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March 1993
PB94-963822

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Superfund
Record of Decision:

Johnstown City Landfill, NY

50272-101

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15. Supplementary Notes

PB94-963822

16. Abstract (Limit: 200 words)

The 68-acre Johnstown City Landfill site is a municipally-operated, unlined landfill situated in the LaGrange Gravel pit located in Johnstown, Fulton County, New York. Land use in the area is predominately mixed residential, agricultural, and recreational. The site overlies both an overburdened and bedrock aquifer, which appear to be hydraulically connected downgradient from the site. The primary surface water in the immediate vicinity of the landfill is Mathews Creek, which along with the associated wetlands, appears to be affected by contamination from the site. The estimated 1,000 people who reside within one mile of the site use private wells to obtain their drinking water supply. The site consists of two flat terraces filled into former borrow pits, and a remnant of a pit along the western side of the landfill, which was used previously to dispose of demolition debris and metals. From 1947 until 1960, 34 acres of the site were used as an open refuse disposal facility, which subsequently was converted into a sanitary landfill. Until 1979, the landfill accepted industrial wastes, which included chromium-treated hides, trimmings, and other materials from local tanneries and textile plants. From 1973 to 1979, sewage sludge

(See Attached Page)

17. Document Analysis a. Descriptors

Record of Decision - Johnstown City Landfill, NY
First Remedial Action - Final
Contaminated Media: soil, sediment, debris, gw
Key Contaminants: VOCs (benzene, PCE, TCE, toluene, xylenes), other organics (PAHs, PCBs, pesticides, phenols), metals (arsenic, chromium, lead), inorganics (cyanide)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 66
	20. Security Class (This Page) None	22. Price

(See ANSI-Z39.18) *See Instructions on Reverse* OPTIONAL FORM 272 (4-77) (Formerly NTIS-35) Department of Commerce

Abstract (Continued)

containing concentrations of chromium, iron, and lead was accepted from the nearby treatment plant and disposed of onsite in open piles. All onsite landfilling operations ceased in 1989. Routine storm water runoff and drainage have created ponded areas on the landfill surface, which have eventually infiltrated into landfill wastes. The associated leachate seeps and occasional ephemeral runoff from the landfill then flowed into, and contaminated, the adjacent LaGrange Gravel pit. This ROD addresses both onsite source and ground water contamination, as the first and final remedial action for this site. The primary contaminants of concern affecting the soil, sediment, debris, and ground water are VOCs, including benzene, PCE, TCE, toluene, and xylenes; other organics, including PAHs, PCBs, pesticides, and phenols; metals, including arsenic, chromium, and lead; and inorganics, including cyanide.

The selected remedial action for this site includes excavating contaminated LaGrange Pit sediment, and placing the excavated material on the existing landfill; regrading and constructing a multi-layer cap over the landfill and excavated sediment; filling any excavated areas with clean fill; allowing ground water to naturally attenuate; expanding the city's municipal water supply to provide potable water to all residences potentially affected by the site; performing a cultural resource survey for onsite and offsite areas to determine sensitivity of the site for cultural resources; monitoring ground water, surface water, and air; maintaining the cap and monitoring and controlling landfill gas emissions, as needed; implementing institutional controls, including deed restrictions, and site access restrictions, including fencing; and providing for a contingency in the event that monitoring indicates that the ground water is not being restored to acceptable levels through natural attenuation. The contingency remedy involves extraction and onsite treatment of ground water using physical/chemical processes such as pH adjustment, chemical precipitation, and carbon adsorption, with discharge of the treated water to the aquifer through percolation ponds, injection wells, or direct discharge to surface water. The estimated present worth cost for this remedial action is $16,454,000, which includes an estimated annual O&M cost of $174,000 for 30 years. The estimated present worth cost for the contingency remedy is $32,580,000, which includes an estimated annual O&M cost of $936,000 for 30 years.

PERFORMANCE STANDARDS OR GOALS:

Not provided.

ROD FACT SHEET

SITE

Name:	Johnstown City Landfill
Location:	Town of Johnstown, New York
HRS Score:	48.36

ROD

Date Signed:	March 31, 1993
Remedy:	Landfill Cap/Extension of City Water Supply Line/ and if needed, GW Collection/Treatment/Disposal
Capital Cost:	$13,763,000 - $16,454,000
O & M Cost:	$174,000 - $936,000
Present Worth Cost:	$18,174,000 - $32,580,000

LEAD

Agency:	NYSDEC
Primary Contact:	Robert Nunes (212) 264-2723
Secondary Contact:	Joel Singerman (212) 264-1132
Main PRPs:	City of Johnstown

WASTE

Type:	Volatiles, Semi-Volatiles, Inorganics
Medium:	Soil, groundwater, surface water
Origin:	Municipal and hazardous wastes
Est. Quantity:	Municipal Landfill Size: 68 acres

DECLARATION FOR THE RECORD OF DECISION

Site Name and Location

Town of Johnstown, Johnstown City Landfill, Fulton County, New York

Statement of Basis and Purpose

This decision document presents the selected remedial action for the Johnstown City Landfill site (the "Site"), located in the City of Johnstown, Fulton County, New York, which was chosen in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. §§ 9601-9675, as amended (CERCLA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300. This decision document explains the factual and legal basis for selecting the remedy for the Site. The information supporting this remedial action decision is contained in the administrative record for the Site. The administrative record index is attached (Appendix III).

The New York State Department of Environmental Conservation (NYSDEC) concurs with the selected remedy. NYSDEC will also concur with the contingent remedy, should future water quality data indicate that the ground-water remediation component of the contingent remedy is appropriate. (See Appendix IV.)

Assessment of the Site

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

Description of the Selected Remedy

This operable unit represents the entire remedial action for the Site. It addresses the principal threats to human health and the environment at the Site by controlling the source of contamination and the generation of leachate.

The major components of the selected remedy include:

- Excavation of the LaGrange Gravel Pit sediments and placing the excavated materials on the existing landfill. The pit will be filled with clean fill, so that it may be used as an infiltration basin and/or stormwater collection basin;

- Regrading and compacting the landfill mound to provide a stable foundation for placement of the various layers of the cap and to promote rapid runoff;

- Construction of a multi-layer closure cap over the landfill mound and excavated sediments as per New York State 6 NYCRR Part 360 regulations. The cap, by reducing leachate generation, will act to improve the ground-water quality in the upper (overburden) and lower (bedrock) aquifers and surface-water quality in Mathew Creek through natural attenuation of contaminants;

- Expansion of the Johnstown City water-supply system to provide potable water to all private water supplies potentially impacted by the landfill. Providing city water will require the extension of the City's water lines and construction of a booster pump station; and

- Erection of approximately 6,800 feet of conventional chain-link fencing surrounding the entire landfill mound, with placement of appropriate warning signs.

The effectiveness of the landfill cap will be evaluated through post-construction monitoring of ground-water and surface-water quality. The evaluation will be conducted within 5 years following initiation of construction of the landfill cap, and at any time as needed thereafter, during the long-term monitoring of the Site. Should the monitoring results indicate that either ground-water quality in the upper (overburden) aquifer or the lower (bedrock) aquifer, or surface-water quality in Mathew Creek, is not being restored to acceptable levels through natural attenuation as a result of reduced leachate generation, the following will be implemented:

- Extraction of contaminated ground water from either of the aquifers, as necessary. The extraction system would utilize extraction wells which would induce flow to the wells through drawdown of the ground-water table. Operation of the ground-water extraction system would reduce the migration of contaminants away from the Site;

- Treatment of ground water by a treatment system located permanently on-Site that would use physical/chemical processes such as pH adjustment, chemical precipitation, and carbon adsorption, to remove inorganic and volatile organic contaminants; and

- Discharge of treated ground water by returning it to the aquifer via percolation ponds or injection wells, or by discharging it to a stream, the nearest being Mathew Creek. The discharge standards would be established by NYSDEC.

Declaration

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. In keeping with the statutory preference for treatment as a principal element of the remedy, the contaminated ground water will be collected and treated, if necessary. The landfill material, however, cannot be excavated and treated effectively, because of the size of the landfill and because there are no on-Site "hot spots" that represent the major sources of contamination.

A review of the Site will be conducted no later than five years after commencement of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment, because this remedy will result in hazardous substances remaining on-Site above health-based levels.

William J. Muszynski, P.E. — 3/31/93
Acting Regional Administrator — Date

DECISION SUMMARY
Johnstown City Landfill SITE

City of Johnstown
Fulton County, New York

United States Environmental Protection Agency
Region II
New York, New York
March 1993

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SITE NAME, LOCATION AND DESCRIPTION

The Johnstown City Landfill is a municipally operated, unlined landfill, situated in a 68-acre gravel pit in the Town of Johnstown, Fulton County, New York. The Site is located approximately 1.5 miles northwest of the City of Johnstown and 1.75 miles west of the City of Gloversville. (See Figure 1.)

The landfill consists of two, generally flat terraces filled into former borrow pits. A remnant of a pit once used as a demolition debris and metals disposal area, approximately 30 feet deep, exists on the westward side of the landfill at the base of a steep ridge. (See Figure 2.)

The surrounding area has a mixed residential, agricultural, and recreational land use. Approximately 10 homes are located within 1,000 feet of the Site, and an estimated 80 homes are located within one mile downgradient of the Site. (See Figure 3.) All of these homes have private wells with depths ranging from 10 to 208 feet. The population within a one-mile radius of the Site is approximately 1,000 persons.

The surface-water drainage in the vicinity of the landfill flows generally to the southeast. Surface waters flow from the upland areas, north of the Site, via intermittent drainage ways towards the south-southeast. The primary surface-water feature in the immediate vicinity of the landfill is Mathew Creek. The headwaters of the creek (LaGrange Springs) are located approximately 1,000 feet southeast of the Site. The creek flows southeasterly until it converges with Hall Creek prior to discharging into Cayadutta Creek. The flow of Mathew Creek is interrupted by a manmade pond (Hulbert's Pond) before it converges with Hall Creek. Cayadutta Creek ultimately discharges to the Mohawk River.

Due to differences in surface elevation, storm-water runoff and drainage from West Fulton Street Extension flow onto the surface of the landfill creating ponded water near its northeast corner. The water in this approximately one-acre pond either evaporates or infiltrates into the landfilled wastes. LaGrange Gravel Pit, located approximately 100 feet east of the eastern margin of the landfill, receives surface runoff from hill slopes in its immediate vicinity, minor flows from leachate seeps and occasional ephemeral runoff from the landfill surface. (See Figure 2.) Except for short-lived discharges to LaGrange Gravel Pit, there is no surface water runoff from the landfill. There is no surface water runoff from LaGrange Gravel Pit.

SITE HISTORY AND ENFORCEMENT ACTIVITIES

Site History

Thirty-four acres of the 68-acre Johnstown City Landfill were used as an open refuse disposal facility from 1947 to 1960 before being converted to a sanitary landfill. The landfill accepted industrial wastes from local tanneries and textile plants until April 1979, and sludge from the Gloversville-Johnstown Joint Sewage Treatment Plant from 1973 to April 1979. Landfill operations ceased in June 1989. Much of the tannery wastes were disposed of as chromium-treated hide trimmings and other materials. Sewage sludge was disposed of in open piles at a rate of approximately 20,000 cubic yards per year. The sludge contained concentrations of chromium, iron, and lead. There are no records available which detail the amounts of industrial wastes accepted by the landfill.

On June 10, 1986, the Johnstown City Landfill site was placed on the Superfund National Priorities List.

Enforcement Activities

On June 5, 1987, the state of New York filed suit under CERCLA and state common law against the City of Johnstown, the Gloversville/Johnstown Joint Sewer Board, Bruce Miller Trucking Company, and about a dozen waste generators. Several of the defendants subsequently impleaded approximately 52 third-party defendants, including additional generators, transporters and a number of area municipalities. When the defendants declined to fund an RI/FS, the State and the City of Johnstown entered into an interim consent order, which was approved by Federal Judge Con. G. Cholakis on October 4, 1988.

Under the interim order, the City agreed to conduct an RI/FS of the Site consistent with the NCP and state guidance, and agreed to close the Site by June 1, 1990, or within thirty days of the date a new solid waste management facility in Fulton County (the Mud Road Facility) was to accept refuse, whichever was sooner.

On February 12, 1988, EPA issued Special Notice Letters to 15 parties potentially responsible for contamination at the Site.

During the implementation of the RI/FS, the parties involved in the litigation have conducted extensive document discovery and the defendants have made initial attempts to allocate responsibility. It is NYSDEC's intention to have the responsible parties for the site undertake any remedial activities.

HIGHLIGHTS OF COMMUNITY PARTICIPATION

On May 17, 1989, the City of Johnstown and NYSDEC conducted a public meeting in Johnstown, New York, to inform local officials and interested citizens of the upcoming RI and to respond to any questions from area residents and other attendees. A follow-up public meeting was held on June 13, 1990 to describe the results of the first phase of the RI and to present plans for the second phase of field work.

The RI report, FS report, and the Proposed Plan for the Site were released to the public for comment on January 21, 1993. These documents were made available to the public in the administrative record repositories at the EPA Docket Room in Region II, New York and at the Johnstown Public Library, Johnstown, New York. The documents were also made available at the information repositories at NYSDEC's Albany, New York office, at NYSDEC's Ray Brook, New York office, and at the City of Johnstown Attorney's Office. The public comment period on these documents ended on February 19, 1993.

During the public comment period, a public meeting was held at the Johnstown High School, Johnstown, New York on February 10, 1993 to present the RI/FS reports and the Proposed Plan, to answer questions, and to accept oral comments. At this meeting, representatives from the NYSDEC, the New York State Department of Health (NYSDOH), and EPA answered questions about problems at the Site and the remedial alternatives under consideration. A summary of the comments presented at the public meeting and their responses, as well as written comments received during the public comment period and their responses, are included in the Responsiveness Summary (see Appendix V.)

SCOPE AND ROLE OF OPERABLE UNIT

This response action applies a comprehensive approach, therefore only one operable unit is required to remediate the Site.

Remedial action objectives are specific goals to protect human health and the environment. These objectives are based on available information and standards such as applicable or relevant and appropriate requirements (ARARs) and risk-based levels established in the risk assessment.

The following remedial action objectives were established: 1) prevent human and animal contact with contaminated soil from the landfill surface; 2) prevent erosion of contaminated surface soil through surface-water runoff; 3) minimize the infiltration of rainfall or snow melt into the landfill, thus reducing the quantity of water percolating through the landfill materials and leaching out contaminants; 4) mitigate the off-Site migration of contaminated ground water; 5) prevent unacceptable exposure to off-Site contaminated ground water; 6) restore ground-water quality to levels which do not exceed state or federal drinking-water standards; 7) prevent ingestion of on-Site ground water; 8) control generation and prevent migration of subsurface landfill gas; and 9) prevent unacceptable exposure to vapors from the landfill.

