade plan shown on Plate 2 includes importing approximately 70,000 cy of clean fill material to the site (as estimated in Appendix B.1), and excavating approximately 7,500 cy of onsite materials along the steep eastern sideslopes where grades exceed the maximum slope of 33%, and in the area in the southeast where waste encroaches the wetland. These estimates are used in the cost estimates for the landfill cap presented in Section 4.4.

The approximately 70,000 cy of fill material required will be a large cost item for construction of the landfill cap. Use of clean fill materials, commonly referred to as alternate grading materials (AGM), other than soil is a potential cost saving measure. AGM are non-organic, non-putricible materials of small particle size and include non-recyclable glass and processed construction and demolition (C&D) materials such as crusher screenings, concrete, stone, and asphalt. AGM would have to meet the physical and chemical characteristic specifications to be set forth for grading material which will include but not be limited to: Toxicity Characteristic Leaching Procedure (TCLP) testing, organic content, odor, grain size, and plasticity. Sources of AGM that comply with grading material specifications will be identified and confirmed during the design phase of the project if AGM is to be used. An AGM Program

Operations Plan (POP) which includes specifications for suitable material will also be developed during the design phase.

3.2 Groundwater Flow and Contaminant Transport Analyses

Infiltration, groundwater flow and contaminant transport analyses were performed in order to assess the impact of a landfill cap on the groundwater flow regime, contaminant concentrations, and potential future groundwater receptors.

3.2.1 Infiltration Analysis

The infiltration analyses were performed utilizing the USEPA Hydrologic Evaluation of Landfill Performance (HELP) model (Schroeder et al., 1983, 1988) for uncapped and capped conditions. Capping options investigated were a double barrier cap and a single barrier (Part 360) cap. The rationale behind the selection of parameters used in the analysis, and the detailed results are presented in Appendix B.2. A summary of input parameters and infiltration results is provided below.

Infiltration through the geomembrane of a double barrier or Part 360 cap is dependent on the "leakage fraction" of the membrane. This parameter represents how much leakage is expected through the membrane, on average, from the entire site through punctures and/or seam breaches. The HELP model offers a range of potential values for the leakage fraction, from a value representing a poor quality of cap construction and maintenance to a value representing a high quality of cap construction and maintenance. Whereas a high quality of cap construction and maintenance is the ultimate goal, a leakage fraction representing a medium quality of cap construction and maintenance was also considered in the infiltration, groundwater and contaminant transport analyses.

A. Existing (Uncapped) Conditions

The following input parameters were used:

Parameter	Assumed Values/Options
General • Climatic data • Vegetative cover • Type of landfill • Number of layers	 Synthetically generated for Albany, NY over a 20-year period. HELP options of "good" and "poor" grass Between 20% and 80% of the area cannot drain (ponding) Two (2)
Layer 1 (cover soil) • Thickness • Soil Type • Type of layer	 Six (6) inches HELP soil types #7, #3 (silty sand), K = 3E-3 to 5E-4 cm/s Vertical percolation layer
Layer 2 (municipal fill) • Thickness • Soil Type • Type of layer	 Twenty-five (25) feet HELP soil #18 (municipal waste), K = 2E-4 cm/s to 2E-2 cm/s Vertical percolation layer

Results of the infiltration analysis in the form of annual averages for the years provided in the HELP model, 1974-78, are summarized on Table 3-1. Infiltration under existing (uncapped) conditions is estimated at 7 to 10 in/yr.

X

B. Double Barrier Cap

The following input parameters were used:

Parameter	Assumed Values/Options
General • Climatic data • Vegetative cover • Type of landfill • Number of layers	 Synthetically generated for Albany, NY over a 20-year period. HELP option of "fair grass" Inactive (entire site able to drain) Four (4)
Layer 1 (topsoil) • Thickness • Soil type • Type of layer	 Six (6) inches HELP soil #9 (silty loam), K = 2E-4 cm/s Vertical percolation layer
Layer 2 (cover soil) • Thickness • Soil type • Type of layer • Slope • Drainage length	 Thirty (30) inches HELP soil type #1 (well graded sand), K = 1E-2 cm/s Lateral drainage layer Five (5) percent Three hundred (300) feet
Layer 3 (geomembrane on barrier layer) • Thickness • Soil type • Type of layer • Leakage fraction of geomembrane	 Twenty-four (24) inches HELP soil #16 (liner soil), K= 1E-7 cm/s Barrier layer with membrane Value of 0.0003
Layer 4 (municipal fill) • Thickness • Soil Type • Type of Layer	 Twenty-five (25) feet HELP soil #18 (municipal waste), K= 2E-4 cm/s to 2E-2 cm/s Vertical percolation layer

Results of the infiltration analysis in the form of annual averages are summarized on Table 3-1. Infiltration through the double barrier cap using the medium quality leakage fraction is estimated to be on the order of 0.0003 to 0.0004 in/yr, as compared to 7-10 in/yr under existing (uncapped) conditions. Infiltration using a high quality leakage fraction would be similar.

C. Part 360 Cap (Single Barrier)

The following input parameters were used:

Parameter	Assumed Values/Options
General • Climatic data • Vegetative cover • Type of landfill • Number of layers	 Synthetically generated for Albany, NY over a 20-year period. HELP option of "fair grass" Inactive (entire site able to drain) Four (4)
Layer 1 (topsoil) • Thickness • Soil type • Type of layer	 Six (6) inches HELP soil #9 (silty loam), K = 2E-4 cm/s Vertical percolation layer
Layer 2 (cover soil) • Thickness • Soil type • Type of layer • Slope • Drainage length	 Eighteen (18) inches HELP soil type #1 (well graded sand), K = 1E-2 cm/s Lateral drainage layer Five (5) percent Three hundred (300) feet
Layer 3 (geomembrane on grading fill) • Thickness • Soil type • Type of layer • Leakage fraction of geomembrane (quality)	 Six (6) inches HELP soil #2 (well graded sand), K=3E-4 cm/s Barrier layer Value of 0.0003 (med), 0.00001 (high)
Layer 4 (municipal fill) • Thickness • Soil Type • Type of Layer	 Twenty-five (25) feet HELP soil #18 (municipal waste), K= 2E-4 cm/s to 2E-2 cm/s Vertical percolation layer

Results of the infiltration analysis in the form of annual averages are summarized on Table 3-1. The estimated infiltration through the Part 360 cap, using the medium quality leakage fraction through the geomembrane, is 1.5 in/yr, and is 0.03 in/yr using a high quality leakage fraction, as compared to 7-10 in/yr for existing (uncapped) conditions.

TABLE 2-3
REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS TO BE CARRIED FORWARD TO POST SCREENING EVALUATIONS

MEDIA	TECHNOLOGIES AND PROCESS OPTIONS
Soil/Fill	• No action • Access restrictions • Double barrier cap • Part 360 cap • Soil vapor extraction with air sparging
Sediments	• No action • Monitoring • Sediment removal/onsite disposal/wetland restoration
Groundwater	• No action • Deed restrictions • Monitoring • Groundwater collection trench with geomembrane lining • Pretreatment, offsite disposal at POTW • Onsite treatment of collected water, discharge to surface water • Onsite treatment of collected water, discharge to groundwater
Air	• No action • Access restrictions • Monitoring • Passive gas collection/venting (add individual carbon treatment units at vents if necessary)

TABLE 2-2 Screening and Evaluation of Remedial Technologies and Process Options (Continued)

Air

General Response Actions	Remedial Technology	Process Option	Description	Screening Comments
No Action	None	None	No Action.	Required by NCP.
Institutional Actions	Access Restrictions	Posting, fencing, deed restrictions	Restrict use and limit access to site.	Potentially applicable.
	Monitoring	Air monitoring	Continued monitoring.	Potentially applicable.
Collection	Passive Gas Collection/ Venting		Gas collected under landfill cap in collection layer and vented through vertical pipes.	Potentially applicable.
	Active Gas Collection/ Venting		Gas collected under landfill cap in collection layer with a vacuum system, piped to blower and vented.	Higher cost, additional effectiveness not necessary.
Treatment	Active Gas Collection/ Treatment		Gas collected under landfill cap in collection layer with a vacuum system, piped to blower facility and incinerated in a flare.	Higher cost, additional effectiveness not necessary.
	Active Gas Collection/ Energy Recovery	Onsite Energy Use Offsite Energy Use	Gas collected under landfill cap in collection layer with a vacuum system, piped to electrical generating facility and either utilized onsite or connected to utility transmission lines for offsite use.	Highest cost.

(hatched box) - Technologies that are screened out due to technical implementability.

(shaded box) - Technologies that are screened out due to effectiveness, implementability and cost.

TABLE 2-2 Screening and Evaluation of Remedial Technologies and Process Options

Groundwater

General Response Actions	Remedial Technology	Process Option	Description	Screening Comments
No Action	None	None	No Action.	Required for consideration by NCP.
Institutional Actions	Deed Restrictions	Deed Restrictions	Deed restrictions prohibiting groundwater use.	Potentially applicable.
	Monitoring	Monitoring Groundwater	Continued monitoring.	Potentially applicable.
Containment	Vertical Barriers	Slurry walls, Sheet piling	Partially penetrating slurry wall or sheet piling along downgradient side of collection trench to reduce inflow of "clean" water.	Partially penetrating vertical barrier not effective.
		Geomembrane lining of trench	Geomembrane lining on downgradient side of collection trench to reduce inflow of "clean" water.	Potentially applicable.
Collection	Collection	Downgradient extraction wells	Extraction wells downgradient of landfill.	Numerous wells needed in low permeability soils present at site.
		Downgradient well points	Well points downgradient of landfill.	Numerous wells needed in low permeability soils present at site.
		Downgradient collection trench	Leachate collection system downgradient of landfill.	Potentially applicable.
Treatment/Disposal	Groundwater Treatment/Disposal	Offsite disposal/treatment	Transportation to offsite treatment/ disposal facility.	Pretreatment of groundwater would be required.
		Pretreatment/offsite disposal	Onsite pretreatment prior to offsite treatment/disposal at POTW.	Potentially applicable; to be evaluated in Section 3.
		Onsite treatment, discharge to groundwater	Onsite treatment with discharge to the groundwater system.	Potentially applicable; to be evaluated in Section 3.
		Onsite treatment, discharge to surface water	Onsite treatment with discharge to adjacent surface waters.	Potentially applicable; to be evaluated in Section 3.
		Air Sparging	Injection of air into the groundwater to drive off VOCs in conjunction with a soil vapor extraction system.	Applicable to VOCs in soil/waste below the water table.

[hatched box] - Technologies that are screened out due to technical implementability.

[shaded box] - Technologies that are screened out due to effectiveness, implementability and cost.

3.2.2 Groundwater Flow Calculations

An analytical groundwater flow model was used to estimate the flow rates leaving the site under existing conditions, as well as potential collection rates after landfill capping. The two potential groundwater collection trenches under consideration include: 1) a localized downgradient collection trench in the vicinity of MW-01; and 2) a downgradient collection trench along the eastern and northern perimeters of the landfill between MW-01 and MW-02. The existing conditions scenario was investigated by analyzing the surface of the water table measured during the RI. It was observed that two areas can be distinguished beneath the landfill. The eastern portion of the site appears to drain to the east, while the flow direction over the remaining portion of the landfill is primarily to the north and northeast. The two are separated by a ridge (high) in the groundwater table. The only apparent source of water in the eastern portion appears to be infiltration. The remaining portion of the site receives inflow from the region upgradient of the landfill.

Existing Conditions

Flow rates to the north and northeast were estimated by using the observed average gradient across the western portion of the site. This value has been estimated at 0.013 based on RI data. The hydraulic conductivity of the sandy deposits under the western portion of the landfill, based on the results of the RI, are between 1×10^{-3} to 1×10^{-2} cm/s. Using the average thickness of the aquifer of 60 feet, and the width perpendicular to the flow direction of 500 feet, the total flow to the north and northeast through the water table aquifer has been estimated to be between 6 to 60 gpm.

Flow rates to the east were estimated by considering infiltration over the area between the ridge in the groundwater table and the eastern boundary of the site. The average annual infiltration for the existing conditions has been estimated to be 7 to 10 inches per year (see Section 3.2.1). The area of the site east of the ridge in the groundwater table is approximately 6 acres. Thus, the total flow rate to the east under existing conditions through the water table aquifer has been estimated at 2 to 3 gpm.

Capped Conditions

After a cap is constructed, infiltration would be reduced to between 0.03 to 1.5 in/yr for a Part 360 cap, or to between 0.0003 to 0.0004 in/yr for a double barrier cap.

It was anticipated that a cap would not change the flow regime in the western portion of the site. The permeable deposits identified in the western portion appear to receive significant inflow from upgradient regions. The decrease in infiltration caused by capping is unlikely to affect that flow pattern. The total flow to the north and northeast passing through the western portion of the site has been estimated at 6 to 60 gpm (Appendix B.3).

Following construction of a cap, flow patterns in the eastern portion of the landfill would change. The groundwater mounding evident beneath the landfill would diminish so that even the seasonally-high water table would be reduced to within the bottom 0.5 feet of waste in the vicinity of boring B-2, and to below the waste over the remainder of the site. There would be a gentle sloping water table in connection with the water table in the western portion of the site. Water levels to the east of the site would be similar to those in eastern monitoring wells outside the landfill perimeter (MW-3S, MW-2S) at approximately 576.1 - 576.5 feet. The mounding in the vicinity of boring B-2, and resulting high water level in MW-01, would reduce to the lower water levels. It is estimated that due to the low permeability of the soil, a time frame of between 2 to 5 years would be required for the water table to reach its lower steady-state condition as calculated in Appendix B.4.

Capping and Groundwater Extraction

Constructing a landfill cap would reduce infiltration through the waste and lower the groundwater table beneath the landfill. Subsequent leaching and offsite migration of contaminants would be reduced, though not eliminated. Active collection of groundwater from the water table aquifer could be considered to further reduce contaminant migration. The location of the collection trench and the rate at which groundwater is collected would dictate the degree to which contaminants are contained. Since the aquifer is approximately 60 feet thick, as determined during the RI, full containment of groundwater is not considered cost-effective for the site.

Therefore, groundwater collection from varying depths of the shallow water table aquifer were considered as discussed in Appendix B.4 and summarized below.

A downgradient perimeter collection trench intercepting flow to the north and northeast would be designed to capture only the flow taking place through the shallow portion of the water table aquifer. It was assumed that a third of the total flow would be affected by a trench ten feet into the aquifer, resulting in a maximum collection rate of 20 gpm.

Flow to a localized groundwater collection trench located along the eastern perimeter of the landfill would be through the low permeability deposits making up the eastern portion of the landfill. The high permeability deposits in the western portion of the landfill are assumed to act as a source of water flowing to the east. Using a geomembrane-lined trench, 500 feet in length, and a drawdown maintained in the trench of approximately 3 feet, a flow rate of approximately 0.3-3.2 gallons per minute (gpm) was calculated, and for a drawdown of approximately 10 feet, a flow rate of 0.5-4.9 gpm was estimated.

3.2.3 Contaminant Transport

Following construction of a cap, infiltration would be reduced thereby reducing the leaching of contaminants from the waste. Further, groundwater mounding which is evident during springtime conditions beneath the eastern portion of the landfill, would also diminish. This would reduce the potential for contaminant flushing during high water table conditions. It is anticipated that due to the low permeability of soils present in the eastern portion of the site, it would take between 2 to 5 years for the water levels in the landfill to reach steady-state levels. Levels in the western portion of the site are not anticipated to change following capping.

An analysis was performed to estimate the cleanup time frames required if, following capping a localized groundwater collection system was installed along the eastern portion of the landfill. (It should be noted that a collection system in the more permeable soils to the north and northeast would take significantly less time than that estimated for a collection trench in the east to achieve cleanup goals, therefore this calculation was not performed.)

Groundwater at the site has been identified to be contaminated with volatile organic compounds (VOCs). The feasibility of lowering the concentrations of VOCs to cleanup levels (SCGs identified in Section 3.4.1.1) was examined using a completely mixed reactor model as presented in Appendix B.4. The remedial measures used in modeling were: decrease in infiltration through capping, extraction of groundwater, and remediation of the unsaturated soils. The model assumes that the contaminants are evenly distributed throughout the eastern portion of the landfill (modeled region). The change in the mass of each contaminant within that region is determined by the loading of contaminant entering the system (via inflowing groundwater and contaminated infiltration), the amount leaving the system with groundwater, and the rate at which the contaminant is destroyed by various decay processes. Also, the model assumes that each contaminant is distributed between the dissolved phase (in groundwater) and the solid phase (in saturated soils). An assumption was made that there are no additional sources of contaminants within the modeled region, such as pools of non-aqueous phase liquids (NAPLs). It was also assumed that the distribution is linear and that the quantities of contaminants in water and in soil are in equilibrium.

The concentration of a chemical in groundwater, evaluated using the above model, depends on a number of factors. The steady-state value is a function of the contaminant loading, as well as its distribution coefficient and decay properties. The time-dependent concentration is also influenced by the initial mass of the contaminant present in the system. In order to provide a reasonably conservative estimate of the process, an indicator chemical was selected that would be the most persistent of all the compounds detected in the onsite groundwater. That compound was 1,1-dichloroethane (1,1-DCA). It was identified as having the highest ratio of detected concentration to cleanup level. Also, as a chlorinated solvent, it is very slow to degrade in natural groundwater systems.

Cleanup time frames were calculated for the eastern portion of the landfill, where the aquifer is made up of low permeability soils which will provide very limited flushing. In the western portion of the site where permeabilities and flushing rates are much higher, natural processes will remediate the aquifer more rapidly.

It was determined that the volume of contaminated water in the eastern portion of the site is approximately 15,000,000 gallons. The flow rate through this volume under existing conditions was estimated at approximately 1 gpm. The resulting hydraulic retention time (time required for one flush through the system) is estimated to be 35 years. Using a half life of 25 years, for 1,1-DCA and the representative design concentration of 1,1-DCA in groundwater of 109 ppb (as discussed in Section 3.3.1), a loading from infiltration was calculated to be 3×10^{-5} g/m^3-day. Referring to Table 3-1, if this loading is decreased in proportion to the reduction in infiltration after capping, the resulting steady-state concentration of 1,1-DCA in groundwater would range from 0.005 to approximately 20 ppb, compared to the SCG of 5 ppb. Therefore, all landfill cap options except a medium quality Part 360 cap would eventually result in remediation of 1,1-DCA to a concentration below SCGs immediately downgradient of the landfill. The time to reach the steady-state concentrations is estimated to be on the order of 80 years for a medium quality Part 360 cap, or 100 years for a double barrier or high quality Part 360 caps due to the reduced leaching of contaminants.

To reduce the steady-state concentration to below the SCG for 1,1-DCA, with a medium quality Part 360 cap, the hydraulic retention time would have to be reduced to less than 3 years using a pumping rate of approximately 10 gpm. However, such a high rate would be difficult to attain in the low permeability deposits of the eastern portion of the site. It would require a very high number of extraction wells, or a significant lowering of the water table along the eastern boundary. If the actual hydraulic conductivities of the aquifer are closer to the lower end of the measured range, such a rate may not be feasible.

In the next step of the analysis, a system was evaluated assuming that contaminant loading into the aquifer was eliminated. This could be accomplished for example by soil vapor extraction of the unsaturated soils (without air sparging). If the unsaturated zone is effectively remediated, infiltration reaching the aquifer would no longer contain contaminants i.e., the loading into the system is zero. For this scenario it was determined that the cleanup time would be approximately 80 years. This time frame could be decreased by extracting more water from the plume. For example, to achieve cleanup in 10 years, an extraction rate of 30 gpm would be required; however, as mentioned previously, high pumping rates may not be feasible in the low permeability soils present in the eastern portion of the site.

By combining air sparging, which releases VOCs from the saturated zone, with soil vapor extraction, the time required to remediate the site for VOCs would be reduced to the implementation time of the in-situ treatment, anticipated to be 3 years, if the treatment, technologies were fully effective.

Potential Future Receptor Evaluation

Results of the analysis presented above indicate that concentrations of 1,1-DCA, a persistent contaminant with the highest ratio of detected concentration to cleanup level, could potentially continue to leach from the landfill wastes and exist in groundwater at concentrations in excess of the SCG immediately downgradient of the landfill, depending on the type and quality of cap constructed over the landfill. An evaluation was performed to determine what the concentration would be, and whether SCGs are attainable at a nearest potential downgradient receptor. At present, the closest existing downgradient residential water well, which is in the bedrock, is approximately 2,000 feet from the edge of the landfill. A potential future groundwater receptor was considered, such as an individual who installs a potable water well on the east side of the existing wetland off of Reagan Road in the shallow water table aquifer. Under existing conditions, over the approximate 1,000-foot distance from the landfill to this potential future groundwater receptor, the concentration of 1,1-DCA decreases from the design concentration of 109 ppb to between approximately 0.1-6 ppb, as calculated in Appendix B.5. This projected concentration range is essentially below the SCG value of 5 ppb. After the landfill is capped, the concentration would continue to decrease.

Cap Recommendation

A Part 360 or a double barrier landfill cap would be protective of human health and the environment and result in lowering the water table such that all waste, except in a localized area near boring location B-2, would be above the water table. This lowering of the water table and reduction in infiltration would improve the groundwater quality downgradient of the landfill. A double barrier or a high quality Part 360 cap is expected to reduce contaminant concentrations immediately downgradient to below SCGs over the long term (approximately 120 years). A medium quality Part 360 cap is expected to reduce contaminant concentrations below SCGs at the nearest future downgradient groundwater receptor (approximately 100 years). Depending on the quality of Part 360 cap constructed, anticipated to be between a medium and high quality based upon typical QA/QC requirements, the 5 ppb SCG can be attained immediately downgradient of the landfill. Given the limited incremental effectiveness, and the time frames involved, the more difficult implementation required for the double barrier cap and the additional cost of a double barrier cap, a Part 360 landfill cap is recommended for implementation.

3.3 Engineering Analysis of Groundwater Treatment/Disposal Options

Groundwater treatment system design requirements depend on the water flow rate, influent chemical concentrations, and discharge criteria. This section includes an evaluation of treatment requirements based on these three factors.

3.3.1 Flow Rates and Chemical Characteristics

Groundwater modeling results discussed in Section 3.2.2 were used to estimate groundwater collection rates for a localized groundwater collection trench along the eastern side of the landfill, and for a downgradient perimeter groundwater collection trench along the north and eastern sides of the landfill. Results were used to calculate design flow rates and operational requirements for treatment systems.

Design Concentrations

Groundwater flowing from the landfill through the shallow portion of the water table aquifer contains volatile organic and inorganic compounds. Data on compounds detected was presented in the RI and is summarized in Table 3-2. The groundwater monitoring well samples considered to represent the quality of water flowing away from the landfill through the shallow portion of the water table aquifer are from the following wells: MW-1S, -2S, -3S, -01, and -02. All the sample analytical results collected from these shallow wells, during both the first and second rounds of RI sampling, as well as the split samples, were used in calculating the average detected concentrations of contaminants.

The Spring 1994 groundwater sample from MW-01 contained most of the organic contaminants at the highest detected concentrations. Low molecular weight chlorinated aliphatic hydrocarbons (e.g., vinyl chloride, chloroethane, 1,1-dichloroethane), ketones (e.g., acetone, 2-butanone, 4-methyl-2-pentanone), and one-ring aromatic hydrocarbons (i.e., toluene, xylenes, ethylbenzene and styrene) were the organic contaminants detected. Additionally, antimony, lead, iron, magnesium, and manganese were detected in these wells at concentrations higher than the groundwater quality standards. Groundwater samples were also analyzed for indicator parameters including Total Dissolved Solids (TDS), phenols and sulfides which were detected above the groundwater quality standards in several samples.

In calculating the landfill-wide average concentrations of contaminants detected in the shallow groundwater, half the contract required quantitation limit was used as the compound concentration for samples where the compound was not detected. This conservative method of calculating average concentrations results in a higher average than the maximum detected concentration for compounds detected at relatively low concentrations in a few samples (i.e., methylene chloride, tetrachloroethene, beryllium, cobalt, silver, and vanadium). The average and maximum concentrations for each detected compound are shown in Table 3-2. The design concentration for each compound or parameter used for treatment system evaluation was assumed to be equal to the maximum concentration detected in the groundwater samples, or four times the average, whichever was less. This approach provides a conservative yet realistic basis for system sizing and cost estimating.

3.3.2 Treatment and Discharge to Surface Water

The collected water could be treated and then discharged to surface waters of the adjacent wetlands. Surface water criteria for Class C (T) waters were considered when determining the appropriate treatment scheme. A dilution factor was not used with these criteria to estimate required effluent limitations. The estimated criteria for discharge to surface water are shown in Table 3-2. Organic contaminants are assumed to be attributable to the landfill, however inorganic chemicals exist naturally at relatively high concentrations. Therefore, inorganic contaminants that exceed the surface water discharge criteria were subsequently compared to the MW-4S background groundwater sample results. Contaminants that exceeded both the surface water discharge criteria and also the background shallow groundwater detections are the ones dictating necessary treatment. Design concentrations of tetrachloroethene, total of organic chemicals, aluminum, cobalt, iron, cadmium, selenium, TDS, and sulfide exceeded the criteria.

Sulfide and TDS are also present in the wetlands, based on the surface water analytical results presented in the RI. This suggests anaerobic bacterial activity is occurring in the wetlands. Concentrations of these parameters in the groundwater are expected to be reduced during metals precipitation. Sulfide reacts with metals and precipitates at high pHs as metal sulfides. The pH of the effluent is expected to be monitored and maintained above 7, so that hydrogen sulfide will not predominate. (Hydrogen sulfide is the only sulfide form that is regulated for surface waters.) Therefore, treatment for removal of sulfides and TDS was not considered. Should groundwater collection and treatment be included in the recommended remedial alternative for the site, the need for additional groundwater treatment will be assessed during the Design Phase.

Based on contaminant exceedances, a groundwater treatment system was developed and is shown on Figure 3-2. Estimated groundwater extraction rates presented in Section 3.2.2 were used to determine the required treatment capacity for the two groundwater collection and treatment scenarios. Based on an estimated influent flow rate of 20 gpm for collection from the downgradient perimeter of the landfill, a design operating capacity of 60 gpm was determined. This operating rate assumes continuous groundwater collection 24 hours a day; however, the treatment facility would operate on a 16-hour per day, 5 days per week basis, thereby minimizing operation and maintenance costs (e.g., labor, power). For localized collection and treatment, an extraction rate of between 0.5 to 4.9 gpm was calculated. An in-between estimate of 3 gpm was used as the approximate collection rate from the localized collector. With a flow rate of 3 gpm, the design operating capacity was estimated to be 15 gpm, based on an 8-hour per day, 5 days per week basis. A 30 percent increase of the influent rate was incorporated in the design capacity of each treatment system to account for such factors as rainwater collection in the treatment facility, recycle streams, dilution allowances for lime/polymer solutions, and downtime for routine and preventive maintenance.

The treatment system shown on Figure 3-2 includes metals and organics removal. Collected groundwater would be stored onsite in an equalization/storage tank during non-operating hours. When the system is operational, water would be pumped to a mixing tank where metals would be precipitated by adjusting the pH with caustic or lime to a point where the metals to be removed have their lowest solubility. Flocculant would be added and the water would next pass through a clarifier to separate the resultant sludge from the water stream. The sludge would subsequently be dewatered in a filter press and the filter cake would be disposed of offsite at an approved facility. Following the clarifier, the water would pass through an air stripper where the volatile organics would be removed. A high air to water ratio would be necessary because some volatile organics (i.e., ketones like acetone and 2-butanone) are not considered readily strippable. The pH of the treated water would be adjusted before discharge.

Vapor phase carbon adsorption might be required to treat off-gas from the air stripper prior to its discharge to the atmosphere. Based on 100 percent transfer of contaminants from the water to the gas phase, a vapor-phase carbon adsorption control, or its equivalent, would be required in order to reduce the level of contaminants emitted to the atmosphere to below air standards. Off-gas treatment requirements would be established during the permitting phase of project design; however, it was conservatively assumed that such treatment (e.g., vapor phase carbon adsorption) would be required, and is included in the above treatment scheme.

The treatment processes proposed represent conventional and accepted methods for treatment of contaminated water. Groundwater samples would be analyzed periodically to monitor water quality and to evaluate when cleanup goals have been achieved.

3.3.3 Treatment and Discharge to Groundwater

Under this option, the collected groundwater would be treated to meet groundwater quality standards prior to reinjection. As can be seen in Table 3-2, detected contaminants that exceed groundwater quality standards are volatile organic compounds, metals, TDS and sulfide. Organic contaminants are assumed to be attributable to the landfill; however inorganic contaminants that exceed the groundwater quality standards but do not exceed their respective background concentration in monitoring well MW-4S are not considered to be attributable to the landfill and thus do not require treatment.

The appropriate groundwater treatment scheme would be identical to the one described in Section 3.3.2 for treatment and discharge to surface water; however, a higher degree of removal for most contaminants would be required. The reinjection of treated groundwater is associated with some risk of introducing residual contamination to the potable water source. Other disadvantages include potential clogging of the reinjection wells and a larger volume of residuals (e.g., sludge, spent carbon) requiring off-site disposal. Based on this evaluation, treatment and discharge to groundwater has been eliminated from further consideration.

3.3.4 Pretreatment and Disposal at POTW

The North East Landfill is located in a sparsely populated rural area and the surrounding communities do not have sewer systems. The Publicly Owned Treatment Works (POTW) facilities closest to the site within New York State are in Pawling, Poughkeepsie, or Beacon, and are located 20 to 60 miles away. The cost of implementing this discharge option would be extremely high due to transportation costs, POTW fees, and potential pretreatment requirements. Therefore, pretreatment and disposal at a POTW will not be considered further.

3.3.5 Recommendations

Treatment and discharge to the adjacent surface water is the recommended option for groundwater treatment/disposal to be included in the development of alternatives. Detailed cost estimates for this option are presented in Section 4.0.

3.4 Standards, Criteria, and Guidance (SCGs)

In New York State, a remedial program is governed by the regulations in 6 NYCRR Part 375, which are analogous to the federal National Contingency Plan (NCP) (40 CFR 300) which requires that the selection of remedial actions meet applicable or relevant and appropriate requirements (ARARs) of state and federal environmental laws and regulations. In New York

State the remedial program for an inactive hazardous waste disposal site must be designed to conform to standards and criteria that are consistently applied and officially promulgated, and to standards and criteria that are either: (1) directly applicable, or (2) relevant and appropriate to the site conditions. A site's remedial program also should be designed with consideration given to state and federal guidance determined to be applicable on a case-specific basis. Standards, criteria, and guidance (SCGs) are state requirements and those federal requirements which are more stringent than state requirements.

SCGs are divided into the following categories, which may overlap;

- chemical-specific (i.e., govern the extent of site remediation);
- location specific (i.e., protect existing natural and cultural features that may be affected by the site); and
- action specific (i.e., govern implementation of the remedial alternative).

As part of the detailed analysis of alternatives, each remedial alternative is evaluated with respect to compliance with the chemical-, location-, and action-specific SCGs discussed in the following subsections. This review will highlight site-specific regulatory conditions that might either limit the choice of alternatives or place limits on contaminant concentrations after remediation.

3.4.1 Chemical-Specific SCGs

Chemical-specific SCGs are health- or risk-based standards that limit the acceptable concentration of a chemical found in or discharged to the environment. These are generally numerical values established for a single chemical or group of closely-related chemicals. They govern the extent of site remediation by providing either actual clean-up levels, or the basis for calculating such levels. Chemical-specific SCGs also may be used to indicate acceptable levels of discharges or emissions. Chemical-specific SCG values for each media at the North East Landfill were presented in the RI report and are summarized below.

3.4.1.1 Groundwater

New York State regulates groundwater quality primarily through numerical standards and guidance values established by the NYSDEC and the New York State Department of Health (NYSDOH). These values have been consolidated into one NYSDEC guidance document, the Division of Water's Technical and Operational Guidance Series (TOGS) 1.1.1, "Ambient Water Quality Standards and Guidance Values," October 1993. There is little practical difference between standards and guidance values since the procedures for determining these values are the same for each, and the state has the authority to enforce guidance values where there are no promulgated standards (6 NYCRR 701.15(d)).

The following are SCGs for groundwater.

NYSDEC Groundwater Classification, Quality Standards, and Groundwater Effluent Standards (6 NYCRR Chapters 701 and 703) - The NYSDEC has promulgated a groundwater classification system and groundwater quality standards for each class of groundwater, and maximum allowable concentrations have been established for discharges to groundwater. The analytical results of groundwater samples indicate that the groundwater at the landfill is classified as GA, or suitable as a source of fresh potable water. Therefore, ambient groundwater quality standards established by the NYSDEC are applicable to the site.

NYSDOH Drinking Water Supplies (10 NYCRR Chapter 5, Subpart 5-1) - Groundwater at the landfill is classified as a source of potable water. The NYSDOH regulates public water supplies in New York State. These regulations include a program similar to that of the federal Safe Drinking Water Act (SDWA), which established Maximum Contaminant Levels (MCLs) for public drinking water supplies. Therefore these are relevant and appropriate to this site.

National Primary Drinking Water Regulations (40 CFR 141) - SDWA MCLs for primary and secondary contaminants are applicable to aquifers and related groundwater used as a potable water supply source. The MCLs are legally enforceable federal drinking water standards and are relevant and appropriate to this site because groundwater is considered a water supply source. Maximum Contaminant Level Goals (MCLGs) are nonenforceable health-based goals used in cases in which multiple contaminants or pathways of exposure present extraordinary risks to human health. Groundwater in the vicinity of the landfill currently is used as a potable water supply; however, there are not extraordinary risks present. Therefore, MCLGs are not considered SCGs.

3.4.1.2 Surface Water

NYSDEC Surface Water Classifications, Derivation and Use of Standards and Guidance Values, and Surface Water Quality Standards (6 NYCRR Parts 701 through 703) - NYSDEC promulgated a surface water classification system (Sections 701.2 through 701.9) and surface water quality standards for each class (Part 703).

NYSDEC TOGS 1.1.1 - New York State establishes water quality standards and guidance values for surface water according to classifications based on best usage of the water. According to classifications established for surface waters in the vicinity of the North East Landfill site, which include Webatuck Creek and its tributaries, these are Class C (T) and Class C streams whose best usage is for fishing. The waters must also be suitable for fish propagation and survival, and for primary and secondary contact recreation even though other factors may limit use for those purposes. The tributary flowing north of the site is also a trout (T) stream. The quality of Class C(T) waters is protected by chemical-specific SCGs developed in the NYSDEC TOGS 1.1.1 guidance document and are presented in the RI report. Effluent limitations to these water bodies would be based on these SCGs.

3.4.1.3 Soil

NYSDEC TAGM HWR-92-4046 "Determination of Soil Cleanup Objectives and Cleanup Levels" - New York State has not promulgated standards for soil contaminants other than for hazardous waste characterization. However, this administrative guidance document has been issued by the NYSDEC to establish chemical-specific SCGs for soil cleanup. The guidance values for organic contaminants in the unsaturated zone are determined through the use of the partition theory model and a correction factor to account for mechanisms preventing the contamination from entering groundwater. These chemical-specific SCGs developed for soil are based on the assumption that one factor in the model equation, Total Organic Carbon (TOC) in the soil, is equal to 1%. Guidance values for metals are based on background levels of natural soils.

3.4.1.4 Sediments

NYSDEC "Technical Guidance for Screening Contaminated Sediments" - No federal or state regulations specify concentration limits for contaminants in sediments. Sediment criteria have been developed in the RI Report in accordance with the November 1993 document provided by the NYSDEC Division of Fish and Wildlife. This document incorporates USEPA's 1991 technical guidance on sediment quality criteria. The guidance presents concentrations of non-polar and phenolic (i.e., relatively insoluble in water) organic compounds in aquatic sediments for four levels of protection, and concentrations of metals for two levels of protection.

3.4.1.5 Air

New York Air Guide - 1, Guidelines for the Control of Toxic Ambient Air Contaminants This guidance from NYSDEC provides guidance values for ambient levels of certain air contaminants. These values are derived from several sources and are indicated as Annual Guideline Concentrations and Short-Term Guideline Concentrations. The values presented in the RI Report were used for a preliminary comparison to soil gas levels determined during the investigation, for comparison to the ambient air sampling results, and for comparison to modeled ambient air concentrations derived from landfill gas emissions sampling.

3.4.1.6 Health-based Criteria

Additional SCGs include USEPA reference doses (RfDs) and reference concentrations (RfCs), and USEPA carcinogen assessment group (CAG) carcinogen potency factors (CPFs). These guidance criteria were used during the preparation of the baseline health risk assessment for the site which was presented in the RI Report.

3.4.2 Location-Specific SCGs

Location-specific requirements pertain to existing natural or cultural features in the vicinity of the site that are protected. These may affect contaminant levels or remedial actions allowed at the site. The following location-specific SCGs were evaluated based on their relevance to the North East Landfill site.

3.4.2.1 Floodplain Protection

National Environmental Policy Act (NEPA) Regulation (40 CFR Part 6) - Appendix A of the NEPA regulations, which sets forth policy for carrying out the Executive Order (E.O.) on Floodplain Management #11988, requires that a remedial alternative impacting a floodplain not be selected unless a determination is made that no other practicable alternative exists. In this case, potential harm must be minimized and action taken to restore and preserve the benefits of the affected floodplain.

NYSDEC Floodplain Management Regulations (6 NYCRR 500- 501) - New York State floodplain management regulations require permits for development within flood hazard areas and specify use of flood control lands. The 100-year and 500-year floodplains adjacent to the site as determined by the Federal Emergency Management Agency in 1984 (FEMA, 1984) are shown on Figure 3-3. As filling operations continued at the landfill past 1984, it is expected that the floodplains shown are not fully representative of existing conditions.

3.4.2.2 Wetlands Protection

National Environmental Policy Act (NEPA) Regulations (40 CFR Part 6) - Appendix A of the NEPA regulations, which sets forth policy for carrying out the Executive Order on Wetlands Protection #11990, requires that a remedial alternative impacting a wetland not be selected unless a determination is made that no other practicable alternative exists. In this case, potential harm must be minimized and action taken to restore and preserve the benefits of the affected wetlands. Freshwater wetlands are known to exist adjacent to the site, therefore, E.O. #11990 is applicable to the remediation.

Fish and Wildlife Coordination Act (16 U.S.C. 661, et seq.) - The Fish and Wildlife Coordination Act requires that U.S. Fish and Wildlife Services, National Marine Fisheries Service, and other related state agencies be consulted before a body of water, including wetlands, is modified (e.g., dredged, filled, or dammed).

NYSDEC Freshwater Wetlands Regulations (6 NYCRR Parts 662 through 665) - NYSDEC governs the preservation, protection, and conservation of freshwater wetlands, as well as the benefits derived therefrom in the State of New York. A permit application must be filed with the regulating authority (i.e., NYSDEC or local government) for activities such as draining, dredging, excavating, mining, dumping, or filling, either directly or indirectly; or erecting structures or roads, driving pilings, placing obstructions to the flow of water, installing sewage systems, or other similar activities that may impinge upon or substantially affect the wetland and/or are located in the wetland or the adjacent area (i.e., within 100 feet of the wetland).

3.4.2.3 Protection of Waters

Section 404 of the Clean Water Act (CWA) (40 CFR 230) - The CWA and its regulations protect the waters of the United States. The CWA prohibits the deposition of dredged or excavated materials to protect aquatic and wetland wildlife habitats. Capping, sediment excavation, groundwater collection and discharge are remedial activities that would be regulated by this program. The Army Corps of Engineers enforces these SCGs through its permit program as specified in 33 CFR 320-330.

New York State Use and Protection of Water (6 NYCRR 608) is the applicable State regulation corresponding to the federal CWA Section 404. Potential disturbances to waters include excavation, placement of fill, and discharges of effluent. The disturbances must be avoided, or adverse impacts must be mitigated through terms and conditions of the joint permitting process between the NYSDEC and the US Army Corps of Engineers.

3.4.2.4 Fish And Wildlife Protection

The Fish and Wildlife Coordination Act (16 USC 661) was enacted to protect fish and wildlife resources when actions result in the control or structural modification of a natural stream or body of water. This act requires federal agencies, such as the US Army Corps of Engineers, involved in actions that will result in the control or structural modification of any natural stream or body of water for any purpose, to take action to protect the fish and wildlife resources which may be affected by the action. The responsible official overseeing or approving the action must consult with the Fish and Wildlife Service and the appropriate state agency to ascertain the means and measures necessary to mitigate, prevent, or compensate for project-related losses of wildlife resources and to enhance the resources. This act is applicable to the site for activities that require Corps approval under Section 404 of the Clean Water Act.

NYS Endangered and Threatened Species of Fish and Wildlife (6 NYCRR 182) and the Federal Endangered Species Act (16 USC 1531) list and protect wildlife species from actions that may threaten their existence. Rare and endangered plant species also are protected in New York State by regulations in 6 NYCRR 193. The species databases with location-specific information are kept by the New York State Natural Heritage Program housed in the NYSDEC. Remedial actions should avoid adverse impacts on critical habitats for endangered and threatened species.

The NYSDEC Natural Heritage Program has identified sightings of the endangered bog turtle in nearby Wetlands MT-22, MT-23, and most significantly, MT-26, which borders the landfill site. The bog turtle is protected by New York State as endangered, and is listed by the federal government as a possible candidate for protection. The Natural Heritage Program has also identified a significant habitat for the endangered bog turtle in the vicinity of the landfill site. An 80-acre sedge meadow community has been identified in nearby Wetland MT-22. The community was identified in 1991 and considered an excellent example of its type based on quality, condition, and viability. Although ecological communities are not generally protected by law or regulation in New York State, as a habitat for an endangered species, this sedge meadow community is protected.

3.4.2.5 Cultural Features

National Historic Preservation Act (NHPA) (16 USC 470) - This federal law protects properties listed on, or eligible for inclusion on, the National Register of Historic Places (NRHP). Archeological finds that are considered eligible for inclusion on the NRHP also are protected by this act. The New York State Historic Preservation Office (SHPO) lists all federal and state protected properties.

Archeological and Historic Preservation Act (16 USC Section 469) - This act provides for the protection of archeological data that might be lost as a result of a federal construction project. This law covers a broader range of resources than the NHPA, but allows for only preservation of the data and not the site itself. The New York SHPO maps archaeologically sensitive areas that require an assessment to avoid adverse impacts.

New York State Parks, Recreation and Historic Preservation Law (Section 14.09) - This Law requires that a determination by the NYS Office of Parks, Recreation and Historic Preservation (SHPO) be made on the impact of a project on properties listed or eligible for listing on the State Register of Historic Places.

SHPO has reviewed information on the landfill and has indicated that the site area lies within the boundaries of the Coleman Station Historic District which is included in the State and National Registers of Historic Places (Appendix C). Therefore, the above statutes are considered applicable with regard to site remediation. Initial discussions with SHPO personnel indicate that the vegetative cover should be congruent with the surrounding area.

3.4.3 Action-Specific SCGs

Action-specific SCGs are technology- or activity-based requirements which determine how remedial actions will be achieved. Action-specific SCGs generally set performance or design standards, controls, or restrictions on particular types of activities. To develop technically feasible alternatives, applicable performance or design standards must be considered during the development and screening of alternatives. Chemical- and location-specific requirements previously discussed in this section also may have activity-based requirements.

Certain action-specific SCGs include permit requirements; however, under the NYSDEC Inactive Hazardous Waste Disposal Site Remedial Program, state and local permits and other administrative requirements are not required for remedial actions conducted entirely on sites being remediated pursuant to an Order on Consent with New York State. Exemptions from permit requirements include approval of or consultation with administrative bodies, documentation, reporting, recordkeeping, and enforcement. However, the substantive requirements of other SCGs, such as health-based, technology-based, or site-specific requirements still must be satisfied.

Potential remedial technologies for the North East Landfill site include a landfill cap, groundwater collection, removal of sediments with placement under the cap, water treatment or pre-treatment and discharge to surface water or groundwater, and air emissions from the cap or treatment technologies. The following summarizes SCGs that would apply to one or more of the remedial technologies.

3.4.3.1 Landfill SCGs

NYSDEC Solid Waste Management Facilities (6 NYCRR 360) - Subchapter 360-2 of these regulations apply to municipal waste landfill closure and post closure. Requirements of 6 NYCRR Part 360 that may be relevant and appropriate include:

- final cover design,
- landfill gas control system,
- perimeter gas collection systems,
- condensate management,
- leachate control,
- groundwater monitoring, and
- post-closure operation and maintenance.

NYSDEC Accelerated Remedial Actions at Class 2, Non-RCRA Regulated Landfills - On February 29, 1992, the NYSDEC Division of Hazardous Waste Remediation issued a Technical and Administrative Guidance Memorandum (TAGM) which allows for the consideration of a final cover designed to 6 NYCRR Part 360 (solid waste) requirements for capping a typical Class 2, non-RCRA regulated landfill which is defined as a landfill that accepted predominantly municipal and commercial waste along with a lesser amount of RCRA waste. Additionally, the TAGM requires that the appropriateness of RCRA final cover standards must be considered in the design of a Part 360 final cover.

3.4.3.2 Hazardous Waste SCGs

The following RCRA treatment, storage, and disposal facility (TSDF) requirements would apply to the disposal of wastes from a water treatment process, or other wastes encountered if identified as RCRA characteristic hazardous wastes.

RCRA Generators (40 CFR Part 262) - Alternatives involving the movement or removal of hazardous waste will trigger RCRA generator requirements. Generators must determine if their waste is hazardous and obtain a USEPA identification number. Hazardous waste transported and disposed of off-site must be properly manifested, packaged, labeled, and marked. Hazardous wastes accumulating onsite for less than 90 days must be placed in appropriate containers or tanks. Holding materials beyond 90 days will trigger RCRA storage facility requirements.

Manifest System, Record Keeping, and Reporting (40 CFR Parts 262, 264) - All RCRA hazardous waste transported offsite must be accompanied by a manifest; requirements for reviewing the manifest system are outlined in 40 CFR Section 264.71. Operating records should be kept on site, including a description and quantification of the hazardous waste treatment process and storage procedures.

RCRA Storage Regulations (40 CFR Part 264) - These regulations apply to specific types of storage methods. These regulations pertain to design, construction, operation, closure, and post closure of the storage facilities.

RCRA Land Disposal Restrictions (40 CFR 268) and NYSDEC Land Disposal Restrictions (6 NYCRR 376) - These regulations will be applicable to the disposal of materials determined to be restricted from land disposal. Restricted wastes and corresponding treatment standards are identified.

NYSDEC Hazardous Waste Management and Facility Regulations (6 NYCRR Parts 370-373) - The NYSDEC regulations governing hazardous waste identification, generation, transportation, and TSDFs parallel the federal RCRA regulations and in some cases are more stringent than the federal counterparts.

NYSDEC is authorized by the USEPA to administer the federal RCRA program except for the Hazardous and Solid Waste Amendments (HSWA). The following list identifies individual chapters of the NYSDEC hazardous waste regulations:

6 NYCRR Chapter 371	Identification and Listing of Hazardous Waste Regulations
6 NYCRR Chapter 372	Hazardous Waste Manifest System Regulations
6 NYCRR Chapter 373-1	Hazardous Waste Treatment, Storage, and Disposal Facility Permitting Requirements
6 NYCRR Chapter 373-3	Interim Status of Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.