NYSDEC is the lead agency for this project; EPA is the support agency.

SUMMARY OF SITE CHARACTERISTICS

The RI field work was carried out in two phases: Phase I, between June 1989 and June 1990; and Phase II, between July 1990 and March 1992. Media sampled during the RI included subsurface soil, ground water, surface water, sediments, and air. The frequency of detection, lowest and highest concentrations detected, and location of highest concentrations detected, are shown for all sampled on-Site and off-Site ground water, surface water, subsurface soils, and sediments in Tables 1a, 1b, 2a, 2b, 3a, and 3b. The RI also included ground-water flow studies to evaluate the hydrogeologic conditions at and in the vicinity of the landfill, a wetlands delineation in the vicinity of the Mathew Creek area, and ecological studies in Mathew Creek and Halls Brook.

Subsurface soil samples were collected for all ground-water monitoring wells shown on Figure 4, except for MW-15 and MW-19. Soils located directly beneath the landfill exhibited the majority of the soil contamination. Eight volatile organic compounds (VOCs), acetone, methylene chloride, xylene, benzene, ethylbenzene, 2-butanone, 4-methyl-2-pentanone, and toluene were detected in landfill subsurface soil samples (MW-16 through MW-18) at concentrations ranging from 3 micrograms per kilogram (µg/kg) to 440 µg/kg. Benzoic acid, phthalate, and polycyclic aromatic hydrocarbon (PAH) compounds comprised most of the semi-volatile organic compound (SVOC) contamination detected in landfill soil zones, with phthalate esters observed to have the highest range of concentrations (42 µg/kg to 1,100 µg/kg). Eighteen metals were detected in subsurface soil samples collected within the landfill ranging in concentrations from 0.43 milligrams per kilogram (mg/kg) to 72,000 mg/kg. Eight of these (antimony, calcium, chromium, lead, magnesium, sodium, aluminum, and zinc) exceeded background values. Eleven pesticides were also detected in landfill subsurface soil samples at concentrations between 4.1 µg/kg and 37 µg/kg. Downgradient inorganic substances found in all of the 4 subsurface soil samples (MW-9 through MW-12) included aluminum, arsenic, barium, beryllium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, sodium, vanadium, and zinc, at concentrations ranging from 0.31 mg/kg to 39,000 mg/kg. Organic contaminants that were found in more than half of the 9 downgradient subsurface soil samples (MW-1 through MW-4, MW-8 through MW-12) included acetone, methylene chloride, toluene, and tetrachloroethylene at concentrations between 0.6 µg/kg and 75 µg/kg.

The volatile contamination detected in the shallow downgradient aquifer (MW-1 through MW-4, MW-8 through MW-12, and MW-15) included 13 VOCs. Concentrations of these contaminants ranged from 0.2 micrograms per liter (µg/L) to 62.0 µg/L, with the highest being toluene detected at MW-3S, which is located near the LaGrange Gravel Pit. Semi-volatile contamination in downgradient monitoring wells included phthalate ester compounds, polycyclic aromatics, methylphenol, and benzoic acid at concentrations between 0.3 µg/L and 150 µg/L. Twenty metals were detected in shallow wells downgradient of the landfill at levels often exceeding background levels. Eight metals (iron, manganese, sodium, arsenic, lead, chromium, copper, and zinc) exceeded EPA and/or NYSDEC standards in downgradient monitoring wells. Two pesticides were detected in downgradient monitoring wells, MW-9S and MW-11D, at 0.04 µg/L (delta-BHC) and 0.05 µg/L (Endosulfan 1), respectively.

Acetone and bis(2-ethylhexyl)phthalate were the primary contaminants detected within the bedrock ground-water aquifer at concentrations generally much greater than those found at the source (landfill) wells. The highest concentration of acetone (2,900 µg/L) was detected at MW-7D located northwest of the landfill. The highest concentration of bis(2-ethylhexyl)phthalate (150 µg/L) was detected at MW-3D located near the LaGrange Gravel Pit.

Five VOCs, acetone, methylene chloride, xylene, benzene, and ethylbenzene were detected in the ground-water sample collected from landfill well MW-16, at concentrations ranging from 9 µg/L (benzene) to 230 µg/L (xylene). Generally, the highest concentrations of inorganic contaminants in ground water were also detected at MW-16. Six pesticide compounds, none of which were found in downgradient ground-water samples, were detected at MW-16 at concentrations ranging from 0.01 µg/L (4,4'-DDE) to 0.35 µg/L (4,4'-DDD). Based on water-level data, these results may be characteristic of leachate. Benzene and ethylbenzene were detected in landfill well MW-19, at 0.9 µg/L and 7 µg/L, respectively. Eleven SVOCs were detected in landfill wells MW-16, MW-18, and MW-19 at concentrations ranging from 0.6 µg/L (di-n-octylphthalate) to 24 µg/L (bis(2-Ethylhexyl)phthalate). No VOCs or pesticides were detected in landfill monitoring well MW-18. No polychlorinated biphenyls (PCBs) were detected in any of the three sampled landfill monitoring wells.

No inorganic contaminants found in residential well samples exceeded New York State or EPA primary drinking water standards. Some compounds, such as iron, manganese, zinc, and total dissolved solids (TDS), were detected at concentrations which may affect aesthetic qualities of drinking water (e.g., taste, odor, and staining of fixtures). VOC compounds detected in residential well samples included acetone, carbon disulfide, methylene chloride, trichloroethylene, 1,1,1-trichloroethane, and toluene, but were found at concentrations below state and federal drinking water standards. Acetone was detected in 6 of the 52 samples collected, at concentrations ranging from 3 to 6 µg/L. Carbon disulfide was detected in 4 of the 52 samples, at concentrations ranging from 0.3 to 3 µg/L. Methylene chloride was detected in 3 of the 52 samples at concentrations up to 2 µg/L. Trichloroethylene, 1,1,1-trichloroethane, and toluene were each detected in one of the 52 samples collected, at 2, 3, and 2 µg/L, respectively. Three phthalate esters were detected in residential well samples. Bis(2-ethylhexyl)phthalate was detected in 34 of the 39 residential wells sampled, at concentrations ranging from 2 to 66 µg/L. In 4 of these samples, concentrations of bis(2-ethylhexyl)phthalate exceeded the NYSDEC ground-water standard of 50 µg/L. (In all three sampling rounds, bis(2-ethylhexyl)phthalate was also detected in laboratory samples, indicating that its presence in collected residential well samples may be attributed to contamination in the laboratory, and may not be representative of actual water quality.) Di-n-butylphthalate was detected in 6 of the 52 samples collected at concentrations ranging from 0.8 to 2 μg/L. N-nitrosodiphenylamine was detected in one of the 52 samples at a concentration of 2 μg/L. No pesticide or PCB compounds were detected in residential well samples.

Surface-water quality and sediment sampling locations are shown on Figures 5a and 5b. Inorganic compounds found in surface-water samples collected from Mathew Creek included aluminum, antimony, barium, chromium, cobalt, copper, iron, lead, magnesium, mercury, nickel, potassium, selenium, sodium, zinc, cyanide, sulfate, chloride, bicarbonate, and ammonia-nitrogen at concentrations ranging from 1.2 μg/L (selenium) to 111,000 μg/L (calcium). Concentrations were generally higher at the headwater springs than at other locations. However, several metals, including chromium, lead, iron, and zinc, were detected at the highest concentration at the furthest downstream sampling location (Station #4). Six VOCs, acetone, methylene chloride, toluene, trichloroethylene, tetrachloroethylene, and chlorobenzene were also detected in Mathew Creek samples at concentrations ranging from 0.7 μg/L (chlorobenzene) to 24 μg/L (acetone). Acetone, methylene chloride, and toluene were detected in more than one sample. Three phthalate ester compounds, diethylphthalate, di-n-butylphthalate, and bis(2-ethylhexyl)phthalate, were detected in Mathew Creek samples at concentrations ranging from 0.4 μg/L (diethylphthalate) to 16 μg/L (bis(2-ethylhexyl)phthalate). Seven of the 8 surface water samples collected in Mathew Creek had detectable concentrations of bis(2-ethylhexyl)phthalate that exceeded the NYSDEC surface water standard of 0.6 μg/L. No pesticides or PCBs were detected in any surface-water samples from Mathew Creek.

Surface-water samples were collected from the LaGrange Gravel Pit (Sta #5 on Figure 5a) during the second and third rounds of on-Site water-quality sampling. The concentrations of inorganic compounds in the LaGrange Pit were typically consistent with those detected in the ground water around the landfill. The sample collected during Round 2 had detectable concentrations of 6 VOCs, namely, acetone, methylene chloride, benzene, 2-butanone, 4-methyl-2-pentanone, and toluene, at concentrations ranging from 2 μg/L (benzene) to 250 μg/L (2-butanone). The Round 2 water-quality sample also indicated the presence of 9 SVOCs from the LaGrange Gravel Pit at concentrations between 0.2 μg/L (di-n-octylphthalate) and 190 μg/L (benzoic acid). Five of these compounds are phthalate esters and were prevalent in both soil and ground-water samples. No pesticides or PCBs were detected in any surface-water samples from LaGrange Pit.

Sediment contamination in Mathew Creek included metals, ammonia-nitrogen, VOCs, SVOCs, and pesticides. Concentrations for arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, and nickel exceeded NYSDEC Sediment Criteria Guidance Values in one or more sediment samples from Mathew Creek. Eight VOCs, acetone, methylene chloride, trichloroethylene, chloroform, benzene, 2-

butanone, carbon disulfide, and toluene, were detected at concentrations ranging from 2 μg/kg to 380 μg/kg (acetone). Twenty-two SVOCs were detected in sediment samples at concentrations ranging from 4 μg/kg (benzo(g,h,i)perylene) to 4,500 μg/kg (benzoic acid). Two pesticides, delta-BHC and 4,4'-DDE, were detected at concentrations ranging from 2.1 μg/kg (4,4'-DDE) to 13 μg/kg (delta-BHC).

Sediment contamination in the LaGrange Gravel Pit also included inorganic compounds, VOCs, SVOCs, and pesticides. Twenty-one metals were detected at concentrations ranging from 0.14 mg/kg (mercury) to 106,000 mg/kg (calcium). Six VOCs, acetone, methylene chloride, benzene, 2-butanone, 4-methyl-2-pentanone, and toluene at concentrations ranging from 2 μg/kg (benzene) to 99 μg/kg (acetone) were detected. Nineteen SVOCs were detected at concentrations ranging from 11 μg/kg (fluorene) to 1,400 μg/kg (naphthalene). Four pesticides, 4,4'-DDE, 4,4'-DDD, heptachlor, and aldrin were detected at concentrations ranging from 1.8 μg/kg (aldrin) to 170 μg/kg (4,4'-DDE).

Ambient air in the vicinity of the landfill was measured for VOCs and particulate chromium. Acetone, benzene, toluene, 2-butanone, 1,1,1-trichloroethane, and carbon tetrachloride were detected at concentrations ranging from 0.47 micrograms per cubic meter ($\mu g/m^3$) (carbon tetrachloride) to 20.6 $\mu g/m^3$ (acetone). The highest total concentration of VOCs for any one sample was 23.2 $\mu g/m^3$. Airborne chromium was detected at concentrations ranging from 0.002 to 0.005 $\mu g/m^3$. All of the airborne VOCs and chromium detected during the RI are within the guideline values for both occupational values and New York State guidance criteria. (See Tables 4 and 5.)

The hydrogeological investigation determined that two aquifers exist beneath the Johnstown City Landfill. The upper (overburden) aquifer flows through till, sand and gravel, and flows generally towards the southeast and south from the landfill following surface drainage patterns. A geologic cross section from the northeastern boundary of the landfill to the LaGrange Springs area is shown in Figure 6. Ground water in the overburden and shallow bedrock aquifers appears to be hydraulically connected downgradient from the Site and to discharge into the wetlands area of LaGrange Springs and Mathew Creek located southeast of the Site. In contrast to the ground-water flow pattern in the shallow water table, deep (bedrock) ground water generally flows from west to east across the Site.

The immediate area of the landfill is underlain by the Canojoharie Shale, a mid-Ordovician age, calcarious shale with occasional pyrite lobes. The bedrock was found to be mildly fractured in the upper 20 feet of the unit. Depth to bedrock ranges across the site from about 30 feet to 120 feet.

Wetland areas associated with Mathew Creek were identified using aerial photography, the NYSDEC wetland map on the Johnstown area, and the U.S. Soil Conservation Service draft soils map of the area. Wetland boundaries were verified in the field in May 1990 by viewing vegetation and hydrology. (See Figure 7.) Wetland types include palustrine forest, scrub-shrub, emergent, and open water. A wetland assessment using the Hollands and Magee (1985) method indicated above-average scores for the biological, hydrological, and socio-economic functions of the wetlands.

SUMMARY OF SITE RISKS

Human Health Risk Assessment

A baseline risk assessment was conducted to evaluate the potential risks to human health and the environment associated with the Site in its current state. The baseline risk assessment focused on contaminants in the soil, ground water, and air which are likely to pose significant risks to human health and the environment. A list of the contaminants of potential concern in ground water, soil, and air is found in Table 6.

The baseline risk assessment evaluated the health effects which could result from exposure to contamination as a result of ten basic exposure pathways. These pathways included: 1) ingestion of soil; 2) dermal contact with soil; 3) inhalation of fugitive dust from the landfill; 4) ingestion of Mathew Creek surface water; 5) dermal contact with Mathew Creek surface water; 6) ingestion of Mathew Creek sediments; 7) dermal contact with Mathew Creek sediments; 8) ingestion of ground water; 9) inhalation of outdoor air; and 10) inhalation of ground-water contaminants while showering. The exposure pathways were evaluated under both current and potential future land-use conditions, except for exposures to landfill soil, for which only current conditions were considered. Three potential receptors were identified: young (ages 6-18) trespassers; adult, young (ages 6-18) and child (ages 0-6) residents living downgradient and off-Site; and young (ages 6-18) and adult users of Mathew Creek. These exposure pathways were evaluated separately for adults and children and are listed in Table 7. Exposure intakes (doses) were calculated for each receptor for all exposure pathways considered.

Under current EPA guidelines, the likelihood of carcinogenic (cancer causing) and noncarcinogenic effects due to exposure to site chemicals are considered separately. It was assumed that the toxic effects of the Site-related chemicals would be additive. Thus, carcinogenic and noncarcinogenic risks associated with exposures to individual compounds of concern were summed to indicate the potential risks associated with mixtures of potential carcinogens and noncarcinogens, respectively.

Noncarcinogenic risks were assessed using a hazard index (HI) approach, based on a comparison of expected contaminant intakes and safe levels of intake (Reference Doses). Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects. RfDs, which are expressed in units of mg/kg-day, are estimates of daily exposure levels for humans which are thought to be safe over a lifetime (including sensitive individuals). Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) are compared with the RfD to derive the hazard quotient for the contaminant in the particular medium. The reference doses for the compounds of concern at the Site are presented in Table 8.

The hazard index is obtained by adding the hazard quotients for all compounds across all media. A hazard index greater than 1 indicates that the potential exists for noncarcinogenic health effects to occur as a result of Site-related exposures. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media.

The HI was significant (i.e., greater than 1.0) for all age groups ingesting ground water under current land use. The HI for ingesting ground water was estimated to be 6.5, 3.3, and 2.5 for children, youths, and adults, respectively. In the case of residents ingesting ground water, the major contribution to noncancer health risk is attributable to ingestion of antimony and thallium in drinking water by nearby residents. A summary of the noncarcinogenic risks associated with the chemicals evaluated across various exposure pathways is found in Table 9. It should be noted that antimony was not detected in any of the 51 water quality samples collected in downgradient ground-water monitoring wells, and thallium was detected in only 2 of the 51 monitoring well samples. Among the 52 residential wells sampled, antimony and thallium were detected in 8 and 6 of the water-quality samples, respectively. Therefore, these compounds may originate from the native soils and not from the landfill waste mass. Without antimony and thallium, the HI for residents ingesting ground water for current land use is below 1.0 for all age groups. Under future land use conditions, which assumes that the contaminated ground water beneath the landfill migrates to a residential receptor, the HI for adults and children ingesting ground water was estimated to be 1.5 and 1.0, respectively. The major contributor to these risks is arsenic.

The HI was also significant for youths and adults wading and fishing in Mathew Creek. The HI was 1.2 and 1.1 for youths and adults, respectively. The major contributors to these risks are lead and mercury.

Potential carcinogenic risks were evaluated using the cancer slope factors developed by EPA for the contaminants of concern. Cancer slope factors (SFs) have been developed by EPA's Carcinogenic Risk Assessment Verification Endeavor for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. SFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to generate an upper-bound estimate of the excess lifetime cancer risk associated with exposure to the compound at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the SF. Use of this approach makes the underestimation of the risk highly unlikely. The SF for the compounds of concern are presented in Table 10.

For known or suspected carcinogens, EPA considers excess upper bound individual lifetime cancer risks of between 10^{-4} to 10^{-6} to be acceptable. This level indicates that an individual has not greater than a one in ten thousand to one in a million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year period under specific exposure conditions at the Site. Under the current land-use conditions, the cumulative cancer risk for all receptors evaluated (i.e., adults, youths, children) was 6 X 10^{-5}. The overwhelming contribution to this risk is attributable to residents ingesting contaminated ground water. This risk is within EPA's acceptable cancer risk range of 10^{-4} to 10^{-6}. However, under future land-use conditions, which assumes that the contaminated ground water beneath the landfill migrates to a residential receptor, a cancer risk of 2 X 10^{-4} was found for the adult receptor. This risk, which slightly exceeds the acceptable cancer range, is attributable to the ingestion of ground water, with beryllium accounting for most of the risk. A summary of the carcinogenic risks for the chemicals evaluated across various current exposure pathways is found on Table 11.

The calculations were based on the contaminants detected in soils, on-Site monitoring wells, and air. It was assumed that in the future case, on-Site monitoring wells would be used for residential purposes. Risk estimates were developed by taking into account various conservative assumptions about the likelihood of a person being exposed to the various contaminated media. It should be noted too, that the carcinogenic and noncarcinogenic risks attributable to lead, which was detected in 44 of 54 on-Site samples at an average concentration of 38.6 µg/L, cannot be quantified because cancer and noncancer toxicity factors have not been developed for this compound. However, EPA considers lead to be a probable carcinogen, and is known to interfere with the central nervous system as a noncarcinogen. An action level of 15 µg/L was established by EPA for this compound, meaning that some remedial measures should be implemented, if the concentration of lead in drinking water exceeds this level.

Uncertainties

The procedures and inputs used to assess risks in this evaluation, as in all such assessments, are subject to a wide variety of uncertainties. In general, the main sources of uncertainty include:

- environmental chemistry sampling and analysis
- environmental parameter measurement
- fate and transport modeling
- exposure parameter estimation
- toxicological data

Uncertainty in environmental sampling arises in part from the potentially uneven distribution of chemicals in the media sampled. Consequently, there is significant uncertainty as to the actual levels present. Environmental chemistry analysis error can stem from several sources including the errors inherent in the analytical methods and characteristics of the matrix being sampled.

Uncertainties in the exposure assessment are related to estimates of how often an individual would actually come in contact with the chemicals of concern, the period of time over which such exposure would occur, and in the models used to estimate the concentrations of the chemicals of concern at the point of exposure.

Uncertainties in toxicological data occur in extrapolating both from animals to humans and from high to low doses of exposure, as well as from the difficulties in assessing the toxicity of a mixture of chemicals. These uncertainties are addressed by making conservative assumptions concerning risk and exposure parameters throughout the assessment. As a result, the baseline risk assessment provides upper bound estimates of the risks to populations near the Landfill, and is highly unlikely to underestimate actual risks related to the Site.

More specific information concerning public health risks, including a quantitative evaluation of the degree of risk associated with various exposure pathways, is presented in the RI report.

Ecological Risk Assessment

A four-step process is utilized for assessing site-related ecological risks for a reasonable maximum exposure scenario: Problem Formulation -- a qualitative evaluation of contaminant release, migration, and fate; identification of contaminants of concern, receptors, exposure pathways, and known ecological effects of the contaminants; and selection of endpoints for further study. Exposure Assessment -- a quantitative evaluation of contaminant release, migration, and fate; characterization of exposure pathways and receptors; and measurement or estimation of exposure point concentrations. Ecological Effects Assessment -- literature reviews, field studies, and toxicity tests, linking contaminant concentrations to effects on ecological receptors. Risk Characterization -- measurement or estimation of both current and future adverse effects.

Sediment, surface water, vegetation, wildlife, fish, and macroinvertebrates were assessed along Mathew Creek and a nearby reference stream, Halls Brook. Fish tissue was collected and analyzed for the presence of heavy metals and pesticides. In-situ and laboratory bioassays were performed to evaluate the toxicity of Mathew Creek surface water to aquatic life.

The contaminants in Mathew Creek sediments appear to be adversely affecting the aquatic communities, and may potentially affect wildlife species such as beaver, muskrat, and waterfowl, which are dependent on food resources from the stream. Arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, and nickel were all present in stream sediments at concentrations that exceeded criteria established by NYSDEC. Exceeding these criteria suggests that a given metal has reached a concentration that can possibly result in chronic, sublethal effects that can include inhibition of reproduction, inefficient metabolism of food items, alteration of an organism's ability to compete, etc. The Mathew Creek biota most likely at risk of exposure to metal contaminated sediments (other than mercury) are benthic macroinvertebrates such as worms, beetles, and midges.

Free-swimming aquatic organisms in Mathew Creek may also be adversely affected by creek contamination, particularly high ammonia concentrations in surface water. Water quality samples collected in Mathew Creek, over three sampling rounds, indicated the presence of 8 inorganic substances, namely, aluminum, iron, lead, manganese, selenium, cyanide, zinc, and ammonia-nitrogen, at concentrations above NYSDEC surface-water standards and/or EPA Ambient Water Quality freshwater toxicity criteria. Concentrations of aluminum, iron, and cyanide were also above EPA acute freshwater toxicity criteria. Aluminum and cyanide exceeded the EPA acute fresh water toxicity criteria at downstream stations in Mathew Creek. Ammonia-nitrogen exceeded the EPA acute fresh water toxicity criterion at the headwater springs and just downstream of Hulbert pond. Vegetation does not appear to be adversely affected by contaminants in Mathew Creek.

In summary, actual or threatened releases of hazardous substances from the Site, if not addressed by the preferred alternative or one of the other active measures considered, may present a current or potential threat to public health, welfare or the environment.

DESCRIPTION OF REMEDIAL ALTERNATIVES

CERCLA requires that each selected site remedy be protective of human health and the environment, be cost-effective, comply with other statutory laws, and utilize permanent solutions, alternative treatment technologies and resource recovery alternatives to the maximum extent practicable. In addition, the statute includes a preference for the use of treatment as a principal element for the reduction of toxicity, mobility, or volume of the hazardous substances.

This Record of Decision evaluates in detail, 7 remedial alternatives for addressing the contamination associated with the Site. The time to implement reflects only the time required to construct or implement the remedy and does not include the time required to design the remedy, negotiate with the responsible parties, or procure contracts for design and construction. These alternatives are described below.

Alternative SC-1: No Action

Capital Cost:	$14,000
Operation and Maintenance Cost:	$119,000
Present-Worth Cost:	$1,860,000
Time to Implement:	3 months

The Superfund program requires that the "no-action" alternative be considered as a baseline for comparison with the other alternatives. The no-action remedial alternative does not include any physical remedial measures that address the problem of contamination at the Site. However, this response action does include the implementation of a long-term ground-water, surface-water and sediment-monitoring program. Water quality samples would be collected on a quarterly basis from upgradient, on-Site and downgradient ground-water monitoring wells and from locations on Mathew Creek. Sediment samples would be collected from the creek bed. Parameters to be sampled and analyzed would be in accordance with 6 NYCRR Part 360 baseline and routine parameters.

The no-action response also includes the development and implementation of a public awareness and education program for the residents in the area surrounding the Site. This program would include the preparation and distribution of informational press releases and circulars and convening public meetings. These activities would serve to enhance the public's knowledge of the conditions existing at the Site. The capital cost for the public awareness program is approximately $14,000. This alternative would also require the involvement of local government, various health departments and environmental agencies.

Because this alternative would result in contaminants remaining on-Site above health-based levels, CERCLA requires that the Site be reviewed every five years. If justified by the review, remedial actions may be implemented to remove or treat the wastes.

Alternative SC-2: Limited Action, Residential Water Replacement

Capital Cost:	$8,343,000
Operation and Maintenance Cost:	$174,000
Present-Worth Cost:	$11,034,000
Time to Implement:	3 years

This alternative includes a Site access restriction which would consist of surrounding the entire landfill mound with approximately 6,800 feet of conventional chain-link fencing and placing appropriate warning signs. In addition to the access restriction, institutional controls would be implemented to restrict the use of the land because of the threat of contamination. This may occur in the form of local ordinances or deed restrictions. As part of the limited action alternative, the landfill would be regraded to prevent stormwater from ponding on the landfill mound, and to allow rapid runoff from the Site, while minimizing soil erosion. The regrading would include excavation of the LaGrange Gravel Pit sediments, placing the excavated material on the existing landfill, and covering them. The pit would then be filled with clean fill so that it may be used as an infiltration basin, and/or an area to collect stormwater.

The limited-action alternative also calls for the expansion of the Johnstown City water supply system to provide potable water to all downgradient private water supplies potentially impacted by the landfill. Providing city water would require the extension of the City's water lines and a booster pump station requiring major construction. Under this alternative, at least 24,600 feet of water line would be constructed.

Similar to Alternative SC-1, this alternative would also include long-term monitoring of ground water, surface water and sediments, and the implementation of a public awareness program to ensure that the nearby residents are familiar with all aspects of this response action.

Because this alternative would result in contaminants remaining on-Site above health-based levels, CERCLA requires that the Site be reviewed every five years. If justified by the review, remedial actions may be implemented to remove or treat the wastes.

Alternative SC-3: Installation of 6 NYCRR Part 360 Landfill Cap, Residential Water Replacement

Capital Cost:	$13,763,000
Operation and Maintenance Cost:	$174,000
Present-Worth Cost:	$16,454,000
Time to Implement:	3 years

The major features of this alternative include constructing a multi-layer closure cap over the landfill mound, supplying city water to replace existing private wells, and erecting a security fence. The replacement of private water sources with Johnstown City water, land use restrictions, and fencing components are identical to those described in Alternative SC-2. Prior to the construction of the cap, the landfill mound would have to be regraded and compacted to provide a stable foundation for placement of the various layers of the cap and to provide rapid runoff as described in Alternative SC-2. The landfill cap would be designed and constructed as per New York State 6 NYCRR Part 360 regulations. A landfill cap meeting these requirements would consist of a filter fabric, 12 inches for a gas venting layer, a 40 mil geomembrane (or 18 inches of clay), 24 inches of drainage material and six inches of topsoil. Capping the landfill would minimize the release of the additional leachate into ground water and would be expected to allow reduction of ground-water contaminants by processes of natural attenuation which may include dilution, biodegradation and sorption. Landfill gases would be monitored and vented into the atmosphere or controlled as needed.

Similar to Alternative SC-1, this alternative would also include long-term monitoring of ground water, surface water, and sediments, and the implementation of a public awareness program to ensure that the nearby residents are familiar with all aspects of this response action.

Because this alternative would result in contaminants remaining on-Site above health-based levels, CERCLA requires that the Site be reviewed every five years. If justified by the review, remedial actions may be implemented to remove or treat the wastes.

Alternative SC-4: Installation of RCRA Landfill Cap, Residential Water Replacement

Capital Cost:	$19,729,000
Operation and Maintenance Cost:	$174,000
Present-Worth Cost:	$22,420,000
Time to Implement:	3 years

The major features of this alternative include constructing a multi-layer closure cap over the landfill mound, supplying city water to residences, and erecting a security fence. This alternative is identical to Alternative SC-3 except that a RCRA capping system would be used instead of the 6 NYCRR Part 360 cap that would be implemented under Alternative SC-3. The RCRA cap system differs from the NYCRR cap by requiring a 24-inch thick soil barrier layer (NYCRR requires 18 inches, if soil is used) and a 40 mil geomembrane (NYCRR requires either the membrane or the soil barrier layer), a 12-inch thick drainage layer (NYCRR requires 24 inches) and a 24-inch thick topsoil layer (NYCRR requires 6-inch thick topsoil). Capping the landfill would minimize the release of the additional leachate into ground water and would be expected to allow reduction of ground-water contaminants by processes of natural attenuation which may include dilution, biodegradation and sorption. Landfill gases would be vented into the atmosphere or controlled, as needed.

Similar to Alternative SC-1, this alternative would also include long-term monitoring of ground water, surface water, and sediments, and the implementation of a public awareness program to ensure that the nearby residents are familiar with all aspects of this response action.

Because this alternative would result in contaminants remaining on-Site above health-based levels, CERCLA requires that the Site be reviewed every five years. If justified by the review, remedial actions may be implemented to remove or treat the wastes.