3.4.3.3 Transportation SCGs

United States Department of Transportation (USDOT) Rules for Transportation of Hazardous Materials (49 CFR Parts 107, 171.1-172.558) - These regulations outline procedures for packaging, labeling, manifesting, and transporting hazardous materials. These USDOT rules would apply to wastes from water treatment processes if classified as hazardous waste. These wastes would be packaged, manifested, and transported to a licensed off-site disposal facility.

NYSDEC Waste Transporter Permits (6 NYCRR Part 364) - The waste transporter permit requirements would apply to any activities at the landfill that include offsite transportation of regulated wastes for treatment or disposal. Transporters are required to have a form of surety/insurance for the transport of waste.

New York State Hazardous Waste Transporter Regulations (NYCRR Part 372) - These regulations will be applicable for remedial activities that involve the transport by the landfill owners and operators of materials determined to be hazardous waste. They include:

- 372.3 Hazardous Waste Manifest System and Related Standards for Transporters, establishes permitting, manifesting, recordkeeping, discharge response, and financial requirements for transporters of hazardous waste.

- 372.7 Hazardous Waste Bulk Shipments by Water may be applicable to barges used to transport hazardous wastes off site. This regulation gives additional requirements including the use of shipping papers in conjunction with hazardous waste manifests.

3.4.3.4 Air Emissions SCGs

Remedial alternatives include collection of landfill gas emissions, and may include intrusive construction activities that cause air emissions of toxic contaminants or particulates. SCGs for air emissions are identified in the following paragraphs.

USEPA Air Regulations for Solid Waste Landfills 40 CFR 60 Subpart WWW - USEPA has proposed rules and guidelines for the control of existing municipal solid waste landfills. The proposed standards and guidelines would require landfills emitting greater than 167 tons/year of non-methane VOCs to design and install gas collection systems with subsequent combustion of captured landfill gases. Emissions from the North East Landfill are anticipated to be well below this level, therefore these regulations are not applicable for this site.

Clean Air Act (40 CFR Part 50) - Site remediation activities must comply with applicable National Ambient Air Quality Standards (NAAQS). In order to determine attainment of the primary and secondary standards, particulate matter should be measured in the ambient air as

PM_{10} (particles with an aerodynamic diameter less than or equal to a nominal 10 micrometers). The PM_{10} standard in 40 CFR 50.6 for a 24-hour period is 150 micrograms per cubic meter ($\mu g/m^3$) of air, not to be exceeded more than once a year. The PM_{10} standard for the annual arithmetic mean is 50 $\mu g/m^3$. The PM_{10} standard is based on the detrimental effects of such particles on the lungs. Activities such as excavation will need to comply with the PM_{10} standard.

Resource Conservation and Recovery Act (RCRA) (40 CFR Parts 264 and 265, Subparts AA and BB) - These federal regulations apply to treatment, storage, and disposal facilities, but may be relevant and appropriate to the air emissions from this site. Process vents in operations managing hazardous waste with organic concentrations of at least 10 parts per million by weight (ppmw) must reduce total organic emissions to below 1.4 kg/hour (3 lb/hour) and 2,800 kg/year (3.1 tons/yr), or reduce total organic emissions by 95 percent by weight.

NYSDEC Ambient Air Quality Standards (6 NYCRR Parts 256, 257) - The NYSDEC Ambient Air Quality Standards potentially are applicable to construction activities involving air emissions. Part 256 identifies the classification levels. Subpart 257-3 establishes standards for settleable and suspended particulates. Settleable particulates or dustfalls are normally above 10 microns in diameter, and suspended particulates are below 10 microns in diameter. The classification and standards most likely applicable to remedial actions at the landfill (a Level II land use area - predominantly single and two family residences, small farms) is the standard for suspended particulates. The requirements include 24-hour (250 $\mu g/m^3$), 30-day (100 $\mu g/m^3$), 60-day (85 $\mu g/m^3$), 90-day (80 $\mu g/m^3$), and annual (55 $\mu g/m^3$) standards.

NYSDEC Division of Air Resources Regulations and General Process Emission Sources (6 NYCRR 200 and 212) - Part 200 prohibits emissions of air contaminants that exceed air quality standards or cause air pollution. In establishing emission standards, the NYSDEC considers all promulgated contaminant standards, as well as levels developed under Air Guide-1, noted below. Depending on the environmental rating of the source, specified emission controls are required. Substantive portions of these regulations may apply to landfill vents.

New York State Air Guide-1, Guidelines for the Control of Toxic Ambient Air Contaminants - This guideline is an SCG for emissions control. It is a screening mechanism to evaluate whether or not permits should be issued and the degree of emission control required for all applications and permits reviewed under 6 NYCRR 212. This guideline also is used to establish whether or not other air contaminant sources are exceeding ambient air quality standards. An acceptable ambient level has been developed for toxic air contaminants which are classified as either high, moderate, or low toxicity. The NYSDEC is empowered to apply and enforce guidance values where there is no promulgated standard.

3.4.3.5 Water Effluent SCGs

NYSDEC Water Quality Regulations for Surface Waters and Groundwaters (6 NYCRR Parts 700-705) - Water quality-based effluent limitations are calculated using ambient water quality standards and guidance values as provided.

Underground Injection Control Program (40 CFR 144, 146, 147, and 1000) - These regulations outline minimum program and performance standards for underground injection programs. Technical criteria and standards for siting, operation and maintenance, and reporting and recordkeeping as required for permitting are set forth in Part 146. This requirement would potentially apply to alternatives that include subsurface injection of treated water.

NYSDEC Technical and Operational Guidance 2.1.2 - Underground Injection/ Recirculation (UIR) at Groundwater Remediation Sites - This document provides guidance on the applicability of SPDES permits and groundwater effluent standards to the use of UIR as a remediation measure. The guidance states that an SPDES permit is required if either of the following conditions is not met: (1) the area where injection is taking place is hydraulically contained, or (2) the site is being remediated pursuant to an order, which incorporates substantive requirements of an SPDES permit. Injected water must meet groundwater discharge standards of Section 703.6 unless (1) injection is into a contained area, (2) there is no net increase in the concentration of any chemical pollutant in the discharge prior to injection, and (3) the remedial plan for the site includes groundwater monitoring to ensure that no degradation of groundwater quality will result.

NYSDEC State Pollution Discharge Elimination System (SPDES) (6 NYCRR Parts 750-756) - The NYSDEC SPDES permit program is authorized by the federal National Pollution

Discharge Elimination System (NPDES) program under the Clean Water Act. Discharge of pollutants from point sources to waters of the state is prohibited without a valid SPDES permit. New York State administers the program and issues SPDES permits.

Any discharges into offsite waters of the United States would require a SPDES permit. Under Part 754, Provision of the SPDES Permits, federal NPDES regulations in 40 CFR Parts 120, 125, 129, 133, and 400 through 460 are referenced in addition to specified effluent limitations and schedules of compliance. Under Part 756, the NYSDEC may impose monitoring, recordkeeping, and reporting requirements on SPDES-permitted discharges. Treatment standards for discharges generally are determined by the state on a case-by-case basis. Factors influencing the treatment standards include the composition and volume of the discharge, the classification of the receiving water body or groundwater, and the treatment technologies currently available. Discharges to surface and groundwater are prohibited from degrading the ambient water quality and classification.

USEPA Stormwater Discharges (40 CFR 122.26) - The NYSDEC SPDES program also administers the stormwater discharge limitations associated with industrial activity including construction. A Notice of Intent may be required prior to landfill cap construction for stormwater discharges into adjacent surface waters.

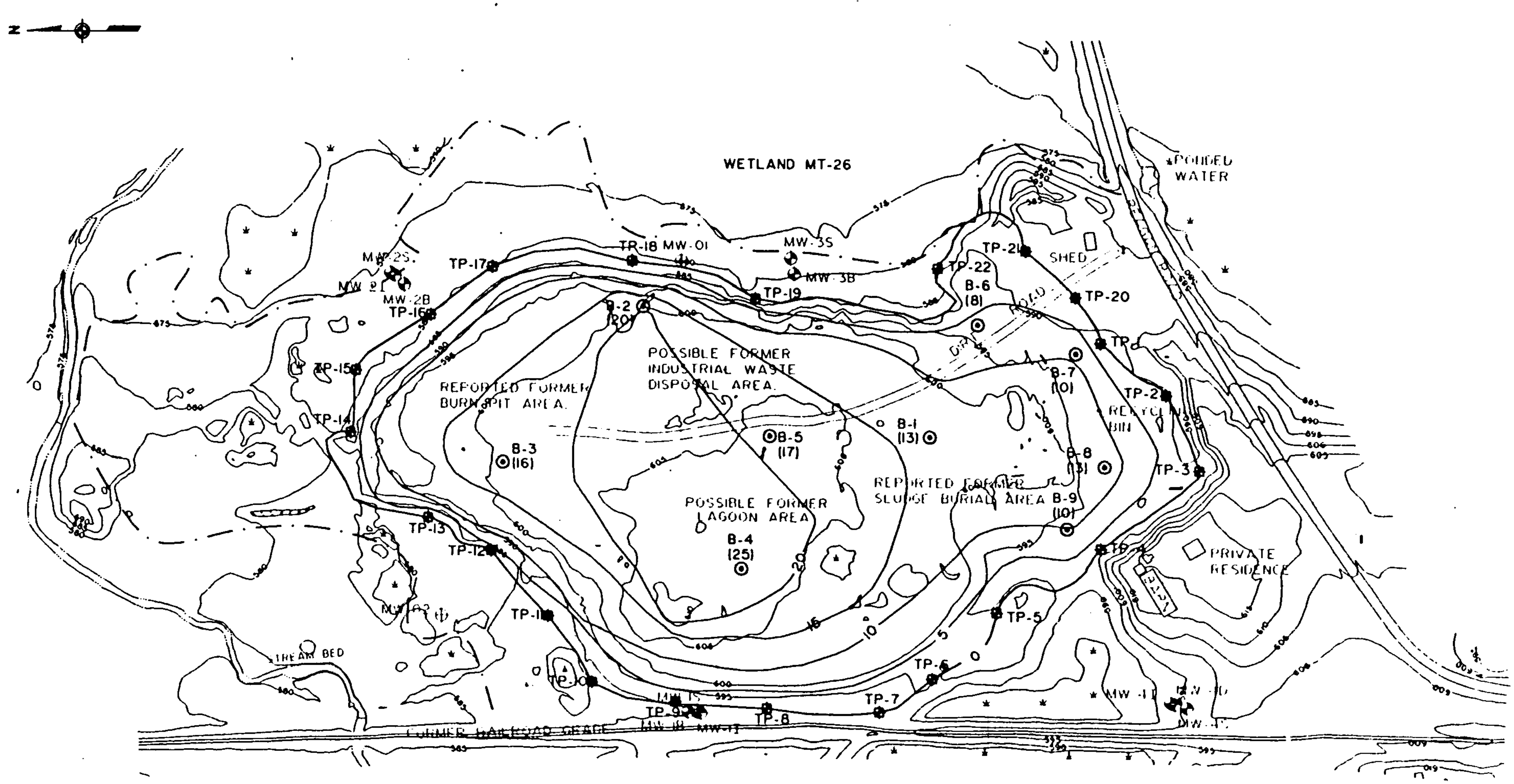
USEPA Publicly-Owned Treatment Works (POTW) Pretreatment Standards (40 CFR 403.5) - Remedial activities may include discharge of collected water to a POTW. The pretreatment rules are general in nature, as each individual POTW, which functions as the Control Authority, has the primary authority to regulate wastewater it receives with only general guidance from the USEPA. New York State has provided general and specific standards for POTWs under Title 15 Chapter 19 - Use of Public Sewers, that would establish discharge limits for remedial activities that include the discharge of collected water from the landfill to the POTW.

3.4.3.6 Health and Safety

Occupational Safety and Health Administration Regulations (29 CFR Parts 1904, 1910, and 1916) - Federal Occupational Safety and Health Administration requirements regulating worker safety and employee records must be followed during all site work. These regulations include health and safety standards for federal service contracts, recordkeeping and reporting, and requirements such as safety equipment and procedures to be followed during site remediation.

3.4.3.7 Local Requirements

Local requirements for construction activities will be determined prior to implementation of the remedial alternative. Requirements, such as obtaining construction permits, will be met.



NOTES

1. BASE MAPPING WAS PREPARED BY AIR SURVEY CORP., RESTON, VA. USING AERIAL PHOTOGRAPHY TAKEN APRIL 14, 1993. GROUND CONTROL WAS BY URS.
2. PROJECT VERTICAL CONTROL IS BASED UPON NATIONAL GEODETIC VERTICAL DATUM OF 1929 AS ESTABLISHED ON USGS MONUMENT "ALBANY 573" ELEV. 575.540.

LEGEND

- ⊙ RI PIEZOMETER (1993) OR BORING (1994)
- TEST PIT LOCATION
- (20) FILL THICKNESS (FT)
- NYSDEC PHASE II MONITORING WELL (1984)
- RI MONITORING WELL (1993)
- — · — WETLANDS BOUNDARY

150 0 150
SCALE IN FEET

NORTH EAST LANDFILL
FILL THICKNESS MAP

URS CONSULTANTS, INC.

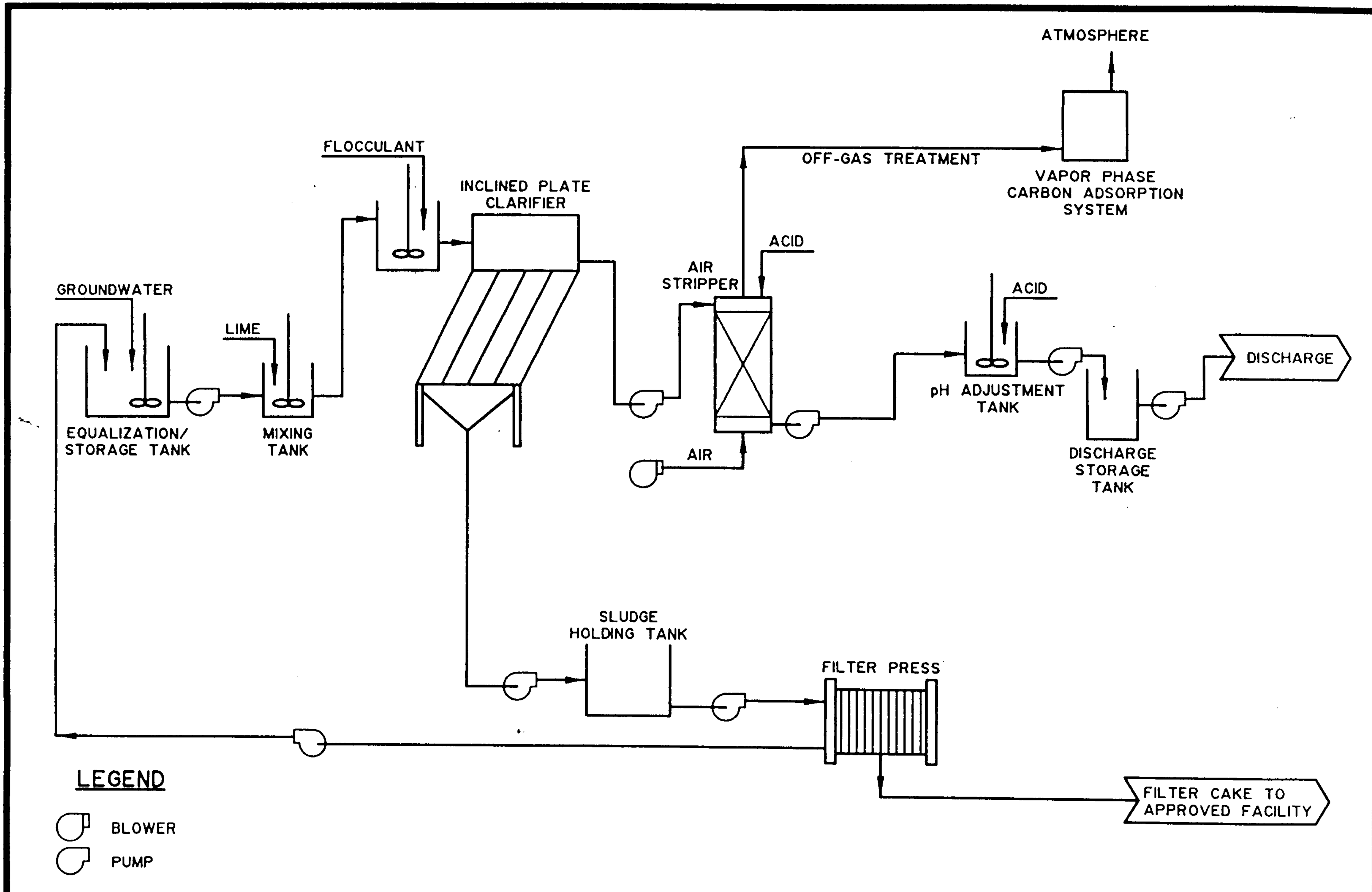
FIGURE 3-1

35319.40 1=150 5/9/95-9 ELB

CC-27875

AC-6570

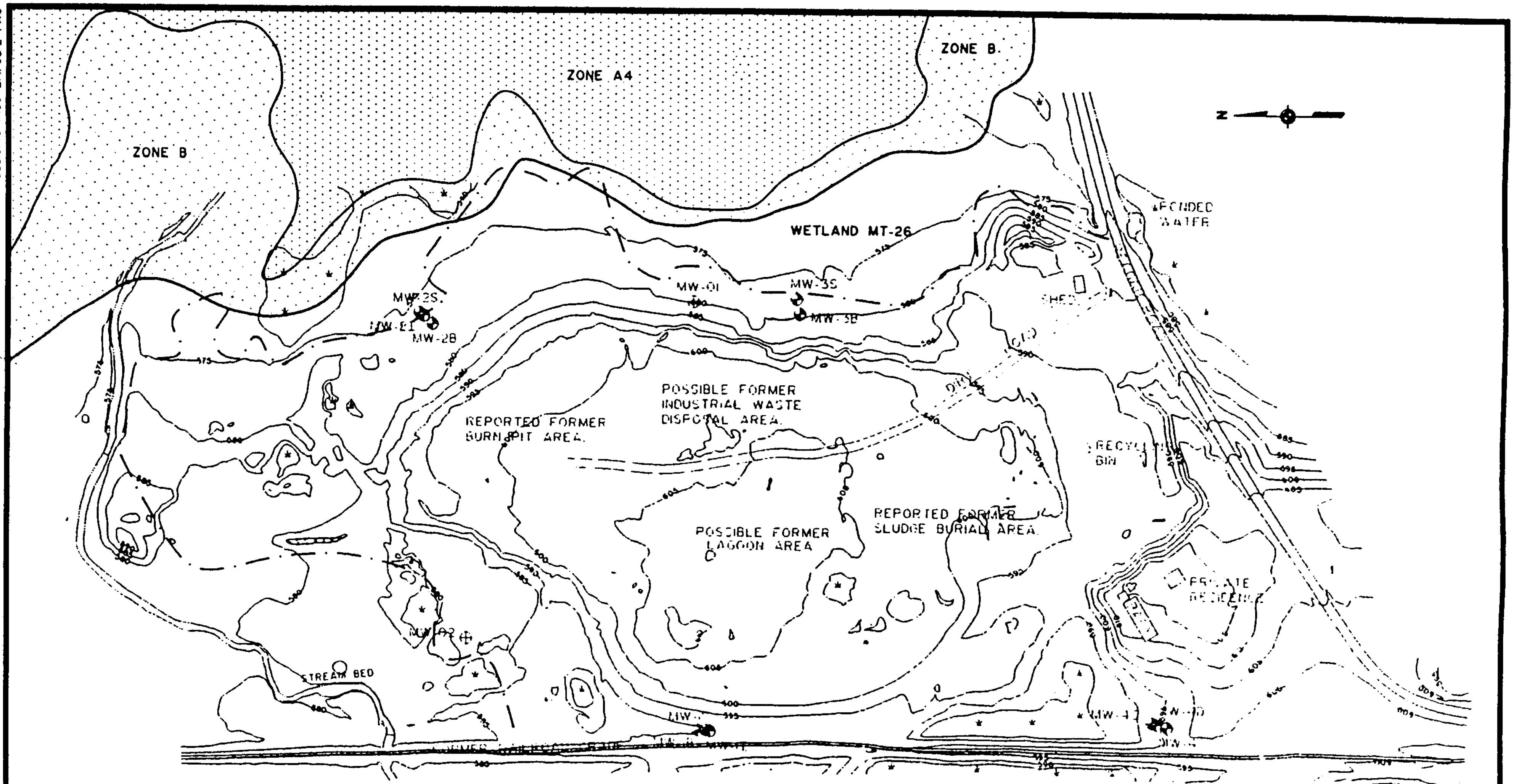
0535319.40\ 1=1 1/11/95-3 MAB



URS CONSULTANTS, INC.

GROUNDWATER TREATMENT SYSTEM

FIGURE 3-2



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3. SOURCE FEMA, 1984

LEGEND

- ZONE A-4 100 YEAR FLOOD AREA
- ZONE B 500 YEAR FLOOD AREA
- NYSDEC PHASE II MONITORING WELL (1984)
- RI MONITORING WELL (1993)
- WETLANDS BOUNDARY

150 0 150
SCALE IN FEET

NORTH EAST LANDFILL FLOODPLAIN LOCATION MAP

URS CONSULTANTS, INC.

FIGURE 3-3

3539.40 1:150 2/1/95-2 FAO

CC-3266

TABLE 3-1

INFILTRATION AND 1,1-DCA MIGRATION ANALYSIS RESULTS

Component	Existing Conditions	Double Barrier Cap	Part 360 Cap Medium Quality Cap Construction	Part 360 Cap High Quality Cap Construction
Precipitation (in./yr.)	33.2	33.2	33.2	33.2
Runoff (in./yr.)	0.0	0.1	0.1	0.1
Evapotranspiration (in./yr.)	23.4-26.7	23.4	24.5	23.5
Lateral drainage (in./yr.)	0.0	9.8	8.0	9.6
Infiltration to groundwater (in./yr.)	7-10	0.0003 - 0.0004	1.5	0.03
Concentration of 1,1-DCA (ppb)	109	0.005	20	0.5

TABLE 3-2 (cont'd)
NORTH EAST LANDFILL
DESIGN CONCENTRATIONS FOR GROUNDWATER TREATMENT

Parameters	Average Detected Concentration (1, 2, 3)	4x Avg (1, 2, 3)	Maximum Detected Concentration (1, 2)	Design Concentration (1, 4)	Discharge Criteria To Groundwater (1, 5)	Discharge Criteria To Surface Water (1, 5)	Discharge Criteria To Atmosphere µg/m3 (6)	Well MW-4S (1, 7)
Hardness (ppm)	389	1,557.20	571	571				310.5
Total Dissolved Solids (ppm)	603.80	2,415.20	1,350	1,350	500	500		355
Total Suspended Solids (ppm)	4,673.40	18,693.60	19,060	18,694				802.5
Total Phosphorus (ppm)	0.28	1.13	1.88	1.13				0.056
Nitrate (ppm)	0.38	1.52	3.27	1.52	10			0.75
Phenols (ppm)	0.009	0.04	0.046	0.04	0.001	0.005		1.37
Sulfate (ppm)	38.39	153.56	81.6	82	250			32.3
Bicarbonate (ppm)	277.10	1,108.40	630	630				116
BOD (ppm)	5.50	22	20	20				
COD (ppm)	28.70	114.80	203	115				
Chloride (ppm)	38.80	155.20	69	69	250			32
Ammonia - Nitrogen (ppm)	0.21	0.86	0.807	0.81	2	(**)		0.058
TKN (ppm)	0.74	2.97	4.28	2.97				0.332
Acidity (ppm)	48.79	195.16	148	148				9
Oil & Grease (ppm)	2.99	11.96	8.2	8.20		No Visible Film		3.05
TOC (ppm)	4.10	16.40	16	16				2
Sulfide (ppm)	36.60	146.40	70.4	70	0.05 (+)	0.002 (+)		16
pH (Field)	7.80		8.8	8.80	6.5-8.5	6.5-8.5		8.1

Notes: 1. All concentrations are in µg/L (ppb), unless otherwise noted.
2. Samples from the following shallow wells were used in calculating the average and maximum values of each parameter: MW-1S, MW-2S, MW-3S, MW-01, MW-02.
3. For non-detects 1/2 the Contract Required Quantitation limit was used to calculate the average concentration.
4. Design concentration is assumed to be four times the average or the maximum value, whichever is less.
5. Limitations for discharge to groundwater, or class C (T) surface water are based on NYSDEC Division of Water TOGS 1.1.1. (10/22/93).
6. For Volatile Organics only (NYDEC Air-Guide 1, Annual Guidance Concentrations, November 1991).
7. For non-detects a zero was used to calculate the average concentration. Average of two sampling rounds.