Alternative SC-5: Ground Water Collection/Treatment/Discharge, Residential Water Replacement

Capital Cost:	$12,754,000
Operation and Maintenance Cost:	$936,000
Present-Worth Cost:	$27,160,000
Time to Implement:	3 years

This remedial alternative includes the collection of contaminated ground water in the upper (overburden) aquifer and/or the lower (bedrock) aquifer, followed by its treatment and discharge via percolation ponds or injection wells. Ground water would be extracted utilizing extraction wells which would induce ground-water flow to the wells by drawdown development. Ground-water flow leaving the Site would be collected by the creation of overlapping zones of influence of the extraction wells. The ground-water treatment system would be located permanently at the Johnstown City Landfill site and would utilize physical-chemical processes, such as pH adjustment, chemical precipitation, and carbon adsorption, to remove inorganic and volatile organic contaminants. Treated ground water would be discharged by returning it to the aquifer, or by discharging to a stream, the nearest being Mathew Creek. The discharge standards would be established by NYSDEC.

The other major features of this alternative include regrading with a two-foot soil cover, residential water replacement with Johnstown City public water, security fencing, and deed restrictions as described in Alternative SC-2.

Similar to Alternative SC-1, this alternative would also include long-term monitoring of ground water, surface water, and sediments, and the implementation of a public awareness program to ensure that the nearby residents are familiar with all aspects of this response action.

Because this alternative would result in contaminants remaining on-Site above health-based levels, CERCLA requires that the Site be reviewed every five years. If justified by the review, remedial actions may be implemented to remove or treat the wastes.

Alternative SC-6: 6 NYCRR Part 360 Cap, Residential Water Replacement, Ground Water Collection/Treatment/Discharge

Capital Cost:	$18,174,000
Operation and Maintenance Cost:	$936,000
Present-Worth Cost:	$32,580,000
Time to Implement:	3 years

This alternative consists of the following: constructing a multi-layer NYCRR closure cap over the landfill mound as in Alternative SC-3; treating extracted ground water with discharge to the aquifer or surface water as in Alternative SC-5; supplying city water to local residents; erecting a security fence around the landfill; and implementing institutional controls as in Alternative SC-2.

Similar to Alternative SC-1, this alternative would also include long-term monitoring of the ground water, surface water, and sediments, and the implementation of a public awareness program to ensure that the nearby residents are familiar with all aspects of this response action.

Because this alternative would result in contaminants remaining on-Site above health-based levels, CERCLA requires that the Site be reviewed every five years. If justified by the review, remedial actions may be implemented to remove or treat the wastes.

Alternative SC-7: RCRA Cap, Residential Water Replacement, Ground Water Collection/Treatment/Discharge

Capital Cost:	$24,139,000
Operation and Maintenance Cost:	$936,000
Present-Worth Cost:	$38,545,000
Time to Implement:	3 years

This alternative consists of the construction of a multi-layer RCRA closure cap over the landfill mound as in Alternative SC-4; treatment of extracted ground water followed by discharge to surface water, as in Alternative SC-5; supplying city water to local residents; implementing ground water and landfill gas monitoring programs; erecting a security fence around the landfill; and implementing institutional controls, as in Alternative SC-2.

Similar to Alternative SC-1, this alternative would also include long-term monitoring of ground water, surface water and sediments, and the implementation of a public awareness program to ensure that the nearby residents are familiar with all aspects of this response action.

Because this alternative would result in contaminants remaining on-Site above health-based levels, CERCLA requires that the Site be reviewed every five years. If justified by the review, remedial actions may be implemented to remove or treat the wastes.

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

During the detailed evaluation of remedial alternatives, each alternative was assessed utilizing nine evaluation criteria as set forth in the NCP and OSWER Directive 9355.3-01. These criteria were developed to address the requirements of Section 121 of CERCLA to ensure all important considerations are factored into remedy selection decisions.

The following "threshold" criteria are the most important, and must be satisfied by any alternative in order to be eligible for selection:

1. Overall protection of human health and the environment addresses whether or not a remedy provides adequate protection and describes how risks posed through each exposure pathway (based on a reasonable maximum exposure scenario) are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

2. Compliance with ARARs addresses whether or not a remedy would meet all of the applicable or relevant and appropriate requirements of federal and state environmental statutes and requirements or provide grounds for invoking a waiver.

The following "primary balancing" criteria are used to make comparisons and to identify the major trade-offs between alternatives:

3. Long-term effectiveness and permanence refers to the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met. It also addresses the magnitude and effectiveness of the measures that may be required to manage the risk posed by treatment residuals and/or untreated wastes.

4. Reduction of toxicity, mobility, or volume through treatment is the anticipated performance of a remedial technology, with respect to these parameters, that a remedy may employ.

5. Short-term effectiveness addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation periods until cleanup goals are achieved.

6. Implementability is the technical and administrative feasibility of a remedy, including the availability of materials and services needed.

7. Cost includes estimated capital and operation and maintenance costs, and the present worth costs.

The following "modifying" criteria are considered fully after the formal public comment period on the Proposed Plan is complete:

8. State acceptance indicates whether, based on its review of the RI/FS and the Proposed Plan, the State supports, opposes, and/or has identified any reservations with the preferred alternative.

9. Community acceptance refers to the public's general response to the alternatives described in the Proposed Plan and the RI/FS reports. Factors of community acceptance to be discussed include support, reservation, and opposition by the community.

A comparative analysis of the remedial alternatives based upon the evaluation criteria noted above follows.

Overall Protection of Human Health and the Environment

The no-action alternative, Alternative SC-1, would be the least protective of human health and the environment since it does not address any of the remedial action objectives established for the Site. Alternative SC-2 would be more effective than Alternative SC-1 in protecting human health and the environment by reducing risks attributed to direct exposure and from ingestion of contaminated drinking water. Direct exposure would be reduced somewhat by constructing fences, posting signs, and implementing institutional controls which would limit access to the Site by trespassers and children. Risks from ingestion of contaminated ground water would be reduced since the landfill would be regraded to prevent stormwater from ponding on the landfill mound and to allow for rapid runoff from the Site while minimizing soil erosion. It is estimated that this would limit infiltration of precipitation into the landfill and reduce the generation of landfill leachate by 36 percent. Also, extension of city water services proposed in Alternative SC-2 would reduce the risk associated with ingestion and exposure to contaminated ground water.

The closure cap systems of Alternatives SC-3 and SC-4, which include an impermeable layer, would further reduce run-on and infiltration of rainfall and snow melt into the landfill, thus reducing the quantity of water percolating through the landfill materials and leaching out contaminants. It is estimated that Alternative SC-3 (NYCRR impermeable cap) would provide a 94 to 99 percent reduction in leachate production and Alternative SC-4 (RCRA impermeable cap) would provide greater than 99 percent reduction in leachate production. Alternative SC-4 would therefore be more protective than Alternative SC-3. But both Alternatives SC-3 and SC-4 would be significantly more protective than Alternative SC-2. None of these alternatives include any direct ground-water control or remediation measures; therefore, the contaminated ground water would remain unaffected except for reduced leachate production allowing ground-water contaminant levels to decline. Although the rate of contaminant decrease cannot be predicted with certainty, mathematical modelling results indicate that Site ground-water contamination levels may continue to exceed ARARs for a period of about 3 to 12 years following installation of the cap, if there is no control or direct remediation of ground water.

The extraction and treatment system of Alternative SC-5 would reduce the movement and toxicity of the contaminated landfill leachate and ground water by pumping and treating this water and preventing its downgradient migration. Under Alternative SC-5 the landfill would be regraded and a soil cover would be placed as described under Alternative SC-2. Alternative SC-5 would be more protective in remediating contaminated ground water than Alternative SC-2. However, Alternative SC-5 would be less effective in limiting leachate production than Alternatives SC-3 and SC-4.

Alternatives SC-6 and SC-7 include the closure cap systems of Alternatives SC-3 and SC-4 respectively, ground water extraction and treatment as in Alternative SC-5, and city water service as in Alternative SC-2. Alternatives SC-6 and SC-7 would thereby further reduce the volume of ground water coming into contact with the contaminant source, reducing the remediation time in comparison with Alternative SC-5. Alternatives SC-7 and SC-6 would be the most protective and second most protective alternatives, respectively, of human health and the environment.

Compliance with ARARs

The New York State Part 360 landfill cap is an action-specific ARAR for landfill closure. Alternatives SC-1, SC-2, and SC-5 would not meet this ARAR, since they do not include any provisions for a landfill cap. Alternatives SC-3, SC-4, SC-6, and SC-7 include provisions for a landfill cap which would meet or exceed the Part 360 requirement for an impermeable cap.

Alternatives SC-6 and SC-7 would be the most effective in reducing ground water contaminant concentrations below maximum contaminant levels (MCLs), because of the lower infiltration rate of precipitation associated with placing an impermeable cap over the landfill, and because they include collection and on-Site treatment of contaminated ground water. Alternative SC-5 may be nearly as effective as Alternatives SC-6 and SC-7 in reducing ground water contamination, provided that the collection system was designed and operated to capture all the contaminated ground water. However, without an impermeable cap there would be more leachate generated and additional contaminated ground water requiring collection and treatment under Alternative SC-5 than under Alternatives SC-6 and SC-7. Alternatives SC-1, SC-2, SC-3, and SC-4 do not provide for any direct remediation of ground water. However, under Alternatives SC-2, SC-3, and SC-4 less leachate would be generated and introduced into the ground water. This would facilitate the reduction of contaminant levels in ground water to ARARs by natural attenuation.

Long-Term Effectiveness and Permanence

Alternative SC-1 provides no long-term controls for handling the on-Site contamination or the ground-water contamination. Alternative SC-2 would minimally reduce the rate of leachate production, thereby limiting direct contact with the contamination. Under Alternative SC-2, the replacement of residential water supplies and the erection of a security fence would be permanent actions which would reduce potential exposure to contaminated ground water and to contaminated waste. However, it is doubtful that ground-water quality would be restored to acceptable levels, since significant quantities of leachate would be generated as a result of continued infiltration of precipitation through the soil cover. Alternatives SC-3 and SC-4 would provide much greater reduction of leachate production than Alternative SC-2, resulting in ground-water remediation by natural attenuation. Alternative SC-5 would provide an equivalent reduction in leachate generation as would Alternative SC-2 due to the soil cover. In addition, ground-water contaminants would be contained by the ground-water collection and treatment system proposed under Alternative SC-5. The collection and treatment system would be operated until contaminant concentration levels in ground water are reduced to acceptable levels. Alternative SC-6 would combine the capping and ground-water remediation components of Alternatives SC-3 and SC-5, and Alternative SC-7 would combine the capping and ground-water remediation components of Alternatives SC-4 and SC-5, thus reducing the period of treatment necessary. The closure cap is a permanent technology that must be maintained at regular intervals to ensure its structural integrity and impermeability.

Reduction in Toxicity, Mobility, or Volume Through Treatment

The no-action alternative (Alternative SC-1) does not contain any remedial measures which would reduce the toxicity, mobility, or volume of the ground-water contamination. The limited action alternative (Alternative SC-2) provides some limited reduction of leachate and leachate seeps through regrading.

Alternatives SC-3 and SC-4 provide further reduction of the volume of contaminated ground water by further reducing the amount of water infiltrating the landfill. These alternatives also eliminate the formation of contaminated leachate seeps.

Implementation of Alternative SC-5, SC-6, or SC-7 would reduce the toxicity, mobility, and volume of the contaminated ground water by extracting and treating the ground water. These alternatives would remove the contaminated ground water from the aquifer and reduce contaminant concentrations in ground water to acceptable levels, which would reduce downgradient migration of the contaminated ground water.

Alternative SC-5 would reduce the leachate production using a soil cover. Alternatives SC-6 and SC-7 would further reduce leachate generation with an impermeable cap. Alternative SC-5 would leach some contaminants from the landfill mound but at a rate slower than is occurring now. Therefore, dilution would be achieved and treatment could probably end after a relatively short period. Alternatives SC-6 and SC-7 would result in the elimination of the production of almost all leachate and, thereby, provide the shortest treatment period. However, leachate production would restart, if the impermeable cap were to fail. Data is not presently available concerning the effective life of a landfill cap.

None of the alternatives proposed reduces the toxicity or volume of waste present in the landfill.

Short-Term Effectiveness

Alternative SC-1 does not include any physical construction measures and, therefore, does not present a risk to the community as a result of its implementation.

The remaining alternatives involve major construction activities at the Site and the use of heavy earth-moving equipment. All of the potential impacts associated with implementation of Alternatives SC-2, SC-3, SC-4, SC-5, SC-6, and SC-7 could be mitigated in part by using proper construction techniques and operational procedures. The potential for on-Site accidents and worker exposure to contaminated media would increase as the number of construction activities increases. These risks would be minimized with proper health and safety training and personal protective equipment. Potential hazards to the surrounding community and environment would include adverse traffic conditions, airborne dust and particulate emissions, an increase in noise levels, and adverse impacts to the wetlands area. Mitigative measures would be implemented to minimize the impacts from these hazards.

The ground-water treatment systems of Alternatives SC-5, SC-6 and SC-7 would require storage and handling of possibly dangerous materials, such as process reagents and residuals. These activities may be accomplished with minimal risks to workers, by the development and implementation of safe operating and maintenance practices. Compliance with applicable regulations would ensure proper hazardous waste transportation and disposal of drummed process sludge at an appropriate off-Site treatment and disposal facility.

Implementability

Alternative SC-1, the no-action alternative, would be the easiest of the alternatives to implement because it requires only minimal on-Site activity. Public information programs and ground-water monitoring are easily implemented.

The construction procedures, materials and earth-moving equipment required for the implementation of Alternatives SC-2, SC-3, SC-4, SC-5, SC-6, and SC-7 are conventional and are used extensively in standard commercial and industrial applications. Supplying city water to nearby residents is readily achievable.

Alternatives SC-3, SC-4, SC-6, and SC-7, which involve capping the landfill, may be somewhat more difficult to implement. Construction methods for capping are well established, although some technical problems, such as those attributed to meeting the required specifications for the impermeable layer, may be encountered. The treatment systems of Alternatives SC-5, SC-6 and SC-7 utilize standard unit operations and water treatment equipment that are well suited for this application and are technically reliable. Transportation and disposal of the dewatered process sludge involves easily implementable practices and the use of commercially available facilities.

All of the alternatives involve some degree of institutional management. Alternative SC-1 requires administrative coordination of the ground-water monitoring program and the five-year site status reviews, along with the development of the public education program. Alternative SC-2 requires a similar level of control for those activities and also for maintenance of the security fence and administrative issues related to extension of the city water system to residents.

The administrative requirements of Alternatives SC-3, SC-4, SC-5, SC-6, and SC-7 include the ground-water, surface-water and sediment monitoring programs, the extension of the city water system, and the security fence inspection. In addition to these activities, the structural integrity and impermeability of the closure cap and cover must be maintained through a program of periodic surveillance and necessary repairs. Because of the large land area of the landfill, this item could be fairly substantial.

Alternatives SC-5, SC-6, and SC-7 also require an extensive monitoring program for the operation and maintenance of the ground-water treatment facility. The administrative elements of this program are extensive because they include equipment maintenance schedules and transportation and disposal of hazardous process residuals in compliance with regulations. Also, should treated leachate and ground water be discharged to surface water, system effluent monitoring to meet surface-water discharge standards would be necessary.