* - Compound is included in Total of Organic Chemicals.
** - Limit varies with temperature and pH.
\+ - Expressed as hydrogen sulfide.

TABLE 3-2
NORTH EAST LANDFILL
DESIGN CONCENTRATIONS FOR GROUNDWATER TREATMENT

Parameters		Average Detected Concentration (1, 2, 3)	4x Avg (1, 2, 3)	Maximum Detected Concentration (1, 2)	Design Concentration (1, 4)	Discharge Criteria To Groundwater (1, 5)	Discharge Criteria To Surface Water (1, 5)	Discharge Criteria To Atmosphere µg/m3 (6)	We MW- (1,
Vinyl Chloride	*	8.53	34.13	32	32	2		0.02	
Chloroethane	*	18.50	74	140	74	5			
Methylene Chloride	*	3.47	13.87	4	4	5		27	1.5
Acetone	*	56.10	224.40	460	224	50		14,000	
Carbon Disulfide		6.70	26.80	22	22			7	
1,1-Dichloroethane	*	27.20	108.80	220	109	5	11,000	500	
1,2-Dichloroethene (total)	*	6.30	25.20	18	18	5		1,900	
2-Butanone (MEK)	*	55.10	220.40	400	220	50		300	
1,2-Dichloropropane	*	4.00	16	5	5	5		0.15	
4-Methyl-2-pentanone (MIBK)		10.30	41.20	58	41			480	
2-Hexanone	*	7.60	30.40	31	30	50			
Tetrachloroethene	*	4.90	19.60	4	4	5	1	0.075	
Toluene	*	14.40	57.60	100	58	5	17,000	2,000	
Ethylbenzene	*	5.60	22.40	11	11	5	32,000	1,000	
Styrene	*	7.90	31.60	34	32	5		510	
Xylene (total)	*	12.90	51.60	84	52	5		300	
Total of Organic Chemicals	*	232.50	930.00	1543.00	873	100	100		
Aluminum		1,823	7,292	10,400	7,292		100		1,25
Antimony		33.9	135.64	69.1	69	3	1,600		
Arsenic		4.5	17.87	6.7	7	25	190		1.3
Barium		28.6	114.45	55	55	1,000			27
Beryllium		2.2	8.96	0.8	0.80	3	1,100		
Cadmium		2.6	10.56	4.6	5	10	4.45		
Calcium		96,856.67	387,426.67	168,000	168,000				77,55
Chromium		15.8	63.01	43	43	50	862		24
Cobalt		24.4	97.56	18.9	19		5		3.6
Copper		8.8	35.21	16.3	16	200	52		10
Iron		5,343.20	21,372.80	24,800	21,373	300	300		8,10
Lead		5.3	21.32	19.3	19	15	29		5
Magnesium		33,640	134,560	45,100	45,100	35,000			28,50
Manganese		644.7	2,578.93	3500	2,579	300			741.0
Nickel		30.7	122.83	121	121		359		92.7
Potassium		4,906.63	19,626.53	25,300	19,627				1,560
Selenium		2.5	10.08	2.7	2.70	10	1		
Silver		4.86	19.44	3.6	4	50	0.1		5
Sodium		13,024.67	52,098.67	22,200	22,200	20,000			7,640
Vanadium		21.0	84.05	14	14		14		3.7
Zinc		23.8	95.08	69.2	69	300	363		32.2

4.0 COSTS OF RECOMMENDED REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS

In Section 2.0, technologies and process options were identified, screened, and evaluated with regard to their effectiveness, implementability, and relative cost. A post screening analysis of technologies related to subgrade preparation and groundwater collection and subsequent treatment/disposal was performed in Section 3.0. The following list identifies those technologies and process options which will be combined into remedial alternatives and evaluated in Section 5.0.

- Posting and fencing;
- Deed restrictions;
- Monitoring;
- Part 360 cap with passive gas collection/venting;
- Groundwater collection trench with geomembrane lining;
- Onsite groundwater treatment, discharge to surface water;
- Soil vapor extraction with air sparging; and
- Sediment remediation with wetland restoration.

This section presents the associated costs for each of these technologies. These costs consist of capital and operation and maintenance (O&M) costs. The present worth of the O&M cost is based on a 6 percent interest rate and a 30 year post closure period.

The sources of the unit prices for capital costs are referenced on the cost tables at the end of the section. Provisions for health and safety protection, not only for workers, but also for the community and the environment, have been included in the unit prices as appropriate (e.g., excavation in contaminated areas). Several indirect cost items were estimated and added as a percentage of the total cost as appropriate. These included standard items such as mobilization/demobilization; construction, administration and design engineering; bonds and insurance; escalation (to account for increased construction costs at the time construction is anticipated to occur); and change order contingencies. Where possible, contractor bids and quotes on similar projects have been used. A 15 percent contractor markup has been included on textbook estimated costs (e.g., Means Construction Cost Data) to reflect construction at inactive hazardous waste sites and the limited number of contractors available to work under these conditions. The actual cost is expected to be within a range of -30 to +50 percent of the costs estimated herein.

4.1 Posting and Fencing

Capital Cost

A fence around the perimeter of the landfill could be constructed. The cost of "posted" signs is considered to be negligible. The capital cost of this option is presented in Table 4-1.

Annual O&M Cost

Monthly inspection and maintenance of the fence is expected to result in annual costs as presented on Table 4-2.

4.2 Deed Restrictions

This cost includes legal and administrative fees required to implement restrictions on groundwater and site use. The cost of this option is presented in Table 4-3.

4.3 Monitoring

Capital Cost

It is assumed that monitoring can be implemented using existing groundwater monitoring wells and at surveyed surface water and sediment locations, therefore, no capital cost is associated with this option.

Annual O&M Cost

The extent of the monitoring program, and therefore the cost, is dependent on the scope of the proposed measures for remediation. If institutional actions (i.e., only access restrictions and monitoring) are implemented, a more extensive monitoring program is required. Under this scenario, surface soil, surface water, sediment, and groundwater samples at the same locations as those collected during the RI/FS would be collected and analyzed for Target Compound List (TCL) and Target Analyte List (TAL) parameters on a regular basis. A soil gas survey would be conducted each year. At the onset, quarterly monitoring may be required; however, in the future it is anticipated that the frequency of monitoring and list of parameters for analysis will be reduced. Therefore, as an average over 30 years, annual monitoring and analysis for all parameters is included for cost comparison purposes. The number of samples for each media and the estimated annual costs for implementing the monitoring program, data validation and reporting are presented in Table 4-4.

If the site is remediated, less extensive monitoring would be required. Under this scenario, only shallow groundwater samples and 1 upstream and 2 downstream surface water and sediment samples would be collected and analyzed for TCL and TAL parameters. LEL monitoring would be performed at the landfill gas vents, and it is estimated that 2 air samples would be taken from the proposed 15 gas vents and sent for laboratory analysis for VOCs. The number of samples and the annual cost for implementation of this monitoring program is presented in Table 4-5.

4.4 Capping

Capital Cost

The capital cost estimate for the Part 360 landfill cap including the gas collection system is based on the following:

- The area to be covered is approximately 15 acres;
- The site will be cleared of brush and debris;

- The subgrade will be prepared as discussed in Section 3.1;
- All synthetic materials will be overlapped by 5 percent;
- Geotextiles will be bonded where possible to increase stability; and
- A variance on the thickness of the barrier protection layer from a minimum of 24 inches to 18 inches will be requested given the presence of the underlying geomembrane (as opposed to a clay layer). This is consistent with what has been granted on similar projects.

From the bottom to top the Part 360 cap consists of:

- 6 inches grading fill;
- Gas collection layer (bonded composite);
- Geotextile added to gas collection layer on steeper perimeter slopes;
- 60-mil textured geomembrane;
- 18 inches general fill;
- 6 inches topsoil;
- Vegetative cover, and
- One gas vent bedded in stone per acre.

A typical section through the Part 360 cap across the landfill is shown on Figure 4-1. Geotextiles are bonded to the geonet to improve cover stability due to the presence of geomembrane. The total estimated capital cost of a Part 360 cap is shown in Table 4-6. As discussed in Section 3.1, approximately 70,000 cy of "clean" fill material will be required in preparing the subgrade for the site. The capital cost estimate presented in Table 4-6 is based on "clean" fill. The use of suitable alternate grading material (AGM), if determined to be available during the design phase, would be expected to cost less than the $15 per cubic yard estimated to purchase and haul "clean" soil to the site, thus decreasing the actual estimated capital cost of the Part 360 cap.

For the purpose of the FS, geomembrane has been considered for use as the barrier layer, and a geosynthetic is included as the gas collection layer. Should, during the course of the project, clay and sand become available at a relatively lower cost than the proposed synthetics for the barrier and gas collection layers, respectively, then their use should be reconsidered. The variance for a reduced thickness of barrier protection layer would not be requested if clay were used.

Annual O&M Cost

The estimated annual O&M costs for the Part 360 cap are presented in Table 4-7. This estimate is based on the following:

- The cap will be inspected twice per year.
- Maintenance includes mowing.
- One area of cap, 400 square feet, will be repaired each year.

4.5 Groundwater Collection System

Capital Cost

The capital cost estimates for the localized and downgradient perimeter groundwater collection trenches are based on the following:

- The localized groundwater trench would be located along the eastern perimeter under the landfill cap in the area of MW-01, and be approximately 500 feet long from MW-3S to the north.

- The downgradient perimeter groundwater collection trench would be approximately 1,200 feet long, located along the eastern and northern perimeters under the landfill cap from approximately MW-3S to MW-02.

- The bottom of the trenches would be approximately ten feet into the water table aquifer.

- Excavated material would be placed onsite under the landfill cap.

- The downgradient side and bottom of the trenches would be lined with a geomembrane to reduce the inflow of "clean" groundwater.

- Manholes would be placed approximately 100 feet apart.

- Collected water would be piped to an onsite treatment facility.

A typical section through a groundwater collection trench is presented on Figure 4-2. The total capital cost for the localized groundwater collection trench is shown on Table 4-8. The total capital cost for the downgradient perimeter groundwater collection trench is shown on Table 4-9.

Annual O&M Cost

The annual O&M cost for the groundwater collection trench is presented on Table 4-10 and is considered to be similar for both trenches. The estimate assumes that the trench will be inspected and maintained through the manholes twice a year. Testing and cleaning of the pipes is expected every four years. Note that pumping and treatment costs for collected water are included on Tables 4-11 through 4-18.

4.6 Groundwater Treatment

Once collected, groundwater would be treated onsite and discharged to surface water using the treatment scheme shown on Figure 3-2. The capital and O&M costs of treated water are dependent on the anticipated flow rate to the treatment system, which varies for the two collection trenches.

Capital Cost - Localized Groundwater Collection

Table 4-11 presents the equipment sizing and design criteria for the design of a 3 gpm treatment system for groundwater collected in a localized groundwater collection trench. The estimated capital cost for this system is presented on Table 4-12.

O&M Costs - Localized Groundwater Collection

Table 4-13 presents the basis for the O&M cost estimate for a 3 gpm treatment system. The estimated O&M cost for this system is presented on Table 4-14.

Capital Cost - Downgradient Perimeter Groundwater Collection

Table 4-15 presents the equipment sizing and design criteria for the design of a 20 gpm treatment system for groundwater collected in a downgradient perimeter collection trench. The estimated capital cost for this system is presented on Table 4-16.

O&M Costs - Downgradient Perimeter Groundwater Collection

Table 4-17 presents the basis for the O&M cost estimate for a 20 gpm treatment system. The estimated O&M cost for this system is presented on Table 4-18.

4.7 Soil Vapor Extraction With Air Sparging

Capital Cost

The recommended method for in-situ treatment of contaminated soil is soil vapor extraction combined with air sparging. Soil vapor extraction is a method for removing VOCs from the unsaturated or "dry" zone of contaminated waste and soil. Air sparging is a method for removing VOCs from soils in the saturated zone. In air sparging, air is injected below the water table through a series of injection wells, and at the North East Landfill would be done in areas where waste and contaminants are present below the water table. The soil vapor extraction system applies a vacuum over the contaminated area through a series of extraction wells that are screened in the zone from which contaminant removal is desired, in this case, from a depth of between 10 to 20 feet. The vacuum creates a pressure gradient which causes the air and contaminant vapors in the soil pores to move towards the extraction wells. The extraction wells are connected by a series of pipes and vacuum blowers to a treatment system. The extracted air is treated for removal of particles and water vapor. The VOCs would be removed from the air stream using carbon adsorption, catalytic oxidation, or other technology. After treatment, the air is discharged to the atmosphere.

Many factors determine the effectiveness of air sparging and soil vapor extraction including: characteristics of contaminants present, air permeability of soil, soil moisture content, clay content, organic carbon content of the soil, temperature, and the homogeneity of the soil at the site. For the purpose of this Feasibility Study, it is assumed that soil vapor extraction would be sufficient for the removal of VOCs from the unsaturated waste and soil, and air sparging would volatilize VOCs present in the areas where contaminants are present below the water table. If, however, results of pilot scale studies to be performed during the design phase show that soil vapor extraction will not provide sufficient removal, the process could be augmented through the use of hot air injection wells or steam injection wells. However, injecting heated gases may contribute to increasing the mobility of SVOCs which are present in waste and soils but currently immobile as evidenced by groundwater analytical data.

A schematic flow diagram of a typical soil vapor extraction and air sparging system is shown on Figure 4-3. Due to the low permeability of the soils present, it is initially estimated that soil vapor extraction wells and air sparging injection wells would be spaced approximately 50 feet apart on a grid pattern over the 5.5 acres. Due to the number of perforations which would be required through the geomembrane it is assumed that soil vapor extraction and air sparging operations would have to be completed prior to construction of the Part 360 cap. The typical components of the air sparging and soil vapor extraction systems included in this cost estimate are indicated below.

- Air Injection Wells - Vertical air injection wells would be used between the soil vapor extraction wells to expedite the process, and at depth in areas where waste is anticipated or confirmed to be below the seasonally high water table. It is estimated that 50 4-inch polyvinyl chloride (PVC) wells would be installed to an average depth of 25 feet.

- Vapor Extraction Wells - For this site, it is assumed that vertical vapor extraction wells would be used to withdraw VOC contaminants from the unsaturated soils beneath the landfill. Based on the areal extent of the VOC-contaminated soil, it is estimated that 50 4-inch diameter PVC wells would be installed for the soil vapor extraction system. The average depth of the extraction wells is estimated to be 15 feet.

- Condensate Separator - Under normal operation of a soil vapor extraction system there are some water and soil particles that would be drawn into the system. A condensate separator or "knockout tank" would be used to remove water and other foreign particles from the soil vapor.

- Vapor Phase Carbon Adsorption - After the vapor is extracted from the soil, it is treated to remove contaminants and then discharged to the atmosphere. Due to the type of contaminants present at this site, and their presence at relatively low levels, granular activated carbon would be the most economical method to adsorb the contaminants from the airstream. After the canisters of carbon reach their adsorptive capacity, the exhausted units are either regenerated or returned to the supplier for regeneration. Existing RI data indicates that only low levels of methane are present at the landfill. If, however, the vapor extraction system collects significant quantities of methane from the subsurface landfill waste, then additional air treatment such as incineration or catalytic oxidation may be required.

- Blowers - Blowers are the system components that actually produce the vacuum in the wells. The carbon absorption system would be located on the vacuum side of the blower unit. This prevents contaminated air from escaping should a leak occur in the collection piping. For the purpose of this Feasibility Study, it is assumed that the air withdrawal rate from each of the extraction wells would be approximately 25 cfm. Assuming 50 wells, the total air flow would be approximately 1,500 cfm. Two blowers of approximately 2,000 cfm each would be installed in the system to permit operating flexibility. The blower operating pressure is assumed to be 15 inches of mercury. The cost of blowers reflects explosion-proof equipment.

- Piping - It is assumed that all of the piping would be PVC. The piping to each of the wells would be connected to a central manifold. All piping would be buried below the frost line to prevent freezing of condensate in the lines during the winter months.

The capital cost for installation of the soil vapor extraction and air sparging system is presented on Table 4-19.

<u>Annual O&M Cost</u>

It is assumed that the system would operate with one operator, 8 hours per day, five days per week for a period of 3 years prior to construction of the landfill cap and then abandoned in place. The annual O&M cost is presented on Table 4-20.

4.8 Sediment Remediation

<u>Capital Cost</u>

Contaminated sediments detected between sample location SED-1 to SED-7 would be removed, replaced with clean hydrophyllic soils and the plant species restored. Contaminated sediments would be placed under the landfill cap. Mitigative measures such as siltation fencing have been included in the cost estimate to prevent short-term contamination of the non-contaminated wetlands during remediation. Due to the small area (0.2 acres) of sediments to be remediated, and the objective of minimizing impacts on the wetlands, conventional large-scale equipment excavation methods are not implementable at this site. Conversely, the estimated 300 cy of sediments may be too significant a quantity to be removed cost effectively by manual methods. While the actual sediment remediation method will be determined following discussions between the Town of North East, NYSDEC, and the remediation contractor, the following approach is recommended. A haul road would be constructed to the edge of the wetland, and siltation fencing would be installed around the proposed remediation area. A small backhoe would remove the top one foot of sediments and transfer them to a lined dump truck waiting on the haul road. Sediments would be transported, deposited, graded and spread over the landfill for drying. Appropriate hydrophyllic soils would be placed in the wetland and plants species introduced by use of either a commercially available seed mix or through live transplants from nearby wetlands to promote growth of species already adapted to the area.

Annual O&M Costs

There are no O&M costs following sediment remediation.

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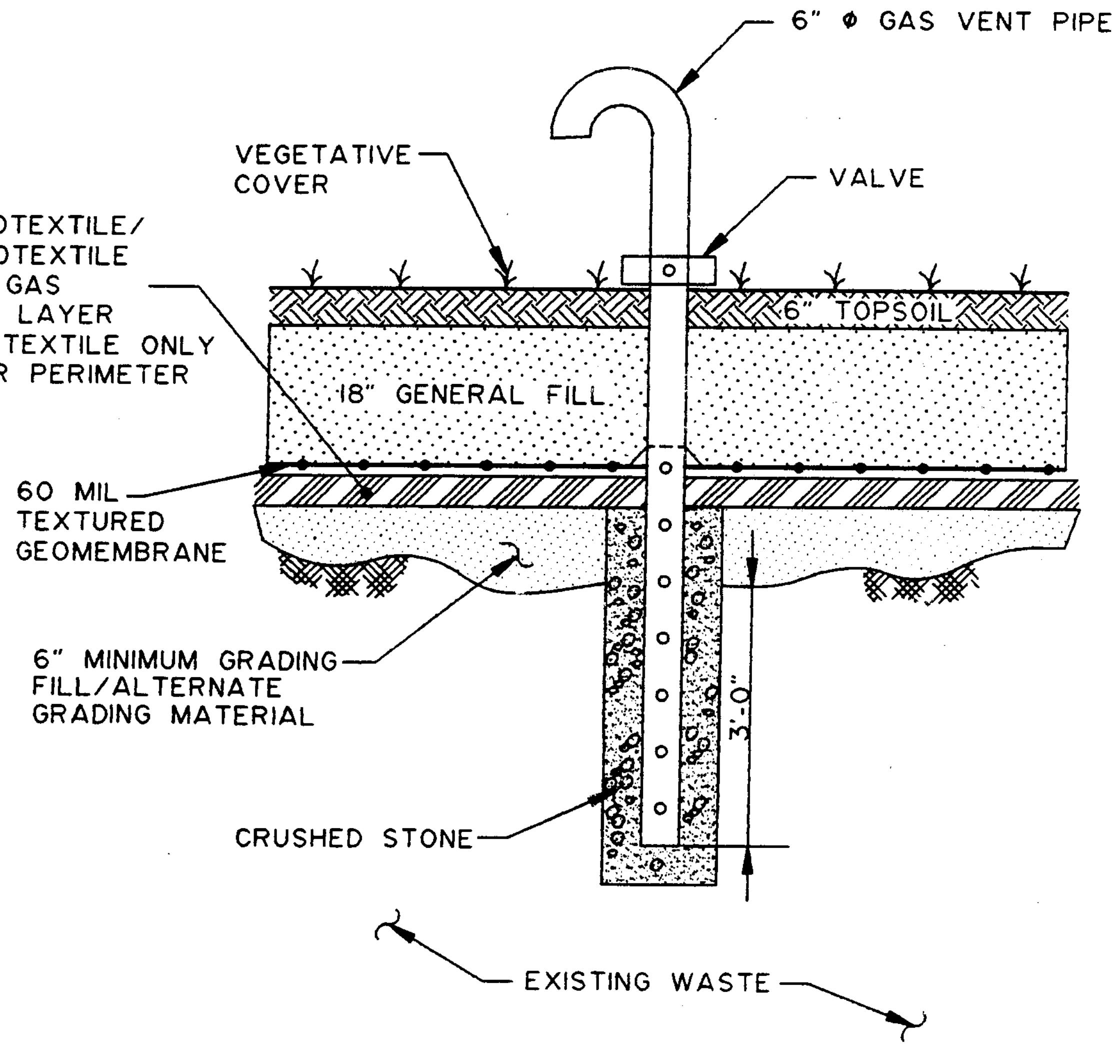