Most services and materials required for implementation of any of these potential remedial alternatives are readily available. Standard construction equipment and practices can be employed for the fence installation and the extensive Site work activities of Alternatives SC-2, SC-3, SC-4, SC-5, SC-6, and SC-7. Most of the materials and equipment required for these alternatives may be obtained locally.

Contractors to provide the construction services are also available in the Fulton County area. Because the work will be taking place at a Superfund site, all on-Site personnel must have approved health and safety training. Many companies are available to provide this training to contractors. The engineering and design services required for implementation of Alternatives SC-2, SC-3, SC-4, SC-5, SC-6 and SC-7 may be obtained from many companies. Hazardous waste transportation and disposal for treatment residuals required for Alternatives SC-5, SC-6, and SC-7 are also commercially available.

Cost

Cost estimates were developed for each of the potential remedial alternatives. The present-worth costs are calculated using a discount rate of 5 percent and a 30-year time interval. The estimated capital, annual operation and maintenance, and present worth costs for each of the alternatives are as follows:

Alternative	Capital Cost	Annual Cost	Present Worth Cost
SC-1	$14,000	$119,000	$1,859,000
SC-2	$8,343,000	$174,000	$11,034,000
SC-3	$13,763,000	$174,000	$16,454,000
SC-4	$19,729,000	$174,000	$22,420,000
SC-5	$12,754,000	$936,000	$27,160,000
SC-6	$18,174,000	$936,000	$32,580,000
SC-7	$24,139,000	$936,000	$38,545,000

The capital cost and annual cost for Alternative SC-1, the no-action alternative, includes the cost for the public awareness program and for long-term monitoring, respectively. The capital cost for Alternative SC-2 includes costs for clearing and regrading the landfill and for construction of the water-line extension. The capital cost for Alternatives SC-3 and SC-4 are for construction of the 6 NYCRR Part 360 cap and RCRA cap, respectively, in addition to necessary clearing and regrading of the landfill and construction of the water-line extension. The annual cost for Alternatives SC-2, SC-3, and SC-4 includes operation and maintenance of the landfill cover and surface-water drainage systems, in addition to long-term monitoring. The capital costs for Alternatives SC-5, SC-6, and SC-7 includes the construction of the ground-water collection, treatment, and discharge system, in addition to those capital costs specified for Alternatives SC-2, SC-3, and SC-4, respectively. The annual cost for Alternatives SC-5, SC-6, and SC-7 include operation and maintenance of the ground-water extraction, treatment, and discharge system, in addition to operation and maintenance of the landfill cover and surface-water drainage systems, and for long-term monitoring.

State Acceptance

NYSDEC concurs with the selected alternative. NYSDEC also concurs with the contingent remedy, should future water-quality data indicate that the ground-water remediation component of the contingent remedy is appropriate.

Community Acceptance

The community's comments and concerns identified during the public comment period are summarized and addressed in the Responsiveness Summary, which is attached as Appendix V to this document. While several residents expressed concerns at the February 10, 1993 public meeting related to the costs of water use and water district taxes associated with extending the Johnstown City water-supply system, it appears that the majority of the community is supportive of the water line. This is evidenced from Resolution No. 110 adopted by the Town Board of Johnstown at its meeting on October 19, 1992 and from statements made at a Town Board meeting on March 4, 1993.

SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, the detailed analysis of the alternatives, and public comments, both NYSDEC and EPA have determined that Alternative SC-3 is the appropriate remedy, with Alternative SC-6 as a contingent remedy for the Site.

Alternative SC-3, as the selected remedy, and Alternative SC-6, as the contingent remedy, are effective in protecting human health and the environment and in meeting ARARs for landfill closure and ground-water quality, since they include an impermeable landfill cap and ground-water remediation, if it is needed. Although Alternative SC-6 would be more protective in that it includes collection and treatment of contaminated ground water, NYSDEC and EPA believe that Alternative SC-3 is more cost-effective than Alternative SC-6. Under Alternative SC-6, ground-water collection and treatment would raise the capital cost of the remedy by more than $4 million and would raise the present-worth cost of the remedy by about $16 million. Given that the levels of ground-water contamination are generally only slightly above ARARs, that the cancerous risk is only slightly above the acceptable risk range, and that the noncancerous risk posed by ground-water ingestion is only slightly above the significant level, ground water remediation does not appear to be warranted unless ground-water contamination levels and surface-water contamination in Mathew Creek do not improve through natural attenuation. It is estimated that as a result of reduced leachate generation, ground-water and surface-water contamination would begin to naturally attenuate within 5 years following initiation of construction of the cap.

NYSDEC and EPA consider Alternative SC-3 (with Alternative SC-6 as the contingent alternative) to be preferable to Alternative SC-4 (with Alternative SC-7 as the contingent alternative), since Alternative SC-3 provides a comparable degree of protection as Alternative SC-4, but is more cost-effective. The RCRA cap required under Alternative SC-4 (and Alternative SC-7) would cost approximately $6 million more to construct than the NYSDEC Part 360 cap under Alternative SC-3 (and Alternative SC-6), but would only, at most, marginally reduce infiltration of precipitation through the cap. Unlike Alternatives SC-2 and SC-5, which do not include an impermeable cap, Alternatives SC-3 and SC-6 will be designed to meet New York State landfill closure ARARs and thereby reduce the volume of contaminated ground water. Although Alternative SC-1 is significantly lower in cost than the other alternatives, including the preferred alternative, it would not attain remedial action objectives for this site, since it would not reduce leachate generation, prevent human and animal contact with contaminated soil from the landfill surface, prevent erosion of contaminated surface soil, nor provide a means of treating landfill gas emissions.

The major components of the selected remedy are as follows:

- Excavation of the LaGrange Gravel Pit sediments and placing the excavated materials on the existing landfill. The pit will then be filled with clean fill, so that it may be used as an infiltration basin and/or stormwater collection basin;

- Regrading and compacting the landfill mound to provide a stable foundation for placement of the various layers of the cap and to promote rapid runoff;

- Construction of a multi-layer closure cap over the landfill mound and excavated sediments as per New York State 6 NYCRR Part 360 regulations. The cap, by reducing leachate generation, will act to improve the ground-water quality in the upper (overburden) and lower (bedrock) aquifers and surface-water quality in Mathew Creek through natural attenuation of contaminants;

- Expansion of the Johnstown City water-supply system to provide potable water to all private water supplies potentially impacted by the landfill. Providing city water will require the extension of the City's water lines and construction of a booster pump station;

- Erection of approximately 6,800 feet of conventional chain-link fencing surrounding the entire landfill mound, with placement of appropriate warning signs;

- Performance of air monitoring prior to, during, and following construction at the Site to ensure that air emissions resulting from the cap construction meet applicable or relevant and appropriate requirements. Perimeter subsurface gas monitoring between the landfill and the adjacent properties will be performed. The gas-monitoring wells will be monitored quarterly for explosive gas concentrations;

- Performance of air dispersion modeling to estimate ambient air concentrations of contaminants. Landfill gas emissions will be vented into the atmosphere, or if necessary, controlled;

- Imposition of property deed restrictions by the appropriate state or local authorities. The deed restrictions will include measures to prevent the installation of drinking water wells at the Site, and restrict activities which could affect the integrity of the cap;

- Performance of a maintenance and sampling program upon completion of closure activities. The monitoring program will fulfill the requirements of 6 NYCRR Part 360 for post-closure landfill monitoring in addition to monitoring parameters of concern found at the Site;

- Development and implementation of a dust control plan. The plan will contain all possible sources of fugitive dust emissions which exceed action levels including intrusive field activities such as excavation or regrading of waste. Normal dust suppression techniques for handling of soils and road materials will be addressed in the plan. The plan will also include how each of these potential dust sources will be controlled by addressing the control methods that will be conducted. The plan will prohibit the use of environmentally unacceptable products such as halides or petroleum products;

- Performance of a Stage IA cultural resources survey (CRS) as early as possible in the Remedial Design phase for both on-Site and off-Site areas to evaluate the sensitivity of the site for cultural resources. The results of the Stage IA survey will be used to assist in determining if additional CRS work will be required.

The effectiveness of the landfill cap will be evaluated through post-construction monitoring of ground-water and surface-water quality. The evaluation will be conducted within 5 years following initiation of construction of the landfill cap, and at any time as needed thereafter, during the long-term monitoring of the Site. Should the monitoring results indicate that either ground-water quality in the upper (overburden) aquifer or the lower (bedrock) aquifer, or surface-water quality in Mathew Creek, is not being restored to acceptable levels through natural attenuation as a result of reduced leachate generation, the ground-water remediation component of the contingent remedy, Alternative SC-6, will be implemented. This would include:

- Extraction of contaminated ground water from either of the aquifers as necessary. The extraction system would utilize extraction wells which would induce flow to the wells through drawdown of the ground-water table. Operation of the ground-water extraction system would reduce the migration of contaminants away from the Site;

- Treatment of ground water by a treatment system located permanently on-Site that would use physical/chemical processes such as pH adjustment, chemical precipitation, and carbon adsorption, to remove inorganic and volatile organic contaminants; and

- Discharge of treated ground water by returning it to the aquifer via percolation ponds or injection wells, or by discharging it to a stream, the nearest being Mathew Creek. The discharge standards would be established by NYSDEC.

The purpose of this response action is to reduce the present risk to human health and the environment due to contaminants leaching from the landfill mound. The capping of the landfill will minimize the infiltration of rainfall and snow melt into the landfill, thereby reducing the potential for contaminants leaching from the landfill and negatively impacting the wetlands habitat and ground-water quality. Capping will prevent direct contact exposure to contaminated soils, and as such, will result in risks which are less than EPA's target levels of 10^{-6} and 1 for carcinogenic risks and the noncarcinogenic HI, respectively. The extension of the City of Johnstown's municipal water lines supply to residents living near the landfill will ensure that the residents have a potable supply of drinking water. The goal of pumping and treating the ground water, if implemented, would be to facilitate the natural attenuation processes in restoring ground water and Mathew Creek surface water to applicable or relevant and appropriate state and federal standards.

STATUTORY DETERMINATIONS

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

Protection of Human Health and the Environment

Alternative SC-3 and Alternative SC-6 are fully responsive to this criterion and to the remedial response objectives. Capping the landfill will protect human health and the environment by reducing the mobility of contaminated materials, in that the leaching of contaminants into the aquifers will be significantly reduced. In addition, capping the landfill will eliminate threats posed to adults, children, trespassers, and wildlife who come in contact with the Site. The extension of the Johnstown City water supply system to all private water supplies potentially impacted by the Site, will ensure that the community continues to have a potable supply of drinking water.

Compliance with ARARs

The multi-layer closure cap over the landfill mound will be designed and constructed as per New York State 6 NYCRR Part 360 regulations.

Attainment of chemical-specific ARARs for ground water and surface water will be hastened due to reduced leaching following construction of the cap. Should monitoring results show that ground-water quality or surface-water quality in Mathew Creek is not being restored to acceptable levels through natural attenuation as a result of reduced leaching, ground water will be extracted and treated as described in the contingent alternative. Action- and location-specific ARARs will be complied with during implementation.

Action-specific ARARs:

- New York State Solid Waste Management Facilities 6 NYCRR Part 360
- National Emissions Standards for Hazardous Air Pollutants (NESHAPs)
- 6 NYCRR Part 257 Air Quality Standards

- 6 NYCRR Part 212 Air Emission Standards
- 6 NYCRR Part 373 Fugitive Dusts
- 40 CFR 50 Air Quality Standards
- SPDES - Discharge
- Resource Conservation and Recovery Act (RCRA)

Chemical-specific ARARs:

- SDWA MCLs
- 6 NYCRR Parts 700-705 Ground Water and Surface Water Quality Regulations
- 10 NYCRR Part 5 State Sanitary Code

Location-specific ARARs:

- Clean Water Act Section 404, 33 USC 1344
- Fish and Wildlife Coordination Act, 16 USC 661
- National Historic Preservation Act, 16 USC 470
- New York State Freshwater Wetlands Law ECL, Article 24, 71 in Title 23
- New York State Freshwater Wetlands Permit Requirements and Classification, 6 NYCRR 663 and 664
- New York State Endangered and Threatened Species of Fish and Wildlife Requirements, 6 NYCRR 182

Other Criteria, Advisories, or Guidance To Be Considered:

- Executive Order 11990 (Protection of Wetlands)
- Executive Order 11988 (Floodplain Management)
- EPA Statement of Policy on Floodplains and Wetlands Assessments for CERCLA Actions
- New York Guidelines for Soil Erosion and Sediment Control
- New York State Sediment Criteria, December 1989
- New York State Air Cleanup Criteria, January 1990
- SDWA Proposed Maximum Contaminant Levels (PMCLs) and Maximum Contaminant Level Goals (MCLGs)
- NYSDEC Technical and Operational Guidance Series 1.1.1,

November 1991

Cost-Effectiveness

The selected remedy and the contingent remedy provide overall effectiveness proportional to their costs. The total capital and present-worth costs for the selected remedy are estimated to be $13,763,000, and $16,454,000, respectively. For the contingent remedy, which includes active ground-water remediation, the total capital and present-worth costs are $18,174,000 and $32,580,000, respectively.

Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

Given the size of the landfill and the absence of isolated hot spots, containment of the waste mass is the only practical means to remediate the Site. By constructing a multi-media cap over the landfill in accordance with New York State's 6 NYCRR Part 360 for landfill closure, hazardous wastes in the landfill will be isolated from the environment and their mobility will be minimized. The closure cap is a permanent technology that must be maintained at regular intervals to ensure its structural integrity and impermeability. The installation of a water line to supply potable water to affected residents is a permanent solution to meeting their drinking water needs. If needed, ground water will be collected via ground-water extraction wells, and treated using a ground-water treatment system located permanently at the Site. Thus, the selected remedy and contingent remedy which require the construction of the Part 360 cap, installation of a water to supply residents with municipal water, and if needed, ground-water collection and treatment, utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. The selected remedy and the contingent remedy represent the best balance of trade-offs among the alternatives with respect to the evaluation criteria.

Ground-water and surface-water monitoring will be performed to demonstrate that the selected remedy meets all remedial action objectives. If the monitoring results indicate that the selected remedy is not effective in meeting remedial action objectives, then the contingent remedy will be implemented. The extraction and subsequent treatment of ground water, if implemented, will permanently and significantly reduce the toxicity, mobility, and volume of contaminants in the ground water.

The selected remedy will require construction of a landfill cap. No technological problems should arise since the technologies and materials needed for capping the landfill are readily available. With the construction of the landfill cap, the direct contact risk to the landfill surface will be eliminated.