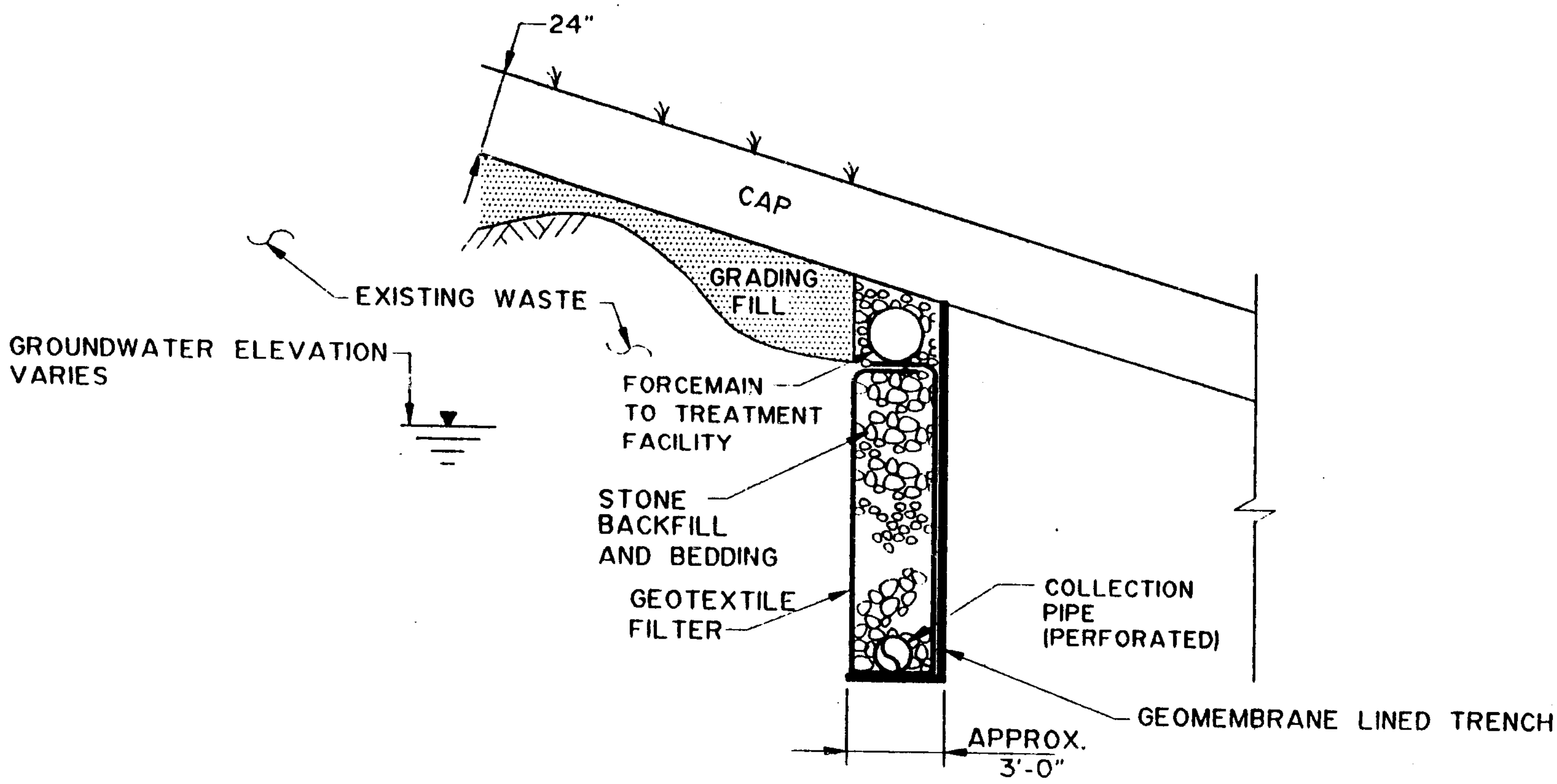
NOT TO SCALE

URS CONSULTANTS, INC.	TYPCIAL SECTION THROUGH PART 360 CAP	FIGURE 4-1

AC-6644

AC-6639

35319\CAD 1:1 2/1/95-6 FAO



NOT TO SCALE

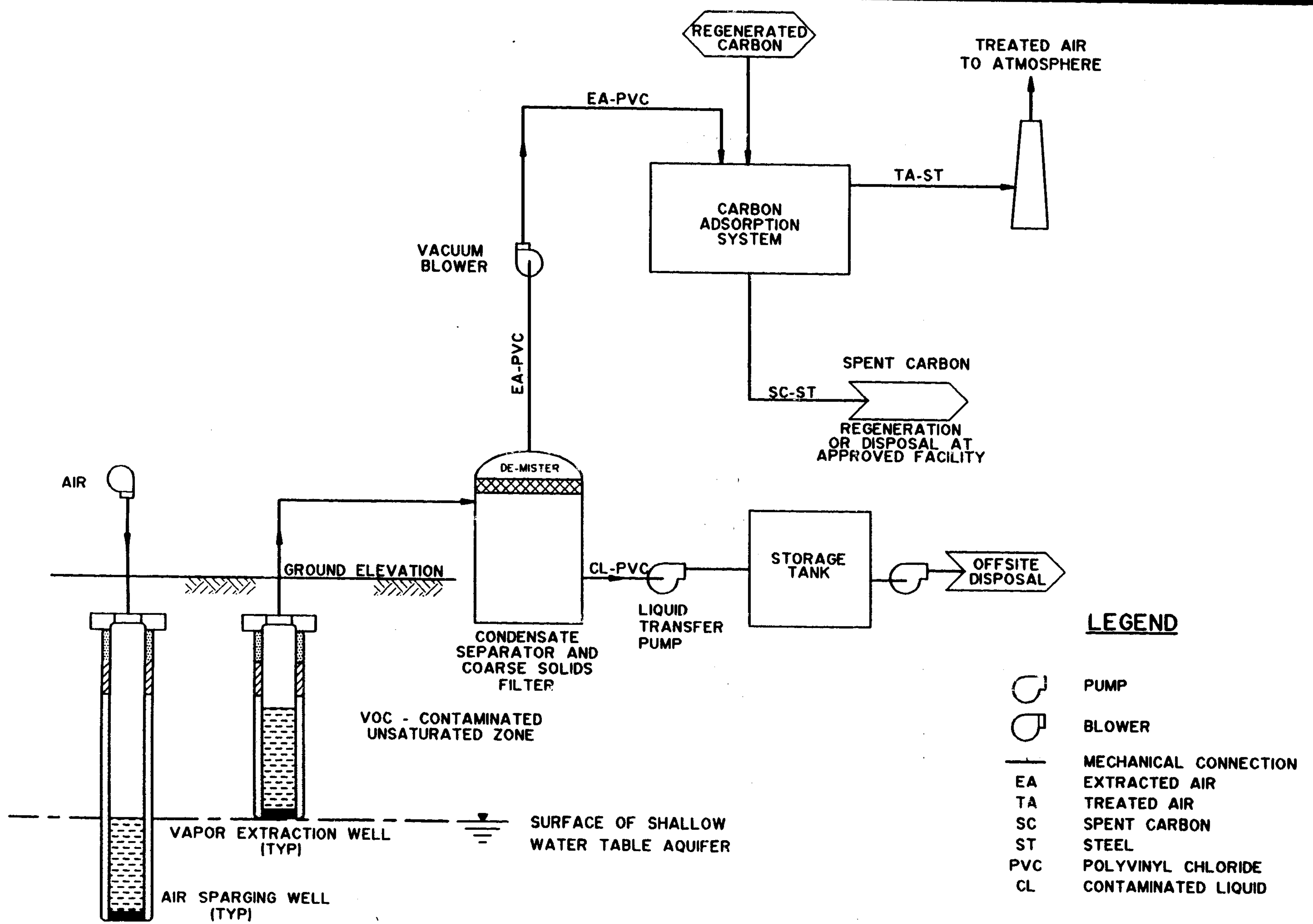
URS CONSULTANTS, INC.

TYPICAL SECTION THROUGH GROUNDWATER COLLECTION TRENCH

FIGURE 4-2

AC-6678A

35319.40\CAD 1=300 5/22/95-4 ELB



URS CONSULTANTS, INC.

SOIL VAPOR EXTRACTION AND AIR SPARGING SYSTEMS
NORTHEAST LANDFILL

FIGURE 4-3

TABLE 4-1
NORTH EAST LANDFILL
CAPITAL COST ESTIMATE

POSTING AND FENCING

DIRECT COSTS:

Component		Item	Units	Unit Cost	Source	Quantity	Total Cost
1	6' Chainlink Fence	Furnish, deliver and Install	LF	$16	1	3,350	$53,600
2	Double Swing Gate	Furnish, deliver and Install	EA	$675	1	1	$675
SUBTOTAL							**$54,275**

INDIRECT COSTS:

Mobilization/Demobilization (3% Direct)	$1,628
Construction, Administration and Design Engineering (15% Direct)	$8,141
Escalation to Midpoint of Construction (3% direct per year for 2 years)	$3,257
Bonds and Insurance (1% Direct)	$543
Contingency (10% Direct)	$5,428
SUBTOTAL	**$18,996**

TOTAL	**$73,300**

Sources:
1 - Means Construction Cost Data, 1994

TABLE 4-2
NORTH EAST LANDFILL
O&M COST ESTIMATE

FENCE INSPECTION & MAINTENANCE

DIRECT COSTS:

Component		Item	Units	Unit Cost	Source	Quantity	Total Cost
1	Inspection	Inspection of Fence	HR	$25	1	48	$1,200
2	Maintenance & Replace	6' Chainlink Fence	LF	$16	2	100	$1,600
SUBTOTAL							**$2,800**

TOTAL ANNUAL O & M	**$2,800**

Sources:
1 - URS Estimate
1 - Means Construction Cost Data, 1994

TABLE 4-3
NORTH EAST LANDFILL
CAPITOL COST ESTIMATE

DEED RESTRICTIONS

DIRECT COSTS:

Component		Item	Units	Unit Cost	Source	Quantity	Total Cost
1	Legal and Administrative Fees	Provide Services For Implementation of Deed Restricions	LS	$2,000	1	1	$2,000
SUBTOTAL							**$2,000**

TOTAL	**$2,000**

Sources:
1 - URS Estimate

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TABLE 4-4
NORTH EAST LANDFILL
O & M COST ESTIMATE

MONITORING PROGRAM FOR INSTITUTIONAL ACTION

DIRECT COSTS:

Component		Item	Units	Unit Cost	Source	Quantity	Total Cost
1	Sampling	a) Labor	HR	$14	1	160	$2,240
		b) Equipment	LS	$1,000	1	1	$1,000
2	Analysis	a) Surface Soil (TCL/TAL)	EA	$1,200	2	3	$3,600
		b) Surface Water (TCL/TAL)	EA	$1,100	2	10	$11,000
		c) Sediment (TCL/TAL)	EA	$1,200	2	10	$12,000
		d) Groundwater (TCL/TAL)	EA	$1,100	2	13	$14,300
		e) QA/QC	EA	$1,100	2	5	$5,500
3	Soil Gas Survey	Labor and Equipment	LS	$20,000	1	1	$20,000
4	Data Validation and Reporting	Labor	HR	$40	1	500	$20,000
						TOTAL ANNUAL O&M	**$89,600**

Sources:

1 - URS Estimate - Same sampling as performed during RI/FS
2 - Quotation from RI

TABLE 4-5
NORTH EAST LANDFILL
O & M COST ESTIMATE

MONITORING PROGRAM FOLLOWING REMEDIATION

DIRECT COSTS:

Component		Item	Units	Unit Cost	Source	Quantity	Total Cost
1	Sampling	a) Labor	HR	$14	1	120	$1,680
		b) Equipment	LS	$1,000	1	1	$1,000
2	Analysis	a) Surface Water (TCL/TAL)	EA	$1,100	2	3	$3,300
		b) Sediment (TCL/TAL)	EA	$1,200	2	3	$3,600
		c) Groundwater (TCL/TAL)	EA	$1,100	2	6	$6,600
		d) Air Vents (Summa canister)	EA	$625	2	2	$1,250
		e) QA/QC	EA	$1,100	2	3	$3,300
3	Data Validation and Reporting	Labor	HR	$40	1	250	$10,000
			TOTAL ANNUAL O&M				$30,700

Sources:

1 - URS Estimate - Sampling of one upstream and two downstream surface water and sediment samples; groundwater sampling from shallow monitoring wells

2 - Quotation from RI

TABLE 4-6
NORTH EAST LANDFILL
CAPITAL COST ESTIMATE

PART 360 CAP

DIRECT COSTS

Component		Item	Units	Unit Cost	Source	Quantity	Total Cost
1	Clearing	Remove	AC	$2,200	1	15	$33,000
2	Grading	a) Waste Cut, Move	CY	$13.42	1	7,500	$100,650
		b) Subgrade preparation, Furnish, Deliver and Grade	CY	$15	1	70,000	$1,050,000
3	6" Grading Fill	Furnish, Deliver and Grade	CY	$15	1	12,700	$190,500
4	Bonded Gas Vent Composite	Furnish, Deliver and Install	SF	$0.52	1	686,000	$356,700
5	60 mil Textured Geomembrane	Furnish, Deliver and Install	SF	$0.45	1	686,000	$308,700
6	Gas Vents	a) Excavate	CY	$455	2	40	$18,200
		b) Furnish, Deliver, Haul and Place Stone	CY	$25	1	40	$1,000
		c) Furnish and install Pipes	EA	$300	1	15	$4,500
		d) Seals	EA	$30	2	15	$450
7	18" General Fill	Furnish, Deliver and Grade	CY	$15	1	42,400	$636,000
8	6" Topsoil	Furnish, Deliver and Grade	CY	$16	1	12,700	$203,200
9	Vegetative Cover	Seed, Mulch and Fertilizer	AC	$2,000	1	15	$30,000
SUBTOTAL							**$2,932,900**

INDIRECT COSTS

Mobilization/Demobilization (3% Direct)	$88,000
Construction, Administration and Design Engineering (15% Direct)	$439,900
Escalation to Midpoint of Construction (3% direct per year for 2 years)	$176,000
Bonds and Insurance (1% Direct)	$29,330
Contingency (10% Direct)	$293,300
SUBTOTAL	**$1,026,500**

TOTAL	**$3,959,400**

Sources:
- 1 - Bids on Previous URS Projects
- 2 - URS Estimate

TABLE 4-7
NORTH EAST LANDFILL
O & M COST ESTIMATE

PART 360 CAP

Component		Item	Units	Unit Cost	Source	Quantity	Total Cost
1	Inspection	Inspection of Cap (2 men, 1 day each, twice per year)	HR	$25	1	32	$800
2	Maintenance	Cut Vegetative Cover	EA	$500	1	6	$3,000
3	Repair Cap	a) Excavation and Removal of Damaged Cap	CY	$10	1	35	$350
		b) Replacement of Gas Vent Composite	SF	$0.52	1	400	$208
		c) Replacement of Geomembrane	SF	$0.45	1	400	$180
		d) Replacement of General Fill (avg. 18")	CY	$15	1	30	$450
		e) Replacement of Topsoil (6")	CY	$16	1	10	$160
		f) Seed, Mulch and Fertilize	SF	$0.05	1	400	$20
TOTAL ANNUAL O & M							$5,200

Sources:
1 - URS Estimate

TABLE 4-8
NORTH EAST LANDFILL
CAPITAL COST ESTIMATE
LOCALIZED GROUNDWATER COLLECTION TRENCH

DIRECT COSTS:

	Component	Item	Units	Unit Cost	Source	Quantity	Total Cost
1	Trench and 60 mil geomembrane liner	Geomembrane	SF	$0.45	2	12,000	$5,400
		Shoring For Excavation (both sides)	SF	$21.00	1	26,000	$546,000
		Excavation and Hauling of Material	CY	$5.75	1	1,200	$6,900
		Grading	CY	$2.30	1	1,200	$2,760
2	Collection Trench (500 long x 3' wide x 20' deep)	Filter Fabric	SY	$1.80	3	3,400	$6,120
		NYSDOT Size 1 Gravel	CY	$24.00	1	1,200	$28,800
		Perforated PVC underdrain	LF	$12.00	1	500	$6,000
3	Manholes	Excavation	CY	$5.75	1	25	$144
		NYSDOT Size 1 Grade	CY	$24.00	1	25	$600
		Manhole	EA	$4,025	1	5	$20,125
		Frame and Cover	EA	$552	1	5	$2,760
	SUBTOTAL						**$625,600**

INDIRECT COSTS:

Mobilization/Demobilization (3% Direct)	$18,768
Construction, Administration and Design Engineering (15% Direct)	$93,840
Escalation to Midpoint of Construction (3% direct per year for 2 years)	$37,536
Bonds and Insurance (1% Direct)	$6,256
Contingency (10% Direct)	$62,560
SUBTOTAL	**$218,960**

TOTAL	**$845,000**

Sources:

1-Means Construction Cost Data, 1994

2-URS Estimate

3-Bids From Previous URS Projects

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TABLE 4-9
NORTH EAST LANDFILL
CAPITAL COST ESTIMATE
DOWNGRADIENT PERIMETER GROUNDWATER COLLECTION TRENCH

DIRECT COSTS:

Component		Item	Units	Unit Cost	Source	Quantity	Total Cost
1	Trench and 60 mil geomembrane liner	Geomembrane	SF	$0.45	2	28,000	$12,600
		Shoring For Excavation (both sides)	SF	$21.00	1	61,000	$1,281,000
		Excavation and Hauling of Material	CY	$5.75	1	2,800	$16,100
		Grading	CY	$2.30	1	2,800	$6,440
2	Collection Trench (1200 long x 3' wide x 20' deep)	Filter Fabric	SY	$1.85	3	8,000	$14,800
		NYSDOT Size 1 Gravel	CY	$24.00	1	2,800	$67,200
		Perforated PVC underdrain	LF	$12.00	1	1,200	$14,400
3	Manholes	Excavation	CY	$5.75	1	50	$288
		NYSDOT Size 1 Grade	CY	$24.00	1	50	$1,200
		Manhole	EA	$4,025	1	11	$44,275
		Frame and Cover	EA	$552	1	11	$6,072
SUBTOTAL							**$1,464,400**

INDIRECT COSTS:

Mobilization/Demobilization (3% Direct)	$43,932
Construction, Administration and Design Engineering (15% Direct)	$219,660
Escalation to Midpoint of Construction (3% direct per year for 2 years)	$87,864
Bonds and Insurance (1% Direct)	$14,644
Contingency (10% Direct)	$146,440
SUBTOTAL	**$512,540**

TOTAL	**$1,977,000**

Sources:

1-Means Construction Cost Data, 1994
2-URS Estimate
3-Bids From Previous URS Projects

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TABLE 4-10
NORTH EAST LANDFILL
O & M COST ESTIMATE

GROUNDWATER COLLECTION TRENCH

Component		Item	Units	Unit Cost	Source	Quantity	Total Cost
1	Labor	2 men twice per year	Mnhr	$40	1	32	$1,280
3	Collection Pipe	Cleaning	Mnhr	$40	1	10*	$400
			TOTAL ANNUAL O & M				$1,680

Sources:
1 - URS Estimate
* - Estimated at 40 hours every 4 years or 10 hours per year

TABLE 4-11
NORTH EAST LANDFILL
EQUIPMENT SIZING & DESIGN CRITERIA
GROUNDWATER TREATMENT (3 GPM)

Equipment Description	Design Criteria	Size
Equalization/Storage Tank	3 day retention time	13,000 gal.
Equalization Tank Agitator	0.15 HP per 1,000 gallons	2 HP
Mixing Tank	30 minute retention time	450 gal.
Mixing Tank Agitator	2 HP per 1,000 gallons	1 HP
Flocculating Tank	10 minute retention time	200 gal.
Flocculating Tank Agitator	2 HP per 1,000 gallons	0.5 HP
Inclined Plate Clarifier	Overflow Rate = 0.25 gpm/sf	60 sf
Sludge Tank	Sludge Flow Rate = 1/3 gpm 8 hour retention time	200 gal.
Filter Press	Suspended Solids = 1,000 mg/l 40% solids in Filter Cake Cake Density = 70 pcf	2 cf
Air Stripper	Water Temp = 55°F Air to Water Ratio = 100:1	Column Base = 3'2" x 3' Column Ht = 7'3"
Blower	Same as Above	200 cfm
Air Preheater	Preheat air to = 40°F	200 cfm
pH Adjust Tank	10 minute retention time	150 gal.
pH Adjust Tank Agitator	2 HP per 1,000 gallons	0.5 HP
2 Process Feed Pumps*		15 gpm
10 Process Pumps*		15 gpm
2 Sludge Pumps (clarifier)*		0.3 gpm
2 Feed Pumps (filter press)*		0.5 gpm
6 Chemical Metering Pumps*		0.25 gpm
Compressor		5 HP
Vapor Phase Carbon		40 lbs. Carbon

Note: Operating rate = 15 gpm
* - It is assumed that standby pumps are installed.

TABLE 4-12
NORTH EAST LANDFILL
CAPITAL COST ESTIMATE
GROUNDWATER TREATMENT (3 GPM)

Item	Unit	Quantity	Unit Cost	Source	Total Cost
DIRECT COSTS:					
1. EQUIPMENT COSTS					
Equalization/Storage Tank	GAL	15,000	$0.63	3	$9,450
Equalization Tank Agitator	EA	1	$2,750	4	$2,750
Mixing Tank	EA	1	$1,211	1	$1,210
Mixing Tank Agitator	EA	1	$1,713	4	$1,710
Flocculating Tank	EA	1	$320	1	$320
Flocculating Tank Agitator	EA	1	$1,474	4	$1,470
Inclined Plate Clarifier	EA	1	$9,900	2	$9,900
Sludge Tank	EA	1	$320	1	$320
Filter Press	EA	1	$14,391	2	$14,390
Air Stripper with Blower and Heater	EA	1	$11,868	2	$11,870
Compressor	EA	1	$5,095	4	$5,100
Vapor Phase Carbon Adsorption	EA	2	$1,028	2	$2,060
pH Adjust Tank	EA	1	$320	1	$320
pH Adjust Tank Agitator	EA	1	$1,474	4	$1,470
Process Feed Pumps	EA	2	$1,839	4	$3,680
Process Pumps	EA	10	$1,839	4	$18,390
Sludge Pumps	EA	2	$983	5	$1,970
Feed Pumps	EA	2	$983	5	$1,970
Metering Pumps	EA	6	$1,920	4	$11,520
SUBTOTAL EQUIPMENT					$99,870
2. ADDITIONAL DIRECT COSTS					
Equipment Installation (50% of Equipment)					$49,935
Instrumentation and Controls (20% of Equipment)					$19,974
Piping (60% of Equipment)					$59,922
Electrical (10% of Equipment)					$9,987
Buildings (40% of Equipment)					$39,948
Service Facilities and Yard Improvements (20% of Equipment)					$19,974

TABLE 4-12 (cont'd)
NORTH EAST LANDFILL
CAPITAL COST ESTIMATE
GROUNDWATER TREATMENT (3 GPM)

Item	Unit	Quantity	Unit Cost	Source	Total Cost
3. FORCEMAIN FROM COLLECTION TRENCH TO TREATMENT PLANT					
Excavate	CY	50	$11.50	3	$580
2" PVC Pipe	LF	150	$3.75	1*	$560
Sand Backfill	CY	20	$15.15	1*	$300
Backfill	CY	30	$15	3	$450
Tie-in at Trench	LS	100%	$575	1*	$580
Testing	LS	100%	$100	3	$100
4. FORCEMAIN TO SURFACE WATER					
Excavate	CY	80	$11.50	3	$920
4" PVC Pipe	LF	200	$6	1*	$1,200
Sand Backfill	CY	20	$15.15	1*	$300
Backfill	CY	60	$15	3	$900
Testing	LS	100%	$100	3	$100
SUBTOTAL OF DIRECT COSTS					$305,600

INDIRECT COSTS:	
Mobilization (3% of Direct)	$9,168
Construction, Demobilization, Administration and Design Engineering (15% of Direct)	$45,840
Contingencies (10% of Direct)	$30,560
Bonds and Insurance (1% of Direct)	$3,056
Escalation to Midpoint of Construction (3% of direct per year for 2 years)	$18,336
SUBTOTAL INDIRECT COSTS	$106,960

TOTAL		$412,600
	SAY	**$413,000**

1-Means Construction Cost Data, 1993 (5.4% escalation included)
2-Vendor Quote
3-URS Estimate
4-Richardson, 1994
5-McMaster-Carr, 1992 (11% escalation included)

1*-Means Construction Cost Data, 1994

TABLE 4-13
NORTH EAST LANDFILL
O&M COST ESTIMATE BASIS
GROUNDWATER TREATMENT (3 GPM)

Item	Basis
O&M Labor	1 man 8 hours per day 5 days per week
Maintenance	3% of Capital Costs
Insurance and Taxes	1% of Capital Costs
Maintenance Reserve and Contingency Costs	5% of Capital Costs
Energy	
-Electricity	HP x 0.7457 x Hours of Operation
Chemicals	
-Calcium Hydroxide (Lime)	500 mg/l
-Sulfuric Acid	100 mg/l
-Polymer	1 mg/l
Activated Carbon	0.1 lbs., per 1,000 gallons
Filter Cake Disposal	10 cf per week
Monitoring Costs	
-Conventional Parameters	2/month
-TCL Parameters	2/month

TABLE 4-14
NORTH EAST LANDFILL
O&M COST ESTIMATE
GROUNDWATER TREATMENT (3 GPM)

Item	Units	Quantity	Unit Cost	Total Cost
O&M Labor	HR	2,080	$26	$54,080
Maintenance		$413,000	3%	$12,390
Insurance and Taxes		$413,000	1%	$4,130
Maintenance Reserve and Contingency Costs		$413,000	5%	$20,650
Energy -Electricity	kWhr	34,120	$0.11	$3,750
Chemicals				
-Calcium Hydroxide (Lime)	LB	7,800	$0.03	$230
-Sulfuric Acid	LB	1,560	$0.05	$80
-Polymer	LB	20	$1.25	$30
Activated Carbon	LB	150	$1.25	$190
Filter Cake Disposal	CY	21	$250	$5,250
Monitoring Costs				
-Conventional Parameters	EA	24	$300	$7,200
-TCL Parameters	EA	24	$1,100	$26,400

TOTAL		$134,380
	SAY	**$134,400**

TABLE 4-15
NORTH EAST LANDFILL
EQUIPMENT SIZING & DESIGN CRITERIA
GROUNDWATER TREATMENT (20 GPM)

Equipment Description	Design Criteria	Size
Equalization/Storage Tank	3 day retention time	100,000 gal.
Equalization Tank Agitator	0.15 HP per 1,000 gallons	15 HP
Mixing Tank	30 minute retention time	1,800 gal.
Mixing Tank Agitator	2 HP per 1,000 gallons	4 HP
Flocculating Tank	10 minute retention time	600 gal.
Flocculating Tank Agitator	2 HP per 1,000 gallons	2 HP
Inclined Plate Clarifier	Overflow Rate = 0.25 gpm/sf	240 sf
Sludge Tank	Sludge Flow Rate = 1 gpm 16 hour retention time	1,000 gal.
Filter Press	Suspended Solids = 1,000 mg/l 40% solids in Filter Cake Cake Density = 70 pcf	9 cf
Air Stripper	Water Temp = 55°F Air to Water Ratio = 100:1	Column Base = 6'2" x 5' Column Ht. = 7'3"
Blower	Same as Above	800 cfm
Air Preheater	Preheat air to = 40°F	800 cfm
pH Adjust Tank	10 minute retention time	600 gal.
pH Adjust Tank Agitator	2 HP per 1,000 gallons	2 HP
2 Process Feed Pumps*		60 gpm
10 Process Pumps*		60 gpm
2 Sludge Pumps (clarifier)*		1 gpm
2 Feed Pumps (filter press)*		1.5 gpm
6 Chemical Metering Pumps*		0.5 gpm
Compressor		20 HP
Vapor Phase Carbon		290 lbs. Carbon

Note: Operating rate = 60 gpm.
* - It is assumed that standby pumps are installed.