Preference for Treatment as a Principal Element

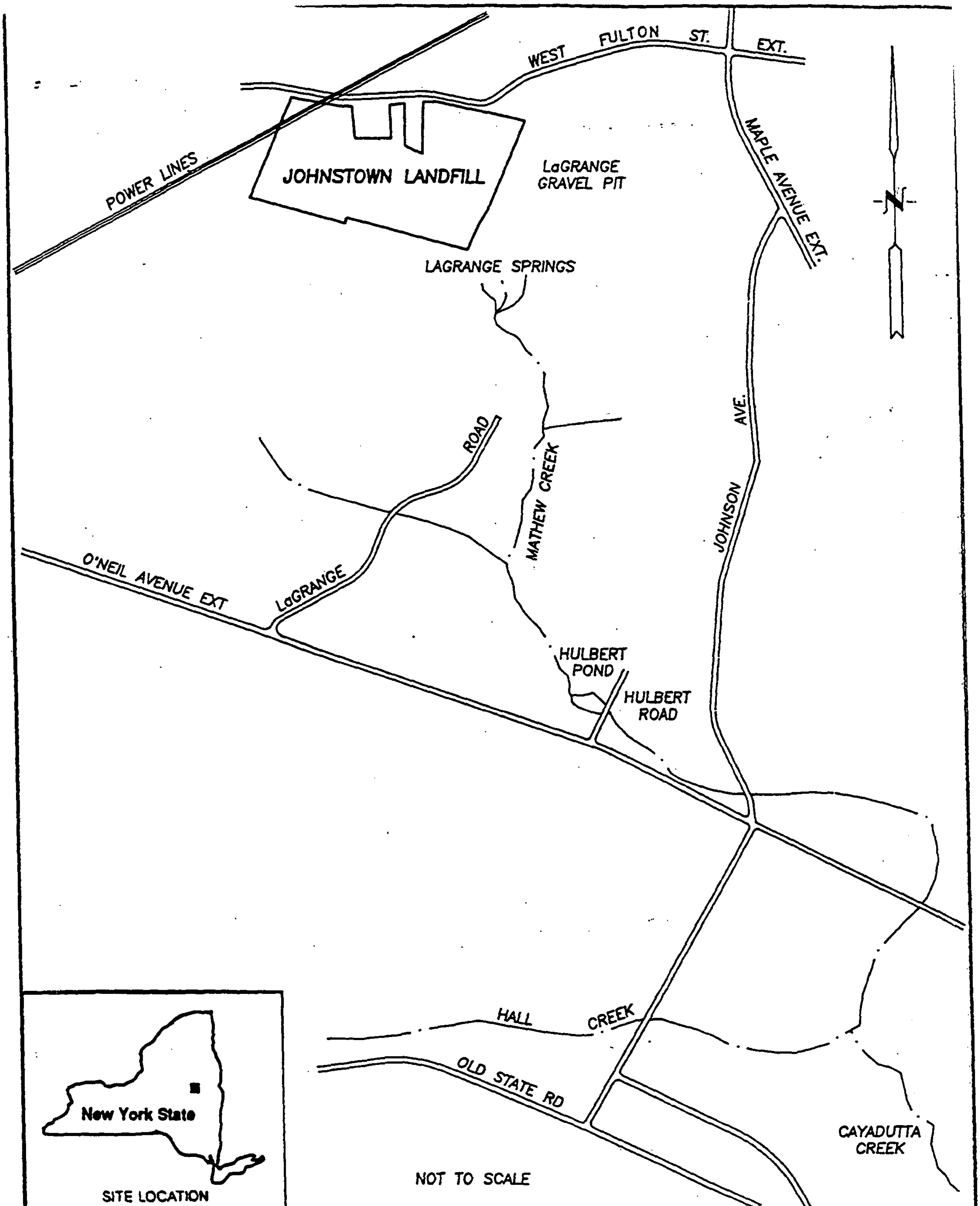
The statutory preference for remedies that employ treatment as a principal element cannot be satisfied for the landfill itself, since treatment of the landfill material is not practicable. The size of the landfill and the fact that there are no identified on-Site hot spots that represent the major sources of contamination preclude a remedy in which contaminants could be excavated and treated effectively. However, the contingent remedy calls for the treatment of contaminated ground water at the Site and, hence, would satisfy the preference for treatment for this portion of the remedy, if needed.

DOCUMENTATION OF SIGNIFICANT CHANGES

There are no significant changes from the preferred alternative presented in the Proposed Plan.

APPENDIX I

FIGURES



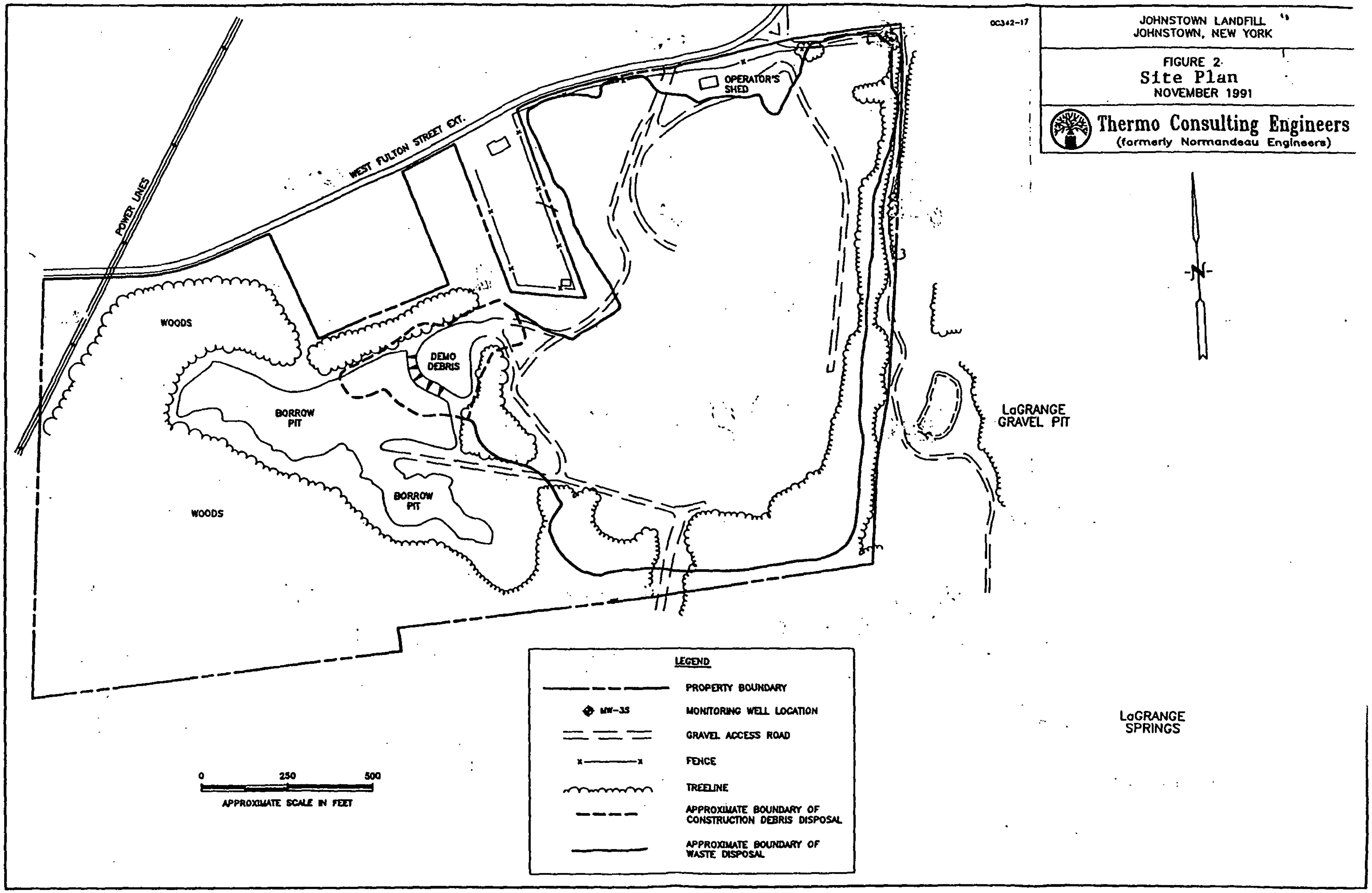
JOHNSTOWN LANDFILL
JOHNSTOWN, NEW YORK

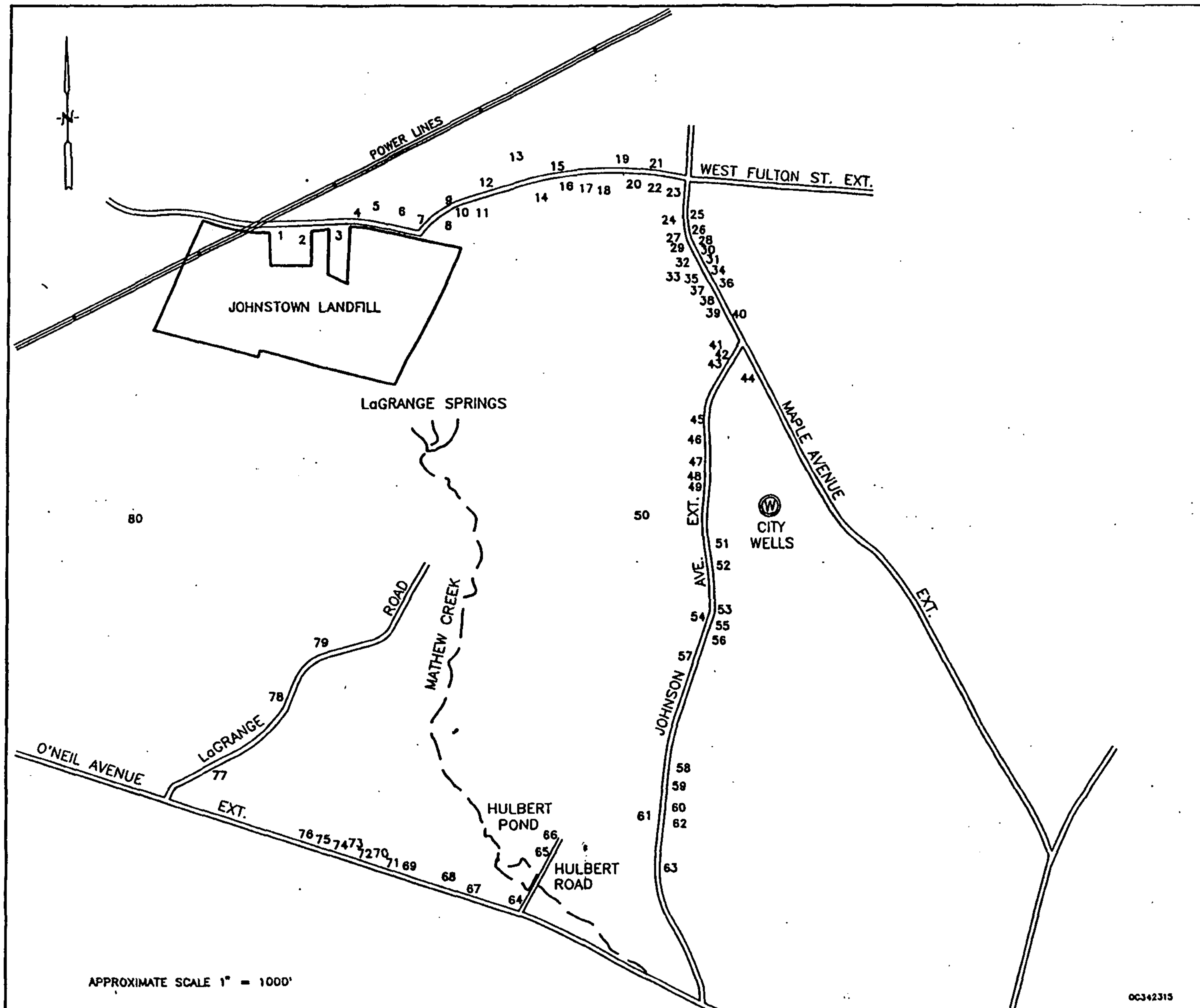
Thermo Consulting Engineers
(formerly Normandeau Engineers)

FIGURE 1

GENERAL LOCATION MAP SHOWING SURFACE WATER FEATURES LaGRANGE SPRINGS, HULBERT'S POND, MATHEW CREEK, HALL CREEK AND CAYADUTTA CREEK.

NOVEMBER 1991


JOHNSTOWN LANDFILL
JOHNSTOWN, NEW YORK
FIGURE 2
Site Plan
NOVEMBER 1991
Thermo Consulting Engineers
(formerly Normandeau Engineers)
OC342-17
WEST FULTON STREET EXT.
POWER LINES
OPERATOR'S SHED
WOODS
DEMO DEBRIS
BORROW PIT
BORROW PIT
WOODS
LaGRANGE GRAVEL PIT
LaGRANGE SPRINGS
N
0
250
500
APPROXIMATE SCALE IN FEET
LEGEND
PROPERTY BOUNDARY
MW-3S
MONITORING WELL LOCATION
GRAVEL ACCESS ROAD
FENCE
TREELINE
APPROXIMATE BOUNDARY OF CONSTRUCTION DEBRIS DISPOSAL
APPROXIMATE BOUNDARY OF WASTE DISPOSAL