TABLE 4-16
NORTH EAST LANDFILL
CAPITAL COST ESTIMATE
GROUNDWATER TREATMENT (20 GPM)

Item	Unit	Quantity	Unit Cost	Source	Total Cost
DIRECT COSTS:					
1. EQUIPMENT COSTS					
Equalization/Storage Tank	EA	1	$88,536	1	$88,540
Equalization Tank Agitator	EA	1	$26,769	4	$26,770
Mixing Tank	EA	1	$2,086	1	$2,090
Mixing Tank Agitator	EA	1	$16,697	4	$16,700
Flocculating Tank	EA	1	$1,644	1	$1,640
Flocculating Tank Agitator	EA	1	$11,044	4	$11,040
Inclined Plate Clarifier	EA	1	$21,000	2	$21,000
Sludge Tank	EA	1	$1,644	1	$1,640
Filter Press	EA	1	$25,300	2	$25,300
Air Stripper with Blower and Heater	EA	1	$24,170	2	$24,170
Compressor	EA	1	$6,420	4	$6,420
Vapor Phase Carbon Adsorption	EA	2	$4,090	2	$8,180
pH Adjust Tank	EA	1	$1,644	1	$1,640
pH Adjust Tank Agitator	EA	1	$11,044	4	$11,040
Process Feed Pumps	EA	2	$1,882	4	$3,760
Process Pumps	EA	10	$1,882	4	$18,820
Sludge Pumps	EA	2	$1,163	5	$2,330
Feed Pumps	EA	2	$1,163	5	$2,330
Metering Pumps	EA	6	$2,789	4	$16,730
SUBTOTAL EQUIPMENT					$290,140
2. ADDITIONAL DIRECT COSTS					
Equipment Installation (50% of Equipment)					$145,070
Instrumentation and Controls (20% of Equipment)					$58,028
Piping (60% of Equipment)					$174,084
Electrical (10% of Equipment)					$29,014
Buildings (40% of Equipment)					$116,056
Service Facilities and Yard Improvements (20% of Equipment)					$58,028

TABLE 4-16 (cont'd)
NORTH EAST LANDFILL
CAPITAL COST ESTIMATE
GROUNDWATER TREATMENT (20 GPM)

Item	Unit	Quantity	Unit Cost	Source	Total Cost
3. FORCEMAIN FROM COLLECTION TRENCH TO TREATMENT PLANT					
Excavate	CY	50	$11.50	3	$580
2" PVC Pipe	LF	150	$3.75	1*	$560
Sand Backfill	CY	20	$15.15	1*	$300
Backfill	CY	30	$15	3	$450
Tie-in at Trench	LS	100%	$575	1*	$580
Testing	LS	100%	$100	3	$100
4. FORCEMAIN TO SURFACE WATER					
Excavate	CY	80	$11.50	3	$920
4" PVC Pipe	LF	200	$6	1*	$1,200
Sand Backfill	CY	20	$15.15	1*	$300
Backfill	CY	60	$15	3	$900
Testing	LS	100%	$100	3	$100
SUBTOTAL OF DIRECT COSTS					$876,410

INDIRECT COSTS:	
Mobilization (3% of Direct)	$26,292
Construction, Demobilization, Administration and Design Engineering (15% of Direct)	$131,462
Contingencies (10% of Direct)	$87,641
Bonds and Insurance (1% of Direct)	$8,764
Escalation to Midpoint of Construction (3% of direct per year for 2 years)	$52,585
SUBTOTAL INDIRECT COSTS	$306,744

TOTAL		$1,183,154
	SAY	**$1,183,000**

1-Means Construction Cost Data. 1993 (5.4% escalation included)
2-Vendor Quote
3-URS Estimate
4-Richardson, 1994
5-McMaster-Carr, 1992 (11% escalation included)

1*-Means Construction Cost Data. 1994

TABLE 4-17
NORTH EAST LANDFILL
O&M COST ESTIMATE BASIS
GROUNDWATER TREATMENT (20 GPM)

Item	Basis
O&M Labor	1 man 16 hours per day 5 days per week
Maintenance	3% of Capital Costs
Insurance and Taxes	1% of Capital Costs
Maintenance Reserve and Contingency Costs	5% of Capital Costs
Energy	
-Electricity	HP x 0.7457 x Hours of Operation
Chemicals	
-Calcium Hydroxide (Lime)	500 mg/l
-Sulfuric Acid	100 mg/l
-Polymer	1 mg/l
Activated Carbon	0.1 lbs., per 1,000 gallons
Filter Cake Disposal	85 cf per week
Monitoring Costs	
-Conventional Parameters	2/month
-TCL Parameters	2/month

TABLE 4-18
NORTH EAST LANDFILL
O&M COST ESTIMATE
GROUNDWATER TREATMENT (20 GPM)

Item	Units	Quantity	Unit Cost	Total Cost
O&M Labor	HR	4,160	$26	$108,160
Maintenance		$1,183,000	3%	$35,490
Insurance and Taxes		$1,183,000	1%	$11,830
Maintenance Reserve and Contingency Costs		$1,183,000	5%	$59,150
Energy -Electricity	kWhr	232,660	$0.11	$25,590
Chemicals				
-Calcium Hydroxide (Lime)	LB	62,500	$0.03	$1,875
-Sulfuric Acid	LB	12,500	$0.05	$625
-Polymer	LB	125	$1.25	$160
Activated Carbon	LB	1,200	$1.25	$1,500
Filter Cake Disposal	CY	165	$250	$41,250
Monitoring Costs				
-Conventional Parameters	EA	24	$300	$7,200
-TCL Parameters	EA	24	$1,100	$26,400

TOTAL		$319,230
	SAY	**$319,200**

TABLE 4-19
NORTH EAST LANDFILL
CAPITAL COST ESTIMATE
SOIL VAPOR EXTRACTION AND AIR SPARGING

DIRECT COSTS:

	Component	Item	Units	Unit Cost	Source	Quantity	Total Cost
1	4" Ø Vapor Extraction Wells	Drilling	LF	$16	3	750	$12,000
		PVC Riser	LF	$4.30	2	250	$1,075
		PVC Slotted Screen	LF	$6	3	500	$3,000
		Stone Bedding	CY	$27.60	1	15	$414
		Sand Backfill	CY	$15.15	1	8	$121
		Precast Concrete Box	EA	$1,373	1	50	$68,650
		PVC Ball Valve	EA	$114.44	2	50	$5,722
		PVC Tee	EA	$18.77	2	50	$939
2	Vapor Extraction and Treatment System	Purchase and Install	LS	$250,000	2	1	$250,000
3	Pipe Manifold	PVC Pipe (8")	LF	$18	2	6,000	$108,000
		PVC Valves	EA	$159	2	40	$6,360
		Excavate Trench	CY	$11.50	3	1,333	$15,333
		Sand Backfill	CY	$15.15	1	475	$7,196
		Backfill	CY	$15	3	858	$12,875
		Testing	LS	$500	3	1	$500
4	Pipe Connection to Treatment Facility	PVC Pipe (12")	LF	$16	3	5,800	$92,800
		Excavate Trench	CY	$11.50	3	1,900	$21,850
		Backfill	CY	$15	1	1,900	$28,500
5	Instrumentation & Monitoring Equipment	Pressure Indicators	EA	$250	3	30	$7,500
		Temperature Indicators	EA	$250	3	10	$2,500
		Misc.	LS	$5,000	3	1	$5,000
6	Air Sparging System 4" Ø Injection Wells	Drilling	LF	$16	3	1,250	$20,000
		PVC Riser	LF	$4.30	2	1,000	$4,300
		PVC Slotted Screen	LF	$6	3	500	$3,000
		Sand Backfill	CY	$15.15	1	15	$227
		Blower	EA	$30,000	3	2	$60,000
		PVC Ball Valve	EA	$114.44	2	50	$5,722
		PVC Tee	EA	$18.77	2	50	$939
	Air Sparging Pipe Manifold	PVC Pipe	LF	$4.30	2	1,000	$4,300
		PVC Valves	EA	$159	2	5	$795
	Instrumentation & Monitoring Equipment	Misc.	LS	$5,000	3	1	$5,000
7	Treatment Building		SF	$15	3	1,000	$15,000
	SUBTOTAL						**$769,600**

INDIRECT COSTS:

Mobilization/Demobilization (3% Direct)	$23,088
Construction, Administration and Design Engineering (15% Direct)	$115,440
Escalation to Midpoint of Construction (3% direct per year for 2 years)	$46,176
Bonds and Insurance (1% Direct)	$7,696
Contingency (10% Direct)	$76,960
SUBTOTAL	**$269,360**

TOTAL	**$1,039,000**

Sources:
1-Means Construction Cost Data, 1994
2-Vendor Quote
3-URS Estimate
4-Richardson 1994

TABLE 4-20
NORTH EAST LANDFILL
O&M COST ESTIMATE
SOIL VAPOR EXTRACTION AND AIR SPARGING

Item	Units	Quantity	Unit Cost	Total Cost
O&M Labor	HRS	2,080	$26	$54,080
Maintenance		269,360	3%	$8,080
Insurance and Taxes		269,360	1%	$2,690
Maintenance Reserve and Contingency Costs		269,360	5%	$13,470
Energy -Electricity	kWhr	327,392	$0.11	$36,010
Chemicals				
Activated Carbon	LB	5,000	$1.25	$6,250
Monitoring Costs				
-Conventional Parameters	EA	24	$300	$7,200
-TCL Parameters	EA	24	$1,100	$26,400

TOTAL		$154,180
	SAY	**$154,200**

TABLE 4-21
NORTH EAST LANDFILL
CAPITAL COST ESTIMATE

SEDIMENT REMEDIATION

DIRECT COSTS

Component		Item	Units	Unit Cost	Source	Quantity	Total Cost
1	Siltation Fencing	Furnish, Deliver and Install	LF	$0.80	2	260	$208
2	Sediment Removal	Small backhoe and operator	CY	$12	1	300	$3,600
3	Haul Road	Construction	LF	$30.75	1	200	$6,150
4	Haul Onsite	Hauling, Grading	CY	$8.05	2	300	$2,415
5	Wetlands	Wetland Restoration	AC	$42,000	3	0.20	$8,400
SUBTOTAL							**$20,800**

INDIRECT COSTS

Mobilization/Demobilization (3% Direct)	$624
Construction, Administration and Design Engineering (15% Direct)	$3,120
Escalation to Midpoint of Construction (3% direct per year for 2 years)	$1,248
Bonds and Insurance (1% Direct)	$208
Change Order Contingencies (10% Direct)	$2,080
SUBTOTAL	**$7,300**

TOTAL	**$28,100**

Sources:
1 - URS Estimate
2 - Means Construction Cost Data, 1994
3 - Bids on Previous URS Projects

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5.0 DEVELOPMENT AND DETAILED ANALYSIS OF ALTERNATIVES

In this section, alternatives will be developed and subjected to detailed and comparative analyses against the nine USEPA remedial alternative evaluation criteria.

5.1 Development of Alternatives

In developing remedial alternatives, technologies and process options surviving the previous screening processes presented in Sections 2.0 and 3.0 are combined into remedial alternatives for the site as a whole. These alternatives, for the most part, meet the remedial action objectives for the site. The development of alternatives is summarized in Table 5-1. With the exception of Alternatives 1 and 2, which are the No Action and Institutional Action alternatives, respectively, all alternatives contain the following:

- posting/fencing;
- deed restrictions;
- long-term monitoring;
- Part 360 landfill cap;
- passive gas collection with venting; and
- sediment remediation.

Additional technologies/process options which are included in some, but not all of the alternatives, are:

- soil vapor extraction with air sparging;
- localized groundwater collection;
- downgradient perimeter groundwater collection; and
- onsite groundwater treatment with discharge to surface water.

When developing alternatives from combinations of the above technologies/process options, one must keep in mind that localized groundwater collection and downgradient perimeter groundwater collection are mutually exclusive; that is, only one would be included in any single alternative. Once groundwater collection is included, onsite groundwater treatment with discharge to surface water must also be included. Soil vapor extraction with air sparging precludes the need for localized or downgradient perimeter groundwater collection and treatment.

As shown in Table 5-1, the No Action and Institutional Action alternatives are listed as Alternatives 1 and 2, respectively. Alternative 3 includes a Part 360 cap and sediment remediation; Alternative 4 includes a Part 360 cap, soil vapor extraction with air sparging, and sediment remediation; Alternative 5 includes a Part 360, localized groundwater collection with onsite treatment and discharge to surface water, and sediment remediation; and Alternative 6 includes a Part 360 cap, downgradient perimeter groundwater collection with onsite treatment and discharge to surface water, and sediment remediation.

5.2 Descriptions and Detailed Analysis of Alternatives

In this section, the six alternatives are described and subjected to a detailed evaluation in order to recommend the most appropriate and cost-effective remedy for the site. The alternatives are evaluated with respect to the nine evaluation criteria specified in the NCP and discussed in detail in the NYSDEC TAGM "Selection of Remedial Actions at Inactive Hazardous Waste Disposal Sites" (NYSDEC, 1990), and in the USEPA Guidance on Conducting RI/FS (USEPA, 1988). The nine evaluation criteria are as follows:

Overall Protection of Human Health and the Environment - Protectiveness is the primary requirement for remedial action at hazardous waste sites. Evaluation of this criterion involves an assessment of how each alternative achieves protection over time and how site risks are reduced.

Compliance with Standards, Criteria and Guidance (SCGs) - Compliance with SCGs includes compliance with chemical-specific, location-specific, and action-specific SCGs which were identified in Section 3.4.

Long-Term Effectiveness and Permanence - This criterion includes assessments of: the magnitude of residual risk after remediation; the adequacy of controls to meet their required performance specifications, both initially and into the future; and the reliability of controls from an operation standpoint.

Reduction of Toxicity, Mobility, or Volume (TMV) - This criterion includes assessments of the magnitude, significance and irreversibility of treatment, where applicable, and an evaluation of the type and quantity of residuals remaining after treatment.

Short-Term Effectiveness - This criterion includes assessments of the short-term impacts of the alternative (i.e., during implementation) upon the surrounding community, onsite workers, and the environment. It also addresses the time required for the alternative to satisfy remedial action objectives.

Implementability - This criterion considers many of the practical aspects associated with technical and administrative implementation of the remedial alternative, such as the ability to construct and operate technologies, the reliability of the technologies, ease of undertaking additional remedial actions if necessary, ability to monitor the alternative's effectiveness, availability of required materials and services, permit requirements, and need to coordinate with other agencies.

Cost - This quantitative evaluation criterion includes the capital (total of direct and indirect) and operation and maintenance costs associated with each alternative, expressed as present worth (using a 6 percent interest rate for 30 years). Costs which were developed for each technology in Section 4 are summarized for each alternative and presented in Table 5-2.

State Acceptance - This criterion indicates whether, based on its review of the RI/FS reports, NYSDEC concurs or opposes the recommended alternative identified in Section 6 of this FS Report. The remedy selection process will be documented in NYSDEC's Record of Decision (ROD).

Community Acceptance - Community acceptance will be evaluated following public review of the FS Report and throughout the public comment period.

5.2.1 Alternative 1 - No Action

Description - This alternative represents current conditions at the site with no additional monitoring or remedial measures undertaken.

Overall Protection of Human Health and the Environment - If this alternative were implemented, contravention of SCGs and the potential ecological risk identified would remain. This alternative is not considered to be protective of human health and the environment.

Compliance with SCGs - Since no action is taken, this alternative would not be in compliance with SCGs.

Long-Term Effectiveness and Permanence - The contamination at the site identified during the RI/FS would remain, and be reduced gradually over time by natural processes.

Reduction of Toxicity, Mobility, or Volume - Treatment is not included as part of this alternative; therefore, there is no reduction of toxicity, mobility, or volume.

Short-Term Effectiveness - Since no action is taken, this alternative would have no short-term impacts on the community, onsite workers, or the environment. As this alternative does not meet remedial action objectives, the time to meet objectives is not relevant.

Implementability - Since no action is taken, implementability is not applicable.

Cost - There is no cost associated with this alternative.

State Acceptance - This alternative is included for baseline comparison purposes as required by the NCP. It does not eliminate or mitigate all significant threats to human health and the environment presented by hazardous waste disposed at the site, as required by 6 NYCRR Part 375-1.10 (b), and therefore is anticipated to be unacceptable to the NYSDEC.

Community Acceptance - Community acceptance will be evaluated following public review of the FS Report and throughout the public comment period.

5.2.2 Alternative 2 - Institutional Action

Description - This alternative includes:

- Posting and Fencing - Fencing would be constructed around the perimeter of the landfill to limit human exposure to contaminants present at the site. The site would be posted as a No Trespassing area.

- Deed Restrictions - Deed restrictions that prohibit use of onsite groundwater and future use of the site would be included.

- Monitoring - Environmental samples similar to those collected during the RI would be collected and analyzed (soil, surface water, sediments, groundwater, air). Every five years, data generated from the monitoring program would be evaluated in a five-year review to determine if the landfill was continuing to impact human health and the environment.

Overall Protection of Human Health and the Environment - This alternative would only reduce the potential risks to human health posed by contact with contaminants on the surface of the landfill. This alternative would not reduce the potential impact on groundwater or on the environment.

Compliance with SCGs - Institutional actions would not alter the current impact of contamination on environmental media and would not comply with chemical-specific SCGs. Monitoring would be used to determine the extent of future SCG exceedances. This alternative does not meet New York State action-specific SCGs regarding landfill closure. Location-specific SCGs are not applicable for this alternative.

Long-Term Effectiveness and Permanence - The contamination at the site identified during the RI/FS would remain, and be reduced gradually over time by natural processes. The monitoring program included with this alternative and the five-year reviews will assess the site's continuing impact on human health and the environment.

Reduction of Toxicity, Mobility, or Volume - Treatment is not included as part of this alternative; therefore, there is no reduction of toxicity, mobility, or volume.

Short-Term Effectiveness - This alternative includes limited construction and therefore would have no impact on the community or the environment, and only minimal impact on workers. Remedial action objectives would not be met with this alternative. The long-term monitoring program and five-year reviews will asses the site's continuing impact on human health and the environment and the magnitude of residual risk. Implementation of this alternative could be accomplished in less than one year.

Implementability - Since minimal action is taken, this alternative is implementable, and would not impede future remedial actions.

Cost - Capital cost, O&M costs, and the present worth of this alternative are presented in Table 5-2.

State Acceptance - This alternative does not eliminate or mitigate all significant threats to human health and the environment presented by hazardous waste disposed at the site, as required by 6 NYCRR Part 375-1.10(b), and therefore is anticipated to be unacceptable to the NYSDEC.

Community Acceptance - Community acceptance will be evaluated following public review of the FS report and throughout the public comment period.

5.2.3 Alternative 3 - Part 360 Cap, Sediment Remediation

Description - This alternative includes:

- Posting/Fencing - Fencing would be constructed around the perimeter to protect the landfill cap. The site would be posted as a No Trespassing area.

- Deed Restrictions - Deed restrictions that prohibit use of onsite groundwater and intrusive activities at the site which could damage the landfill cap would be included.

- Monitoring - Environmental samples (sediments, groundwater, air) fewer in number than those collected during the RI, would be collected and analyzed. Every five years, data generated from the monitoring program would be evaluated to determine if remedial measures are adequately addressing the remedial action objectives for the site.

- Part 360 Cap - The site would be graded to a minimum 4 percent and maximum 33 percent slope. Surface water controls would be included with the grading and capping plans to control runoff, minimize erosion, and limit groundwater recharge. A Part 360 landfill cap would extend over the approximately 15 acres identified on Plate 2 as being within the limits of waste. Following subgrade preparation to adequate slopes, from bottom to top, the cap would consist of: 6 inches of grading fill, a gas collection geosynthetic composite, a geomembrane barrier layer, 18 inches of barrier protection soil, 6 inches of topsoil, and vegetative cover.

- Sediment Remediation - The limited extent of sediment contamination identified in Section 2.3.2 would be removed and sediments placed onsite prior to construction of the landfill cap. Mitigative measures such as siltation fencing would be undertaken, and physical intrusion would be limited, so as to minimize the impacts on the wetlands during remediation. Wetland restoration would be implemented following sediment removal.

Overall Protection of Human Health and the Environment - This alternative would be protective of human health and the environment and satisfy the remedial action objectives for soil, sediments, and air. The ecological risk will be eliminated following sediment remediation. There is no current or future human health risk posed by site-related groundwater contaminants migrating to existing or potential downgradient receptors. The remedial action objective for groundwater would be met over the long term. The presence of a cap would reduce infiltration and lower the seasonally-high water table in the contaminated eastern portion of the landfill, thereby reducing the potential for contaminant flushing into shallow groundwater.

Compliance with SCGs - Soil SCGs would not be met since treatment is not included in this alternative; however, it is expected that the State will defer compliance with soil SCGs as contaminated soil/fill would be covered by the Part 360 cap, and would not pose a potential risk to human health or the environment. With the addition of a Part 360 cap, there will be less infiltration and a lowering of the water table in the eastern portion of the site. The potential for the non-springtime water table to flush contaminants into the groundwater would be eliminated, and the potential for the seasonally-high water table to flush contaminants would be practically eliminated. This effect combined with natural processes would reduce the concentrations of contaminants present in the groundwater. The majority of groundwater SCGs would be met at the site. At present, no site-related contaminants have been detected in existing downgradient residential wells. In addition, it is projected that groundwater SCGs would be met at the nearest potential future groundwater receptor.

Surface water and sediment quality would be improved to below SCGs by sediment remediation and by the presence of a cap which would eliminate the erosion of contaminants.