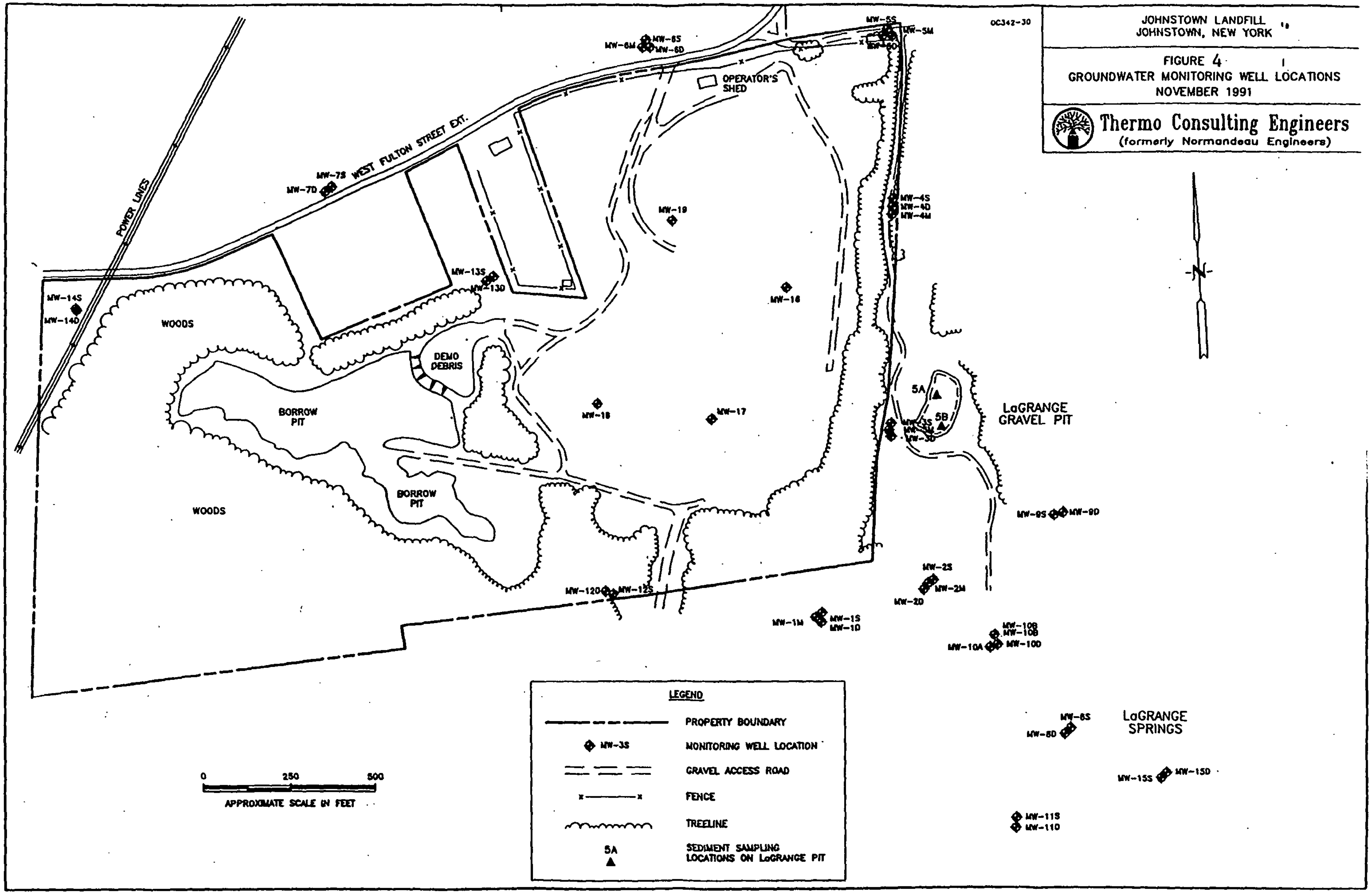
JOHNSTOWN LANDFILL
JOHNSTOWN, NEW YORK

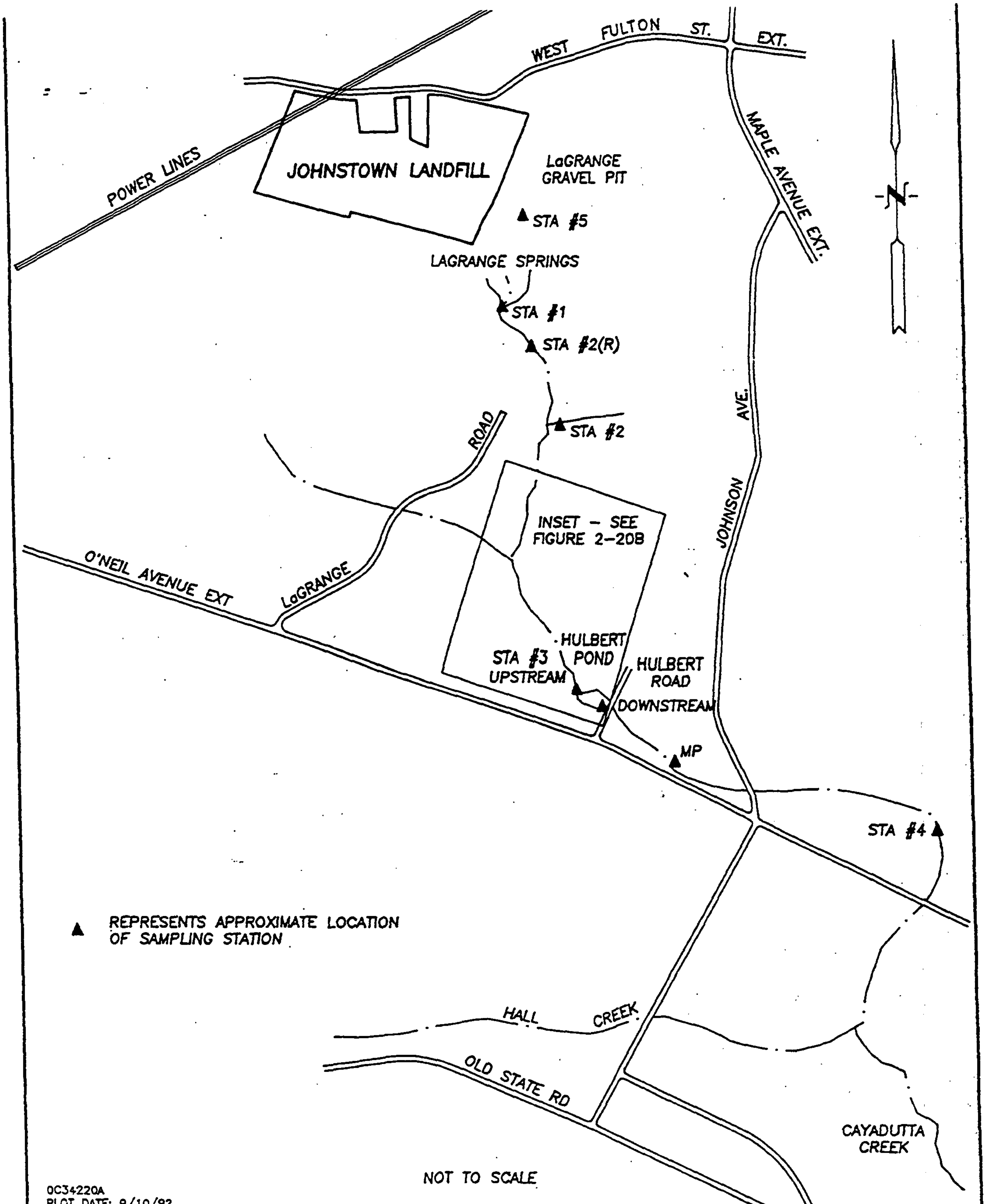
FIGURE 3

APPROXIMATE LOCATIONS OF RESIDENCES CANVASSED DURING DOMESTIC WELL INVENTORY.

NOVEMBER 1991

Thermo Consulting Engineers
(formerly Normandeau Engineers)


JOHNSTOWN LANDFILL
JOHNSTOWN, NEW YORK
FIGURE 4
GROUNDWATER MONITORING WELL LOCATIONS
NOVEMBER 1991
Thermo Consulting Engineers
(formerly Normandeau Engineers)
OC342-30
WEST FULTON STREET EXT.
POWER LINES
OPERATOR'S SHED
WOODS
WOODS
BORROW PIT
BORROW PIT
DEMO DEBRIS
LaGRANGE GRAVEL PIT
LaGRANGE SPRINGS
5A
5B
N
MW-5S
MW-5M
MW-5D
MW-6M
MW-6S
MW-6D
MW-7S
MW-7D
MW-4S
MW-4D
MW-4M
MW-19
MW-13S
MW-13D
MW-16
MW-14S
MW-14D
MW-18
MW-17
MW-3S
MW-3D
MW-9S
MW-9D
MW-2S
MW-2M
MW-2D
MW-12D
MW-12S
MW-1M
MW-1S
MW-1D
MW-10B
MW-10B
MW-10A
MW-10D
MW-8S
MW-8D
MW-15S
MW-15D
MW-11S
MW-11D
LEGEND
PROPERTY BOUNDARY
MW-3S
MONITORING WELL LOCATION
GRAVEL ACCESS ROAD
FENCE
TREELINE
5A
SEDIMENT SAMPLING LOCATIONS ON LaGRANGE PIT
0
250
500
APPROXIMATE SCALE IN FEET



JOHNSTOWN LANDFILL
JOHNSTOWN, NEW YORK

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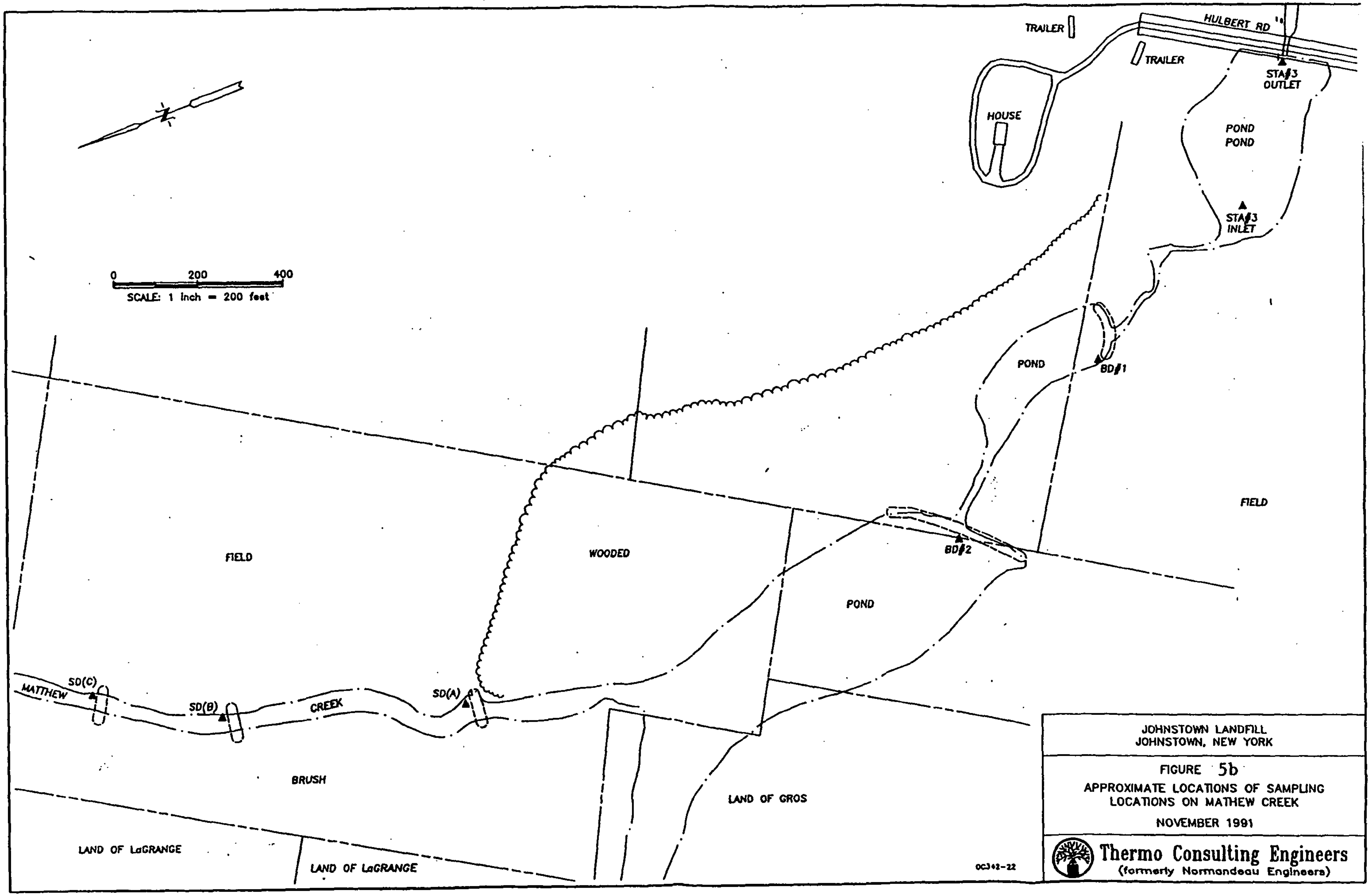
FIGURE 5a

APPROXIMATE LOCATIONS OF SAMPLING STATIONS ON LaGRANGE SPRINGS AND MATHEW CREEK

NOVEMBER 1991



JOHNSTOWN LANDFILL
JOHNSTOWN, NEW YORK

FIGURE 5b
APPROXIMATE LOCATIONS OF SAMPLING LOCATIONS ON MATHEW CREEK
NOVEMBER 1991

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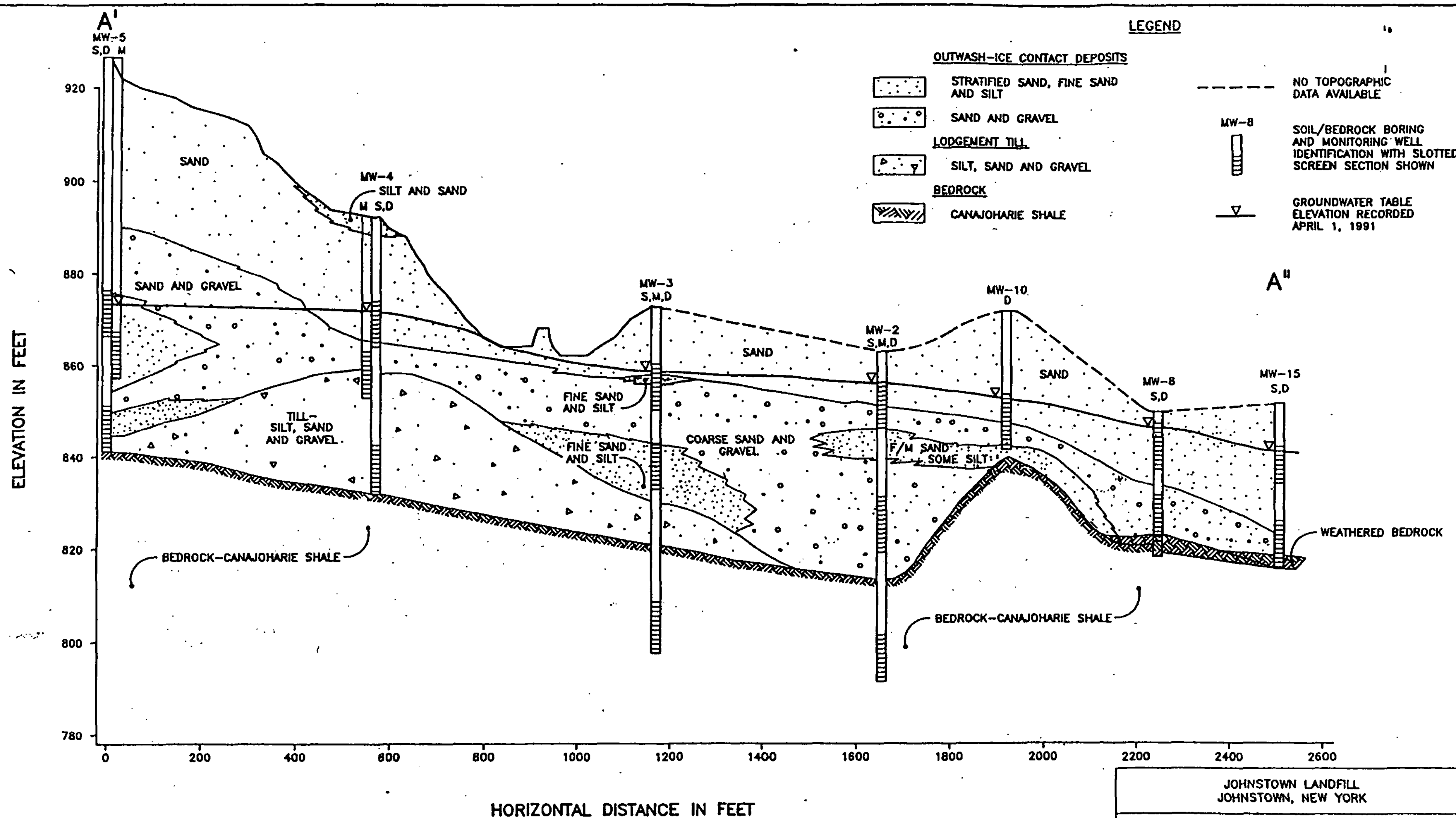