Long-term monitoring of emissions from the landfill gas vents is included in order to evaluate future compliance with air SCGs. Should air SCGs be contravened, treatment units (e.g., carbon canisters) could be retrofitted onto individual gas vents to achieve compliance.

This alternative will comply with action-specific SCGs for landfill closure if a variance is granted for reducing the thickness of the barrier protection layer in conjunction with the use of geomembrane as a substitute for the clay barrier. Additional location- and action-specific SCGs for activities impacting the wetlands and floodplain, such as sediment remediation and surface water drainage from the cap, would be met.

Long-Term Effectiveness and Permanence - The potential ecological risk from sediments would be eliminated following implementation of this alternative. The potential for risk to human health or the environment from soil or air would be eliminated. The potential for risk to human health from groundwater would be eliminated. The potential impacts from contaminants migrating through the shallow portion of the water table aquifer will be reduced following construction of the landfill cap and lowering of the water table in the eastern portion of the site. Long-term monitoring and maintenance are included with this alternative, and will be used in the five-year review(s) to determine if remedial measures are protecting human health and the environment.

Reduction in Toxicity, Mobility, or Volume - This alternative does not reduce the toxicity or volume of waste present at the site. However, the presence of a Part 360 cap and contaminated sediment removal will reduce the mobility of contaminants present in soil and sediments, and subsequently reduce leaching of contaminants from the unsaturated zone. Further, the water table will be lowered, thereby practically eliminating the flushing action of groundwater in contact with waste. The mobility and offsite migration of contaminants through the groundwater will therefore be significantly reduced.

Short-Term Effectiveness - During the construction period, short-term impacts to the community, onsite workers, and the environment would exist from many pathways, e.g., direct contact with waste, surface water runoff, erosion of exposed waste, fugitive dust and vapors, the presence of methane, and contact with contaminated sediments. These impacts would have to be mitigated through controls including appropriate health and safety measures for workers in contact with fill, daily covering of exposed waste upon completion of work, precautions (e.g., air monitoring) to protect against fugitive dust, vapors, and methane, the installation of temporary surface water controls for runoff collection and erosion protection, and temporary controls for preventing contamination during sediment removal. Once the exposed waste is covered, the majority of short-term impacts posed by contaminants will no longer exist. In addition, measures to protect the endangered bog turtle will have to be considered.

It is estimated that construction of this alternative will require one year. Remedial action objectives for soil/fill, sediments, and air will be met upon completion of construction. It is estimated that due to the low permeability of the soils present in the eastern portion of the site, it may take between 2 to 5 years for the water table to drop to steady-state levels nearly below the waste. Concentrations of 1,1-DCA at the nearest potential future downgradient receptor are projected to be between 0.1 to 6 ppb as compared to the SCG of 5 ppb. Following capping, the concentration would be reduced even further. Therefore remedial action objectives for groundwater at the nearest potential future downgradient receptor will be met.

Implementability - The technologies proposed for this alternative are proven technologies that have been implemented at landfill sites. The availability of necessary materials and services should not pose a problem. Minimal excavation of fill is proposed; however, as the nature of fill is not completely known, difficulties could arise during excavation. Due to the presence of adjacent wetlands, the endangered bog turtle, and nearby significant habitat, mitigative measures for sediment remediation have been included. While these measures are not overly restrictive, implementation of sediment remediation will require coordination and approvals from multiple agencies.

Cost - Capital cost, O&M costs, and the present worth of this alternative are presented in Table 5-2.

State Acceptance - This alternative eliminates or mitigates to acceptable levels, the potential risk to human health or the environment presented by waste disposed at the site, in accordance with 6 NYCRR Part 375-1.10 (b). This alternative is anticipated to be acceptable to the NYSDEC.

Community Acceptance - Community acceptance will be evaluated following public review of the FS report and throughout the public comment period.

5.2.4 <u>Alternative 4 - Part 360 Cap, Sediment Remediation, Soil Vapor Extraction with Air Sparging</u>

Description - This alternative includes:

- Posting/Fencing - Fencing would be constructed around the perimeter to protect the landfill cap. The site would be posted as a No Trespassing area.

- Deed Restrictions - Deed restrictions that prohibit use of onsite groundwater and intrusive activities at the site which could damage the landfill cap would be included.

- Monitoring - Environmental samples (sediments, groundwater, air) fewer in number than those collected during the RI, would be collected and analyzed. Every five years, data generated from the monitoring program would be evaluated to determine if remedial measures are adequately addressing the remedial action objectives for the site.

- Part 360 Cap - Following completion of the soil vapor extraction and air sparging activities (anticipated to be 3 years), a Part 360 cap would be constructed. The site would be graded to a minimum 4 percent and maximum 33 percent slope. Surface water controls would be included with the grading and capping plans to control runoff, minimize erosion, and limit groundwater recharge. A Part 360 landfill cap would extend over the approximately 15 acres identified on Plate 2 as being within the limits of waste. Following subgrade preparation to adequate slopes, from bottom to top, the cap would consist of: 6 inches of grading fill, a gas collection geosynthetic composite, a geomembrane barrier layer, 18 inches of barrier protection soil, 6 inches of topsoil, and vegetative cover.

- Sediment Remediation - The limited extent of sediment contamination identified in Section 2.3.2 would be removed, and sediments placed onsite prior to construction of the landfill cap. Mitigative measures such as siltation fencing would be undertaken, and physical intrusion would be limited, so as to minimize the impacts on the wetlands during remediation. Wetland restoration would be implemented following sediment removal.

- Soil Vapor Extraction with Air Sparging - The soil vapor extraction and air sparging system described in Section 4.7 is included in this alternative. The air sparging system consists of air injection wells installed in areas in the eastern portion of the site where waste is periodically in contact with the water table. The soil vapor extraction system consists of a series of extraction wells installed in the unsaturated zone within the eastern portion of the site. The wells are connected by a collection of pipes to a vacuum and treatment system. Volatile organic compounds (VOCs) are withdrawn from the subsurface and treated before release to the atmosphere. Due to the extensive number of wells necessary for a soil vapor extraction and air sparging system, it is assumed that this process would be complete before installation of a landfill cap to avoid impacting the integrity of the cap.

Overall Protection of Human Health and the Environment - This alternative would be protective of human health and the environment and satisfy the remedial action objectives for soil, sediments, groundwater and air.

Compliance with SCGs - Soil SCGs would be met for VOCs since VOC collection and treatment is included in this alternative. It is expected that the State will defer compliance with soil SCGs for non-VOC contaminants, as few metals are migrating offsite through the shallow portion of the water table aquifer. Further, with the addition of a Part 360 cap, there will be less infiltration and a lowering of the water table in the eastern portion of the site. The potential for the seasonally-high water table to flush relatively insoluble non-VOC contaminants into the groundwater would be practically eliminated.

Surface water and sediment quality would be improved to below SCGs by sediment remediation and by the presence of a cap which would eliminate the erosion of contaminants.

Long-term monitoring of emissions from the landfill gas vents is included in order to evaluate future compliance with air SCGs. Should air SCGs be contravened, treatment units (e.g., carbon canisters) could be retrofitted onto individual gas vents to achieve compliance. Provisions would be made for air emissions from the soil vapor extraction and air sparging system to be in compliance with action-specific SCGs.

This alternative will comply with action-specific SCGs for landfill closure if a variance is granted for reducing the thickness of the barrier protection layer in conjunction with the use of geomembrane as a substitute for the clay barrier layer. Additional location- and action-specific SCGs for activities impacting the wetlands and floodplain, such as sediment remediation and surface water drainage from the cap, would be met.

Long-Term Effectiveness and Permanence - The potential ecological risk from sediments would be eliminated following implementation of this alternative. The potential for risk to human health or the environment from soil, air or VOCs in the groundwater would be eliminated. The potential impacts from relatively insoluble non-VOC contaminants in the shallow portion of the water table aquifer will be reduced following construction of the landfill cap and lowering of the water table in the eastern portion of the site. Long-term monitoring and maintenance are included with this alternative, and will be used in the five-year review(s) to determine if remedial measures are protecting human health and the environment.

Reduction in Toxicity, Mobility, or Volume - This alternative reduces the volume of VOCs present in the unsaturated soils and below the water table. VOCs will be either treated using carbon, or destroyed through a flare, as necessary. The presence of a Part 360 cap and contaminated sediment removal will reduce the mobility of contaminants and significantly reduce infiltration to the landfill, subsequently reducing leaching of the relatively insoluble non-VOC contaminants from the unsaturated zone. Further, the water table will be lowered, thereby practically eliminating the flushing action of groundwater in contact with waste. The mobility and offsite migration of contaminants through the groundwater will therefore be significantly reduced.

Short-Term Effectiveness - During the construction period, short-term impacts to the community, onsite workers, and the environment would exist from many pathways, e.g., air emissions from the soil vapor extraction process, direct contact with waste, surface water runoff, erosion of exposed waste, fugitive dust and vapors, the presence of methane, and contact with contaminated sediments. These impacts would have to be mitigated through controls including appropriate health and safety measures for those potentially impacted by operation of the soil vapor extraction system, workers in contact with fill, daily covering of exposed waste upon completion of work, precautions (e.g., air monitoring) to protect against air emissions, fugitive dust, vapors, and methane, the installation of temporary surface water controls for runoff collection and erosion protection, and temporary controls for preventing contamination during sediment removal. Once the exposed waste is covered, the majority of short-term impacts posed by contaminants will no longer exist. In addition, measures to protect the endangered bog turtle will have to be considered.

It is estimated that operation of the soil vapor and air sparging system would continue for three years prior to construction of the cap. In total, construction of this alternative will require four years. Remedial action objectives for soil/fill, sediments, air, and VOC contaminants in groundwater will be met upon completion of implementation if treatment is fully effective in the short term. It is expected that similar to what was found to occur during the RI, the relatively insoluble non-VOC contaminants will not migrate following cap construction, although the use of air sparging may mobilize some of the SVOCs present but currently immobile.

Implementability - The technologies proposed for this alternative are technologies that have been implemented at landfill sites. Air sparging and soil vapor extraction are relatively innovative technologies which will require pilot studies in order to determine their effectiveness on the contaminants present at the site, and permits/approvals for air emissions prior to implementation. The availability of necessary materials and services should not pose a problem. Minimal excavation of fill is proposed; however, as the nature of fill is not completely known, difficulties could arise during excavation. Due to the presence of adjacent wetlands, the endangered bog turtle, and nearby significant habitat, mitigative measures for sediment remediation have been included. While these measures are not overly restrictive, implementation of sediment remediation will require coordination and approvals from multiple agencies.

Cost - Capital cost, O&M costs, and the present worth of this alternative are presented in Table 5-2.

State Acceptance - This alternative eliminates or mitigates to acceptable levels, the potential risk to human health or the environment presented by waste disposed at the site, in accordance with 6 NYCRR Part 375-1.10 (b). This alternative is anticipated to be acceptable to the NYSDEC.

Community Acceptance - Community acceptance will be evaluated following public review of the FS report and throughout the public comment period.

5.2.5 Alternative 5 - Part 360 Cap, Sediment Remediation, Localized Groundwater Collection with Onsite Treatment

Description - This alternative includes:

- Posting/Fencing - Fencing would be constructed around the perimeter to protect the landfill cap. The site would be posted as a No Trespassing area.

- Deed Restrictions - Deed restrictions that prohibit use of onsite groundwater through the remediation period, and intrusive activities at the site which could damage the landfill cap would be included.

- Monitoring - Environmental samples (sediments, groundwater, air) fewer in number than those collected during the RI, would be collected and analyzed. Every five years, data generated from the monitoring program would be evaluated to determine if remedial measures are adequately addressing the remedial action objectives for the site.

- Part 360 Cap - The site would be graded to a minimum 4 percent and maximum 33 percent slope. Surface water controls would be included with the grading and capping plans to control runoff, minimize erosion, and limit groundwater recharge. A Part 360 landfill cap would extend over the approximately 15 acres identified on Plate 2 as being within the limits of waste. Following subgrade preparation to adequate slopes, from bottom to top, the cap would consist of: 6 inches of grading fill, a gas collection geosynthetic composite, a geomembrane barrier layer, 18 inches of barrier protection soil, 6 inches of topsoil, and vegetative cover.

- Sediment Remediation - The limited extent of sediment contamination identified in Section 2.3.2 would be removed and sediments placed onsite prior to construction of the landfill cap. Mitigative measures such as siltation fencing would be undertaken, and physical intrusion would be limited, so as to minimize the impacts on the wetlands during remediation. Wetland restoration would be implemented following sediment removal.

- Localized Groundwater Collection - A subsurface trench approximately 500 feet long would be constructed beneath the landfill cap along the eastern portion of the landfill in the vicinity of MW-01 from MW-3S to the north. Wells within the trench would draw the water down to capture contaminants from the shallow portion of the water table aquifer.

- Onsite Groundwater Treatment with Discharge to Surface Water - Collected groundwater would be treated onsite, as described in Section 3.3.2, to meet surface water discharge standards.

Overall Protection of Human Health and the Environment - This alternative would be protective of human health and the environment and satisfy the remedial action objectives for soil, sediments, and air. The remedial action objective for groundwater would be met over the long term through groundwater collection and treatment.

Compliance with SCGs - Soil SCGs would not be met since treatment is not included in this alternative; however, it is expected that the State will defer compliance with soil SCGs as contaminated soil/fill would be covered by the Part 360 cap, and would not pose a potential risk to human health or the environment.

By collecting groundwater from the shallow portion of the water table aquifer on the eastern side of the landfill, groundwater SCGs would eventually be met. The relatively few SCG exceedances which were found in shallow groundwater to the north of the landfill should be reduced over time through flushing and natural processes.

Surface water and sediment quality would be improved to below SCGs by groundwater collection, the presence of a cap which would eliminate the erosion of contaminants, and by sediment remediation.

Long-term monitoring of emissions from the landfill gas vents is included in order to evaluate future compliance with air SCGs. Should air SCGs be contravened, treatment units (e.g., carbon canisters) could be retrofitted onto individual gas vents to achieve compliance.

This alternative will comply with action-specific SCGs for landfill closure if a variance is granted for reducing the thickness of the barrier protection layer in conjunction with the use of geomembrane as a substitute for the clay barrier layer. Additional location- and action-specific SCGs for air emissions and activities impacting the wetlands and floodplain, such as sediment remediation, surface water drainage from the cap, and discharge from the groundwater treatment facility, would be met.

<u>Long-Term Effectiveness and Permanence</u> - The potential ecological risk from sediments would be eliminated following implementation of this alternative. The potential for risk to human health or the environment from soil, groundwater, and air would be eliminated. The potential impacts from contaminants migrating to the north in the shallow portion of the water table aquifer will be reduced following construction of the landfill cap and continued flushing of the soils. Long-term monitoring and maintenance are included with this alternative, and will be used in a five-year review(s) to determine if remedial measures are protecting human health and the environment.

Reduction in Toxicity, Mobility, or Volume - This alternative does not reduce the toxicity or volume of waste present in soils or sediments at the site. However, the presence of a Part 360 cap and contaminated sediment removal will reduce their mobility. The mobility and offsite migration of contaminants to the east of the landfill through the shallow portion of the water table aquifer will be eliminated through implementation of the landfill cap and groundwater collection; and the toxicity will be reduced through treatment.

Short-Term Effectiveness - During the construction period, short-term impacts to the community, onsite workers, and the environment would exist from many pathways, e.g., direct contact with waste, surface water runoff, erosion of exposed waste, fugitive dust and vapors, the presence of methane, and contact with contaminated groundwater and sediments. These impacts would have to be mitigated through controls including appropriate health and safety measures for workers in contact with fill, daily covering of exposed waste upon completion of work, precautions (e.g., air monitoring) to protect against fugitive dust, vapors, and methane, the installation of temporary surface water controls for runoff collection and erosion protection, and temporary controls for preventing contamination during sediment removal. Once the collection trench construction is complete, and the exposed waste is covered, the majority of short-term impacts posed by contaminants will no longer exist. In addition, measures to protect the endangered bog turtle will have to be considered.

It is estimated that construction of this alternative will require less than two years. Remedial action objectives for soil/fill, sediments, and air will be met upon completion of construction. Remedial action objectives for groundwater will be met over the long term, when monitoring results indicate that collection is no longer needed to meet SCGs.

Implementability - The technologies proposed for this alternative are proven technologies that have been implemented at landfill sites, although a treatability study would be required to determine the effectiveness of the proposed treatment scheme. The availability of necessary materials and services should not pose a problem. As the nature of fill is not completely known, difficulties could arise during excavation for the collection trench and the landfill cap. Due to the presence of adjacent wetlands, the endangered bog turtle, and nearby significant habitat, mitigative measures for sediment remediation have been included. While these measures are not overly restrictive, implementation of sediment remediation will require coordination and approvals from multiple agencies.

Cost - Capital cost, O&M costs, and the present worth of this alternative are presented in Table 5-2.

State Acceptance - This alternative eliminates or mitigates to acceptable levels, the potential risk to human health or the environment presented by waste disposed at the site, in accordance with 6 NYCRR Part 375-1.10 (b). This alternative is anticipated to be acceptable to the NYSDEC.

Community Acceptance - Community acceptance will be evaluated following public review of the FS report and throughout the public comment period.

5.2.6 Alternative 6 - Part 360 Cap, Sediment Remediation, Downgradient Perimeter Groundwater Collection with Onsite Treatment

Description - This alternative includes:

- Posting/Fencing - Fencing would be constructed around the perimeter to protect the landfill cap. The site would be posted as a No Trespassing area.

- Deed Restrictions - Deed restrictions that prohibit use of onsite groundwater through the remediation period, and intrusive activities at the site which could damage the landfill cap would be included.

- Monitoring - Environmental samples (sediments, groundwater, air) fewer in number than those collected during the RI, would be collected and analyzed. Every five years, data generated from the monitoring program would be evaluated to determine if remedial measures are adequately addressing the remedial action objectives for the site.

- Part 360 Cap - The site would be graded to a minimum 4 percent and maximum 33 percent slope. Surface water controls would be included with the grading and capping plans to control runoff, minimize erosion, and limit groundwater recharge. A Part 360 landfill cap would extend over the approximately 15 acres identified on Plate 2 as being within the limits of waste. Following subgrade preparation to adequate slopes, from bottom to top, the cap would consist of: 6 inches of grading fill, a gas collection geosynthetic composite, a geomembrane barrier layer, 18 inches of barrier protection soil, 6 inches of topsoil, and vegetative cover.

- Sediment Remediation - The limited extent of sediment contamination identified in Section 2.3.2 would be removed, and sediments placed onsite prior to construction of the landfill cap. Mitigative measures such as siltation fencing would be undertaken, and physical intrusion would be limited, so as to minimize the impacts on the wetlands during remediation. Wetland restoration would be implemented following sediment removal.

- Downgradient Perimeter Groundwater Collection - A subsurface trench approximately 1,200 feet long would be constructed beneath the landfill cap along the northern and eastern portions of the landfill between monitoring wells MW-02 and MW-01. Wells within the trench would draw the water down to capture contaminants from the shallow portion of the water table aquifer.

- Onsite Groundwater Treatment with Discharge to Surface Water - Collected groundwater would be treated onsite, as described in Section 3.3.2, to meet surface water discharge standards.

Overall Protection of Human Health and the Environment - This alternative would be protective of human health and the environment and satisfy the remedial action objectives for soil, sediments, and air. The remedial action objective for groundwater would be met over the long term through groundwater collection and treatment.

Compliance with SCGs - Soil SCGs would not be met since treatment is not included in this alternative; however, it is expected that the State will defer compliance with soil SCGs as contaminated soil/fill would be covered by the Part 360 cap, and would not pose a potential risk to human health or the environment.

By collecting groundwater from the shallow portion of the water table aquifer on the north, northeastern, and eastern sides of the landfill, groundwater SCGs would eventually be met.

Surface water and sediment quality would be improved to below SCGs by groundwater collection, the presence of a cap which would eliminate the erosion of contaminants, and by sediment remediation.

Long-term monitoring of emissions from the landfill gas vents is included in order to evaluate future compliance with air SCGs. Should air SCGs be contravened, treatment units (e.g., carbon canisters) could be retrofitted onto individual gas vents to achieve compliance.

This alternative will comply with action-specific SCGs for landfill closure if a variance is granted for reducing the thickness of the barrier protection layer in conjunction with the use of geomembrane as a substitute for the clay barrier layer. Additional location- and action-specific SCGs for air emissions and activities impacting the wetlands and floodplain, such as sediment remediation, surface water drainage from the cap, and discharge from the groundwater treatment facility, would be met.

Long-Term Effectiveness and Permanence - The potential ecological risk from sediments would be eliminated following implementation of this alternative. The potential for risk to human health or the environment from soil, groundwater, and air would be eliminated. Long-term monitoring and maintenance are included, and will be used in a five-year review(s) to determine if remedial measures are protecting human health and the environment.

Reduction in Toxicity, Mobility, or Volume - This alternative does not reduce the toxicity or volume of waste present in soils or sediments at the site. However, the presence of a Part 360 cap and contaminated sediment removal will reduce their mobility. The mobility and offsite migration of contaminants through the shallow portion of the water table aquifer will be eliminated through implementation of the landfill cap and groundwater collection; and the toxicity will be reduced through treatment.

Short-Term Effectiveness - During the construction period, short-term impacts to the community, onsite workers, and the environment would exist from many pathways, e.g., direct contact with waste, surface water runoff, erosion of exposed waste, fugitive dust and vapors, the presence of methane, and contact with contaminated groundwater and sediments. These impacts would have to be mitigated through controls including appropriate health and safety measures for workers in contact with fill, daily covering of exposed waste upon completion of work, precautions (e.g., air monitoring) to protect against fugitive dust, vapors, and methane, the installation of temporary surface water controls for runoff collection and erosion protection, and temporary controls for preventing contamination during sediment removal. Once the collection trench construction is complete and the exposed waste is covered, the majority of short-term impacts posed by contaminants will no longer exist. In addition, measures to protect the endangered bog turtle will have to be considered.

It is estimated that construction of this alternative will require less than three years. Remedial action objectives for soil/fill, sediments, and air will be met upon completion of construction. Remedial action objectives for groundwater will be met over the long term, when monitoring results indicate that collection is no longer needed to meet SCGs.

Implementability - The technologies proposed for this alternative are proven technologies that have been implemented at landfill sites, although a treatability study would be required to determine the effectiveness of the proposed treatment scheme. The availability of necessary materials and services should not pose a problem. As the nature of fill is not completely known, difficulties could arise during excavation for the collection trench and the landfill cap. Due to the presence of wetlands, the endangered bog turtle, and nearby significant habitat, mitigative measures for sediment remediation have been included. While these measures are not overly restrictive, implementation of sediment remediation will require coordination and approvals from multiple agencies.

Cost - Capital cost, O&M costs, and the present worth of this alternative are presented in Table 5-2.

State Acceptance - This alternative eliminates or mitigates to acceptable levels, the potential risk to human health or the environment presented by waste disposed at the site, in accordance with 6 NYCRR Part 375-1.10 (b). This alternative is anticipated to be acceptable to the NYSDEC.

Community Acceptance - Community acceptance will be evaluated following public review of the FS report and throughout the public comment period.

5.3 Comparative Analysis of Alternatives

A comparison of alternatives within each of the evaluation criteria is presented in Table 5-3 and summarized below. This comparison is based on all evaluation criteria except Cost and State and Community Acceptance. The costs for each of the alternatives are presented in Table 5-2. State and Community Acceptance will be evaluated during the public comment period and during preparation of the Record of Decision.

Overall Protection of Human Health and the Environment - Alternative 1 does not satisfy the remedial action objectives and is not protective of human health and the environment. Alternative 2 includes measures to restrict human access to contaminants and therefore reduces the potential for human health risk, but does not include measures to address potential environmental risk. Alternative 2 does not satisfy the remedial action objectives and is not completely protective. Alternatives 3 through 6 are protective as there would be no human health risk and the ecological risk is eliminated, and they satisfy remedial action objectives for soil, sediments, and air. Remedial action objectives for groundwater would be met upon completion of implementation for Alternative 4, and over the long term for Alternatives 3, 5 and 6. There is no current or future human health risk posed by groundwater migrating to existing or potential downgradient receptors. Remedial action objectives at the nearest potential downgradient receptor would be met following capping for Alternatives 3 through 6.

Compliance with SCGs - Alternatives 1 and 2 are not in compliance with SCGs. Alternatives 3 through 6 all meet the Part 360 landfill closure regulations if a variance is granted for a reduced thickness of barrier protection layer in conjunction with the use of geomembrane. Provisions to meet location- and action-specific SCGs are included in all alternatives. Groundwater SCGs will be met with Alternative 4 following soil vapor extraction and air sparging. Compliance with groundwater SCGs will occur over the long term with Alternatives 5 and 6. Groundwater SCGs are met with Alternative 3 at existing and potential future downgradient receptors.

Long-Term Effectiveness and Permanence - Alternative 1 does not reduce risk at the site and is not an effective or permanent remedy. Alternative 2 relies on access restrictions to reduce potential human health risk. Alternatives 3 through 6 equally reduce the potential for risks to human health and the environment for soil, sediments, and air. The potential risks from contaminants migrating through the shallow portion of the water table aquifer will be reduced following construction of the landfill cap and lowering of the water table in the eastern portion of the site. Long-term monitoring will be used in the five-year review(s) to determine if remedial measures are protecting human health and the environment. Alternative 3 relies on natural processes (degradation, dispersion, biodegradation) and the influence of the cap to reduce contaminant migration through the groundwater. Implementation of a Part 360 cap will lower the non-springtime water table to below the waste, and to within 0.5 feet of the bottom of the waste in the area of boring B-2 during seasonally-high spring-time conditions. Alternative 4 includes VOC collection from subsurface soils and treatment to enhance groundwater remediation. Alternative 5 and 6 include groundwater collection and treatment to reduce or eliminate, respectively, offsite contaminant migration through the shallow portion of the water table aquifer.

Reduction of Toxicity, Mobility, or Volume - Alternatives 1 and 2 do not reduce toxicity, mobility or volume. Alternatives 3 through 6 would reduce the mobility of contaminants in soil, sediments, and groundwater following construction of a landfill cap and lowering of the water table. The toxicity of VOCs would be either reduced or destroyed with the soil vapor extraction and air sparging system (Alternative 4). The mobility and toxicity of contaminants in groundwater would be further reduced in Alternatives 5 and 6 (Alternative 6 more so than Alternative 5).

Short-Term Effectiveness - Alternative 1 has no impact on the community, onsite workers, or the environment. Alternative 2 has little impact on onsite workers. During the construction period for Alternatives 3 through 6, short-term impacts to the community, onsite workers, and the environment would exist from many pathways. These impacts would have to be mitigated through controls including appropriate health and safety measures. Alternative 3, which includes the least construction, would have the least short-term impacts, followed by Alternative 5, Alternative 4, and finally Alternative 6 which includes construction of the longer collection trench.

Remedial action objectives for soil, sediments, and air would be met upon completion of construction for Alternatives 3, 5, and 6. The groundwater objective to meet SCGs immediately downgradient of the landfill would be met as the water table is lowered, anticipated to take 2 to 5 years, and following that, through natural processes which would dilute and degrade the contaminants over the long term for Alternatives 5 and 6. Groundwater SCGs would be met at the nearest potential future downgradient receptor for Alternative 3 following capping. Alternative 4 would meet objectives for all media in four years if the treatment proposed was fully effective. Alternatives 5 and 6 would meet the groundwater objective over the long term when monitoring results indicate that collection is no longer needed to meet SCGs.

Implementability - Alternatives 1 and 2 are technically implementable. With the exception of the in-situ treatment technologies included in Alternative 4, the technologies proposed for Alternatives 3 through 6 are proven technologies that have been implemented at landfill sites. The availability of necessary materials and services should not pose a problem. Treatability studies would be required to determine the effectiveness of treatment proposed in Alternatives 4, 5, and 6. As the nature of fill is not completely known, difficulties could arise during excavation for the collection trenches (in Alternatives 5 and 6) and the landfill cap. Due to the presence of adjacent wetlands, the endangered bog turtle, and nearby significant habitat, mitigative measures for sediment remediation are included. While these measures are not overly restrictive, implementation of sediment remediation will require coordination and approvals from multiple agencies. Air sparging and soil vapor extraction, included in Alternative 4, are relatively innovative technologies which will require pilot studies in order to determine their effectiveness on the contaminants present at the site, and permits/approvals for air emissions prior to implementation.

TABLE 5-1

DEVELOPMENT OF ALTERNATIVES

Alternative Number	1	2	3	4	5	6
Posting, Fencing Deed Restrictions Monitoring		X X X	 X X	 X X	 X X	 X X
Part 360 Cap			X	X	X	X
Soil Vapor Extraction with Air Sparging				X		
Localized Groundwater Collection Downgradient Perimeter Groundwater Collection					X 	 X
Onsite Groundwater Treatment, Discharge to Surface Water					X	X
Sediment Remediation			X	X	X	X

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TABLE 5-2
COST SUMMARY

ALTERNATIVE NUMBER	1	2	3	4	5	6
CAPITAL COST						
Posting and Fencing		$73,300	$73,300	$73,300	$73,300	$73,300
Deed Restrictions		$2,000	$2,000	$2,000	$2,000	$2,000
Part 360 Cap			$3,959,400	$3,959,400	$3,959,400	$3,959,400
Soil Vapor Extraction and Air Sparging				$1,039,000		
Groundwater Collection Trench					$845,000	$1,977,000
Groundwater Treatment System					$413,000	$1,183,000
Sediment Remediation			$28,100	$28,100	$28,100	$28,100
TOTAL CAPITAL COST	$0	$75,300	$4,062,800	$5,101,800	$5,320,800	$7,222,800
ANNUAL O&M COSTS						
Fence Inspection & maintenance		$2,800	$2,800	$2,800	$2,800	$2,800
Monitoring		$89,600	$30,700	$30,700	$30,700	$30,700
Cap			$5,200	$5,200	$5,200	$5,200
Collection Trench					$1,680	$1,680
Groundwater Treatment					$134,400	$319,200
Soil Vapor Extraction and Air Sparging (each of 3 yrs.)				$154,200		
TOTAL ANNUAL O&M	$0	$92,400	$38,700	$38,700	$174,780	$359,580
Present Worth of O&M	$0	$1,271,424	$532,512	$995,112	$2,404,973	$4,947,821
Total Present Worth (Capital and O&M)	$0	$1,346,724	$4,595,300	$6,096,900	$7,726,000	$12,170,621

TABLE 5-3
COMPARATIVE ANALYSIS OF ALTERNATIVES

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
	No Action	Access Restrictions Monitoring	Access Restrictions Monitoring Part 360 Cap Sediment Remediation	Access Restrictions Monitoring Part 360 Cap Sediment Remediation Soil Vapor Extraction With Air Sparging	Access Restrictions Monitoring Part 360 Cap Sediment Remediation Localized Groundwater Collection, Onsite Treatment	Access Restrictions Monitoring Part 360 Cap Sediment Remediation Downgradient Groundwater Collection, Onsite Treatment
Evaluation Criteria						
Overall Protection of Human Health and the Environment	• Not Protective	• Not protective	• Eliminates ecological risk • No human health risk • Protective • Reduces infiltration and contaminant migration	• Eliminates ecological risk • No human health risk • Protective • Eliminates VOC contaminant migration • Reduces non-VOC contaminant migration	• Eliminates ecological risk • No human health risk • Protective • Eliminates contaminant migration to east • Reduces contaminant migration to north	• Eliminates ecological risk • No human health risk • Protective • Eliminates contaminant migration
Compliance with SCGs	• Not in compliance	• Not in compliance	• Requires a variance from Part 360 cap • Sediment SCGs met • Action and location SCGs to be met • Groundwater quality improved; SCGs met at downgradient receptors • Gas vents fitted with treatment units if necessary	• Requires a variance from Part 360 cap • Soil and sediment SCGs met • Action and location SCGs to be met • Groundwater SCGs met • Gas vents fitted with treatment units if necessary	• Requires a variance from Part 360 cap • Sediment SCGs met • Action and location SCGs to be met • Groundwater SCGs met • Gas vents fitted with treatment units if necessary	• Requires a variance from Part 360 cap • Sediment SCGs met • Action and location SCGs to be met • Groundwater SCGs met • Gas vents fitted with treatment units if necessary
Long-Term Effectiveness and Permanence	• Not effective or permanent	• Contamination reduced by natural processes	• Reduction of potential risk from soil, groundwater, sediments and air to acceptable levels • Contaminant migration through groundwater significantly reduced	• Reduction of potential risk from soil, groundwater, sediments and air to acceptable levels • Contaminant migration of VOCs through groundwater eliminated	• Reduction of potential risk from soil, groundwater, sediments and air to acceptable levels • Contaminant migration through groundwater to the east eliminated	• Reduction of potential risk from soil, groundwater, sediments and air to acceptable levels • Contaminant migration through groundwater eliminated

TABLE 5-3 (Continued)

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
	No Action	Access Restrictions Monitoring	Access Restrictions Monitoring Part 360 Cap Sediment Remediation	Access Restrictions Monitoring Part 360 Cap Sediment Remediation Soil Vapor Extraction With Air Sparging	Access Restrictions Monitoring Part 360 Cap Sediment Remediation Localized Groundwater Collection, Onsite Treatment	Access Restrictions Monitoring Part 360 Cap Sediment Remediation Downgradient Groundwater Collection, Onsite Treatment
Reduction of Toxicity, Mobility, or Volume	• No reduction of TMV	• No reduction of TMV	• Mobility of contaminants in soil, groundwater and sediments significantly reduced	• Soil vapor extraction will either reduce toxicity or destroy VOCs • Mobility of contaminants in soil, groundwater and sediments reduced	• Groundwater treatment will reduce toxicity and mobility • Mobility of contaminants in soil and sediments reduced	• Groundwater treatment will reduce toxicity and mobility • Mobility of contaminants in soil and sediments reduced
Short-Term Effectiveness	• No impact	• Little impact	• Cap construction and sediment remediation require implementation of controls to mitigate impacts • One year required for construction	• Cap construction and sediment remediation require implementation of controls to mitigate impacts • Air sparging may mobilize SVOCs • Four years required for implementation	• Cap, collection trench, and sediment remediation require implementation of controls to mitigate impacts • Less than two years required for construction	• Cap, collection trench and sediment remediation require implementation of controls to mitigate impacts • Less than three years required for construction
Implementability	• No construction	• Constructable	• Materials and services available • Permits/approvals for impacting wetlands	• Materials and services available • Permits/approvals for impacting wetlands • Approvals/permits for emissions from soil vapor extraction system	• Permits/approvals for impacting wetlands • Approvals/permits for surface water discharge • Approvals/permits for offsite filter cake transportation and disposal • Approvals/permits for emissions from air stripper	• Permits/approvals for impacting wetlands • Approvals/permits for surface water discharge • Approvals/permits for offsite filter cake transportation and disposal • Approvals/permits for emissions from air stripper

6.0 RECOMMENDATIONS

6.1 Recommended Alternative

The selection of a remedial action is a two-step process. In the first step, a recommended alternative is identified and an explanation of the reasons for its preference is stated and presented to the public. The second step involves consideration of public comments in order to determine if the recommended alternative is appropriate. In this section of the FS, a recommended remedial alternative is identified. A final remedy will be selected by NYSDEC after review of public comments on the recommended alternative and consultation with appropriate agencies. This remedy will be incorporated into NYSDEC's Record of Decision (ROD) which is the document that forms the basis for implementation of the selected remedial action.

The USEPA outlines an approach for selection of a remedy in the National Contingency Plan (NCP). In accordance with the NCP, a remedy should:

- be protective of human health and the environment;
- attain appropriate Standards, Criteria, and Guidance (SCGs);
- be cost effective; and
- utilize permanent solutions to the greatest practical extent.

NYSDEC's Inactive Hazardous Waste Disposal Site Remedial Program, 6 NYCRR Part 375-1.10, indicates that at a minimum, the remedy selected shall eliminate or mitigate all significant threats to the public health and to the environment presented by hazardous waste disposed at the site through the proper application of scientific and engineering principles. NYSDEC's general rules for remedy selection call for application of an approach that is consistent with the NCP.

Identification of the recommended remedy is based on an evaluation of alternatives with respect to the evaluation criteria identified in Section 5. For the process of remedy selection, USEPA has categorized the evaluation criteria into three principal groups as follows:

Threshold Criteria

1. Overall protection of human health and the environment.
2. Compliance with SCGs.

Primary Balancing Criteria

3. Long-term effectiveness and permanence.
4. Reduction of toxicity, mobility, and volume (TMV).
5. Short-term effectiveness.
6. Implementability.
7. Cost.

Modifying Criteria

8. State Acceptance.
9. Community Acceptance.

The threshold criteria must be met by the recommended alternative. 6 NYCRR Part 375-1.10(c)(1) provides for variances from complying with SCGs when considering such factors as human health and environmental risk and performance equivalency.

The balancing criteria are used to determine the best balance of trade-offs among alternatives and the cost-effectiveness of the remedy. A remedy is cost effective if its costs are consistent with the overall effectiveness relative to the other alternatives. The modifying criteria include the evaluation of state and community input regarding the recommended alternative which is factored into final remedy selection to be presented by NYSDEC in the ROD.

On the basis of the evaluation criteria and the comparative analysis of alternatives presented in Section 5.3, Alternative 3 is recommended for implementation at the North East Landfill site. This alternative includes access restrictions, monitoring, a Part 360 cap and limited sediment remediation. The components and conceptual design of this alternative are discussed in greater detail in Section 6.2. The rationale for the recommendation, in consideration of the threshold and balancing criteria, is presented below. Modifying criteria will be evaluated by the NYSDEC after receipt of public comments on this Final FS Report.

Threshold Criteria

Alternatives 1 and 2 will not meet remedial action objectives or SCGs, or be protective of human health and the environment. Alternatives 3, 4, 5, and 6 are protective of human health and the environment, eliminating the potential ecological risk presented by the landfill. There is no potential current or future human health risk associated with the landfill. Alternative 4 will meet SCGs and the groundwater remedial action objective upon completion of implementation. Alternatives 5 and 6 will meet SCGs and the groundwater remedial action objective over the long-term. Alternative 3 will meet SCGs and the groundwater remedial action objective at a potential future downgradient groundwater receptor following capping.

Primary Balancing Criteria

Alternatives 1 and 2 are implementable and low in cost, but would not be effective in protecting human health and the environment over the long-term. Alternatives 3 through 6, which all include a Part 360 cap and limited sediment remediation, are effective in providing long-term protection to human health and the environment. Localized sediment remediation will eliminate the potential ecological risk which is present at the site. Installation of a Part 360 cap will eliminate approximately 85 percent of the infiltration which is currently contributing to leaching of VOCs into shallow groundwater. Further, the cap will lower the water table below the waste over all but a small area where groundwater mounding is evident during springtime conditions. Reduced infiltration and a lowered water table will substantially reduce contaminant migration from the landfill such that groundwater SCGs would be met at the nearest potential future groundwater receptor for Alternative 3.

Alternatives 4, 5 and 6 offer a further reduction in the mobility of contaminants through groundwater compared to Alternative 3; Alternatives 4 and 6 more so than Alternative 5. Alternative 4 includes an in-situ soil vapor extraction system; Alternatives 5 and 6 include groundwater collection and treatment. Toxicity of VOCs would also be reduced or destroyed with Alternative 4. The reduction in mobility of groundwater contaminants for Alternatives 4, 5, and 6 is more difficult to accomplish and creates more potential short-term impacts to the environment from the additional construction required. Alternatives 4 through 6 have higher capital and O&M costs compared to Alternative 3.

Recommended Alternative

Alternative 3 is the recommended remedy for the North East Landfill because it is protective of human health and the environment from waste present at the site. Groundwater SCGs are met at current and potential future downgradient groundwater receptors. Deed restrictions will preclude exposure to onsite groundwater. Selection of Alternative 3 as the final remedy for the site will require a variance from 6 NYCRR Part 375-1.10(c)(1). Other factors which favor the selection of Alternative 3 include that it is easier to implement, poses less short-term impacts, and is more cost-effective than other alternatives meeting the threshold criteria.

6.2 Conceptual Design

The recommended remedial alternative consists of limited sediment remediation, a Part 360 cap, access restrictions, and monitoring. The conceptual design for each of these components is discussed below.

Sediment Remediation

Sediment remediation is proposed in an estimated 80-foot by 100-foot (approximately 0.2 acres) area between sediment sample locations SED-1 and SED-7. Metals-contaminated sediments would be removed, replaced with clean hydrophilic soils, and plant species would be restored. Contaminated sediments would be placed under the landfill cap.

Due to the limited area of sediments to be remediated, and the objective to minimize impacts on the wetlands, traditional large equipment excavation methods would not be appropriate at this site. Conversely, the affected area and volume (300 cy) of contaminated sediments are considered too large to cost-effectively utilize manual removal methods. While the actual sediment remediation method will be determined following discussions between representatives of the Town, NYSDEC and the remediation contractor, the following method is proposed. A haul road would be constructed to the edge of the wetland, and siltation fencing installed around the proposed remediation area. A small backhoe would remove the top one foot of sediments and transfer them to a lined dump truck waiting on the haul road. Sediments would have to be transported, deposited, graded and spread over the landfill for drying. A berm may have to be constructed to control runoff. Appropriate hydrophilic soils would then be placed in the wetland and plant species would be introduced by either a commercially available seed mix or through live transplants from nearby wetlands to promote growth of species already adapted to the area.

Part 360 Cap

The Part 360 cap configuration is shown on Figure 4-1. From bottom to top, the proposed cap and subgrade will consist of the following components:

- Undisturbed existing landfill waste
- Regraded landfill waste, where applicable (primarily at site perimeter)
- Minimum of 6 inches of grading fill
- Geotextile filter/geonet bonded as gas vent layer
- Geotextile friction layer on steeper slopes
- 60-mil textured geomembrane
- 18 inches of general fill barrier protection (capable of promoting vegetative growth in the overlying layer while remaining stable)
- 6 inches of topsoil
- Vegetative cover
- Gas vent risers on 200-foot grid system (one per acre).

Prior to construction of the cap, the landfill and perimeter areas will be stripped and cleared of all vegetation. The landfill will then be regraded per the proposed site subgrade plan for this conceptual design as shown on Plate 2. The intent of the subgrade plan is to minimize the amount of waste regrading, the amount of imported clean fill, and associated air emissions and odors. Some regrading of existing landfill waste is anticipated for portions of the east perimeter to preclude encroachment of cap and perimeter drainage structures into the wetlands. Similarly, portions of the west and southwest edges of the landfill waste require regrading to preclude encroachment into adjacent properties. Some regrading will be necessary to meet a maximum slope on the landfill of 33 percent, and a minimum slope of 4 percent, in accordance with Part 360 regulations. A minimum of 6 inches of grading fill will be placed on top of the landfill as final grading for the subsequent cap construction. The cap subgrade will then be considered suitably prepared.

Use of alternate grading materials (AGM) other than soil will be evaluated during the design phase as a potential cost saving measure. Recommended AGM are non-organic, non-putricible materials of small particle size and include: non-recyclable glass and processed C&D materials. AGM would have to meet the physical and chemical characteristic specifications to be set forth for grading material which will include but not be limited to: Toxicity Characteristic Leaching Procedure (TCLP) testing, organic content, odor, grain size, and plasticity. An AGM Program Operations Plan (POP), which includes specifications for suitable material, will be developed during the Design Phase.

The existing landfill surface configuration and surface drainage patterns will generally be maintained. Surface drainage will, in general, be radially outward with the high point near the center of the landfill. Surface drainage will be directed via perimeter drainage channels into controlled outlet structures towards the wetlands and Webatuck Creek to the north and east of the landfill, as opposed to the west and south, in order to limit groundwater recharge in upgradient areas.

Except for the perimeter areas, the current landfill slopes are relatively flat. Therefore, most of the landfill cap area should not require any special drainage material (i.e., geotextile) over the geomembrane as a cap stability feature.

Access Restrictions

Access restrictions will be implemented at the site in the form of deed restrictions and posting and fencing of the landfill. Posting and fencing will prohibit access to the landfill to protect the integrity of the cap. Deed restrictions will prohibit intrusive activities and the use of groundwater.

Monitoring

Long-term monitoring will be conducted at the site in compliance with Part 360 landfill closure regulations. Monitoring of surface water, sediment, groundwater and landfill gas vents is proposed as detailed on Table 4-5.

6.3 Predesign Studies

Limited predesign studies are proposed for the North East Landfill site. The only study proposed is the assessment of Alternate Grading Material (AGM) as a substitute for offsite soil as grading or general fill. Data collected during the RI/FS is considered to be sufficient and suitable to support the detailed design effort, as discussed below.

The extent of the landfill has been properly delineated by the test trench program during the RI phase so no further work of this nature is necessary. The current topographic survey (April 14, 1993) is considered directly applicable to the design since no onsite activities have altered the grades and landfill settlement should be negligible. Wetlands were formally delineated by the NYSDEC and mapped by URS during the RI/FS. Given the geotechnical information available from the RI, and apparent stable conditions of existing slopes, no further geotechnical investigations are proposed.

As part of the predesign effort it is proposed that the use of AGM be evaluated and an AGM Program Operations Plan be prepared. Procedures for utilization of AGM will be developed in accordance with 6 NYCRR Part 360-1.5 "Beneficial Use", so that source evaluation, tracking, monitoring/inspections, and any environmental/health and safety concerns will be addressed. Since the NYSDEC has permitted using AGM to achieve proper grade in other Part 360 landfill closures, it is anticipated that the NYSDEC will be receptive to placement of suitable AGM beneath the geomembrane, such as that considered for this site.

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APPENDIX A

FS Sediment Sample Data and Evaluation

ANALYTICAL RESULTS -- SEDIMENT
NORTHEAST LANDFILL
METALS RESULTS

Sample I.D.		SED 8	SED 9	SED 10	SED 11
Date Sampled		12/22/94	12/22/94	12/22/94	12/22/94
Date Received		12/28/94	12/28/94	12/28/94	12/28/94
Beginning Depth		0	0	0	0
Ending Depth		18"	24"	24"	12"
% Moisture		82.2	68.9	81.1	52.4
Matrix		Sediment	Sediment	Sediment	Sediment
Compound	Class				
Aluminum	MET	40200 J	3580 J	10500 J	10200 J
Antimony	MET				
Arsenic	MET	26.5 J	545 J	14.8 J	7.1 J
Barium	MET	292 J	1910 J	162 J	37.9 J
Beryllium	MET				
Cadmium	MET		12.8 J		3.2 J
Calcium	MET	19900 J	45800 J	27200 J	31900 J
Chromium	MET	46.2 J		11.5 J	13.7 J
Cobalt	MET	29.1 J	51.7 J	15.3 J	10.7 J
Copper	MET	61.4 J		17.6 J	25.4 J
Iron	MET	76000 J	165000 J	27600 J	20000 J
Lead	MET	59.1 J	8.2 J	47.1 J	41.7 J
Magnesium	MET	23800 J	5860 J	6910 J	19600 J
Manganese	MET	3950 J	23600 J	2940 J	221 J
Mercury	MET	3 J	0.47 J	0.87 J	0.34 J
Nickel	MET		41.4 J	28.1 J	21.9 J
Potassium	MET	2510 J			702 J
Selenium	MET	7.2 J		5.2 J	0.63 J
Silver	MET				
Sodium	MET				
Thallium	MET				
Vanadium	MET	50 J	17.5 J	15.9 J	15.4 J
Zinc	MET	209 J	56.2 J	109 J	130 J

All results reported in mg/kg.

J-values are estimated due to % moisture being >50%.

MADE BY JC DATE 2/21/95
CHKD BY C.N. DATE 2/21/95