JOHNSTOWN LANDFILL
JOHNSTOWN, NEW YORK

FIGURE 6

GEOLOGIC CROSS SECTION OF SURFICIAL DEPOSITS AND BEDROCK ALONG TRANSECT A' – A" LOCATED EAST OF THE JOHNSTOWN LANDFILL

FEBRUARY 1992

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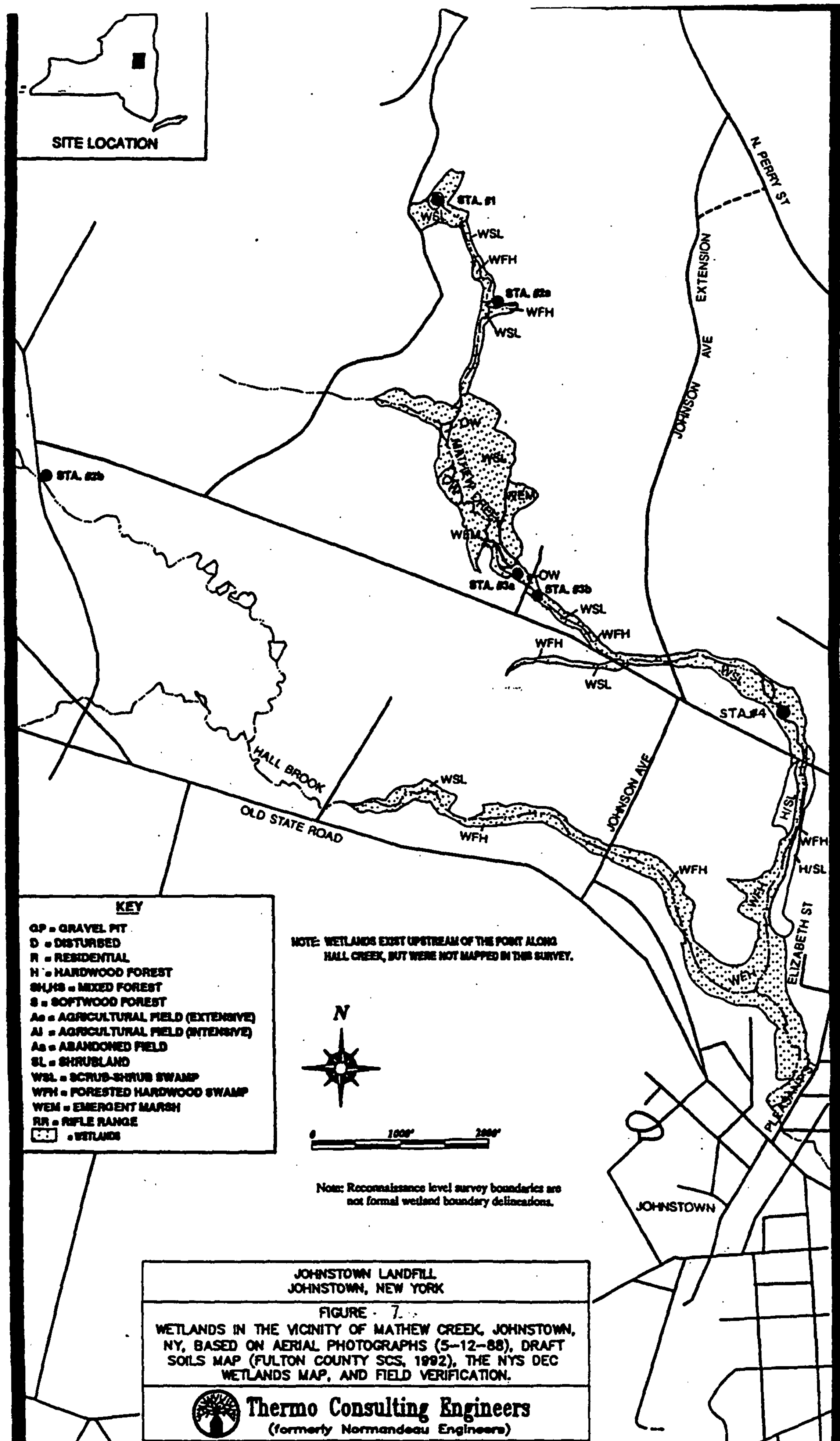

JOHNSTOWN LANDFILL
JOHNSTOWN, NEW YORK

FIGURE 7

WETLANDS IN THE VICINITY OF MATHEW CREEK, JOHNSTOWN, NY, BASED ON AERIAL PHOTOGRAPHS (5-12-88), DRAFT SOILS MAP (FULTON COUNTY SCS, 1992), THE NYS DEC WETLANDS MAP, AND FIELD VERIFICATION.

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APPENDIX II

TABLES

Tables

Table .-1A: Nature and Source of Contaminants Profile
Metals and Miscellaneous Inorganics
Groundwater and Surface Water
Johnstown Landfill, Johnstown, New York

	GROUND WATER UPGRADIENT WELLS				GROUND WATER LANDFILL WELLS				GROUND WATER DOWNGRADIENT WELLS				GROUND WATER RESIDENTIAL WELLS				SURFACE WATER MATHEW CREEK				SURFACE WATER LaGRANGE PIT		
Parameter	FREQ	LOW	HIGH	MW	FREQ	LOW	HIGH	MW	FREQ	LOW	HIGH	MW	FREQ	LOW	HIGH	RESIDENT	FREQ	LOW	HIGH	STAT#	FREQ	LOW	HIGH
METALS (µg/L)																							
Aluminum	27/27	67	43,200	5S	3/3	13,300	55,800	16	51/51	83.8	104,000	11S	34/52	16.0	1,410	Gunnison	11/12	34.9	363	#2R	2/2	192	357
Antimony	2/27	15.8	26.3	14D	0/3				0/51				8/52	13.6	21.4	Palmateer	1/12		13.9	#1	1/2		17
Arsenic	22/27	1.1	16.0	5S	3/3	11.9	35.7	16	44/51	0.8	49.5	3S	11/52	0.30	1.6	LaGrange	0/12				1/2		1.6
Barium	26/27	16.4	425	13D	3/3	17.7	1,060	16	51/51	41.6	594	15S	41/52	2.1	555	Gunnison	12/12	27	72.6	#1	2/2	22.9	32.4
Beryllium	7/27	0.23	3.3	13D	3/3	2.4	6.0	16	51/51	0.37	9.2	11S	4/52	0.21	0.45	Hulbert	0/12				0/2		
Cadmium	16/27	1.3	53.0	7D	3/3	2.5	77.6	16	22/51	1.1	11.4	3D	0/52				0/12				0/2		
Calcium	27/27	42,700	796,000	13D	3/3	327,000	1,430,000	16	51/51	35,300	1,610,000	3S	51/52	87.8	121,000	Pine Tree	12/12	49,900	111,000	#1	2/2	64,900	88,200
Chromium(T)	25/27	3.5	187	13D	3/3	145	2,330	16	46/51	2.6	229	15S	1/52		3.4	Blanket	4/12	3.7	7.2	#4	2/2	34	40.6
Cobalt	13/27	2.4	69	5S	3/3	20.6	61.2	18	29/51	2.2	121	1S	0/52				1/12		3.7	#1	0/2		
Copper	19/27	3.5	269	13D	3/3	104	259	16	39/51	6.8	288	3S	22/52	3.1	30.5	Gunnison	0/12		-		0/2		
Iron	27/27	651	124,000	5S	3/3	45,800	130,000	16	51/51	58.0	202,000	3S	43/52	53.0	6,840	Gunnison	12/12	63.7	4,940	#4	2/2	1,410	6,330
Lead	26/27	1.0	65.3	5S	3/3	34.0	487	16	45/51	1.0	454	2S	18/52	0.4	5.6	Pine Tree	1/12		5.9	#4	1/2		2.2
Magnesium	27/27	5,210	86,600	5S	3/3	36,800	82,900	16	51/51	4,960	80,400	2S	51/52	33.9	26,100	LaGrange	12/12	6,480	15,000	#2	2/2	8,070	11,100
Manganese	27/27	24	4,630	5S	3/3	1,350	2,570	18	51/51	7.9	57,300	1S	46/52	0.72	7,990	Gunnison	12/12	29.3	557	#1	2/2	93.9	944
Mercury	2/27	0.20	0.40	5S	3/3	0.21	10.6	16	9/51	0.25	0.49	1S	0/52				0/12				0/2		
Nickel	18/27	6.9	247	13D	3/3	91.7	445	16	46/51	7.6	332	3S	5/52	5.9	13.6	Pine Tree	3/12	9.2	12	#4	1/2		12.6
Potassium	27/27	701	13,100	5S	3/3	7,100	206,000	16	50/51	1,070	19,500	3S	43/52	518	13,500	Blanket	12/12	2,980	5,420	#1	2/2	9,790	23,000
Selenium	0/27				0/3				0/51				10/52	0.5	1.4	Forrester	2/12	1.2	1.4	#2R	0/2		
Silver	0/27				0/3				0/51				1/52		2.5	Wintermute	0/12				0/2		
Sodium	27/27	1,890	89,800	6D	3/3	13,300	423,000	16	51/51	1,790	166,000	1S	52/52	2,200	258,000	Hannon	12/12	14,700	70,900	#2	2/2	33,000	97,300
Thallium	0/27				1/3		1.9	16	2/51	1.0	2.7	1S	6/52	0.7	1.6	Schreppel	0/12				0/2		
Vanadium	21/27	3.7	163	13D	2/3	49.9	131	18	35/51	4	270	15S	2/52	6.5	7.2	Wheeler	0/12				2/2	5.9	8
Zinc	27/27	10.8	798	13D	3/3	215	2,730	16	50/51	3.6	479	1S,3S	38/52	4.2	750	Pine Tree	3/12	3.5	20.4	#4	2/2	16.8	283
Cyanide	0/27				1/3		73	16	1/51		10.2	1D	2/52	16.0	29.2	Wager	2/12	34.8	41.0	#3	0/2		
Hexchrome	2/27	30	30	5S,M	0/3				3/51	20	40	1S	0/52				0/12				0/2		
INORG. (mg/L)																							
Sulfate	20/27	7.41	103	5M	3/3	11.5	13.2	19	36/51	11.9	51.8	3D	45/52	10.3	57.9	Wager	10/12	11.1	58.9	#1	2/2	18.9	29.2
Chloride	25/27	6.30	112	6D	3/3	25.3	699	16	46/51	3.17	215	3S	34/52	3.1	154	Pine Tree	12/12	22.2	88.8	#2	2/2	40.3	136
COD	14/27	11.2	668	13D	3/3	19.3	852	18	29/51	10.3	672	10B	5/52	12.7	36.7	Hulbert	6/12	10.4	41	#3	2/2	25.2	219
TDS	27/27	101	634	5S	3/3	286	2,100	16	51/51	134	1,330	3S	52/52	82.0	1,160	Wheeler	12/12	202	463	#1	2/2	322	738
Bicarbonate	27/27	84.4	522	5S	3/3	411	2,890	16	51/51	74.4	760	3S	52/52	67.5	590	Pine Tree	12/12	140	409	#1	2/2	245	315
Carbonate	0/11				0/3				0/23				12/35	0.02	2.4	LaGrange	0/4				0/1		
TOC	11/11	1.4	105	7D	3/3	16.1	178	16	22/23	0.64	68.7	15D					4/4	4.70	11.2	#3	1/1		8.15
Hardness	11/11	81.0	550	5S	3/3	251	700	16	23/23	108	448	4S	17/17	74	328	Pine Tree	4/4	198	279	#1	1/1		197
Ammonia-N	10/11	0.05	15.9	5M	3/3	33.8	472	16	23/23	0.08	64.5	15S,9D	8/8	0.010	5.5	Pine Tree	4/4	2.72	33.5	#1	1/1		11.2

Notes:

FREQ = Frequency of analyte detected above sample detection limits

LOW = Lowest concentration detected in each sampling category

HIGH = Highest concentration detected in each sampling category

MW,RESIDENCE,STAT# = Sample location where highest concentration of analyte was detected

UPGRADIENT WELLS: CLUSTER MWs 5,6,7,13,14

DOWNGRADIENT WELLS: CLUSTER MWs 1,2,3,4,8,9,10,11,12,15

LANDFILL WELLS: MWs 16,18,19

Table 1B: Nature and Source of Contaminants Profile
Metals and Miscellaneous Inorganics
Soil Boring and Sediment Samples
Johnstown Landfill, Johnstown, New York

	SOIL SAMPLES UPGRADIENT BORINGS				SOIL SAMPLES LANDFILL BORINGS				SOIL SAMPLES DOWNGRADIENT BORINGS				SEDIMENT-ROUNDS 1 & 2 MATHEW CREEK				SEDIMENT-ROUND 3 MATHEW CREEK				SEDIMENT-ROUNDS 2 & 3 LaGRANGE PIT		
Parameter	FREQ	LOW	HIGH	MW	FREQ	LOW	HIGH	MW	FREQ	LOW	HIGH	MW	FREQ	LOW	HIGH	STATION	FREQ	LOW	HIGH	STATION	FREQ	LOW	HIGH
METALS (mg/Kg)																							
Aluminum	2/2	3,860	5,710	14D	3/3	4,000	6,480	16	4/4	3,050	11,200	11D	16/16	1,940	16,100	#1,0-6"	16/16	1,590	20,200	BD#2,6-12"	6/6	2,600	3,660
Antimony	0/2				1/3		4.2	17	0/4				0/16				0/16				0/6		
Arsenic	2/2	0.7	1.4	14D	3/3	0.43	1.1	16	4/4	0.5	1.0	12D	16/16	0.58	12.2	#1,6-12"	16/16	0.76	91.0	2R,0-6"	6/6	0.30	2.2
Barium	2/2	14.4	21.3	14D	3/3	16.0	23.9	16	4/4	11.3	21.0	9D	16/16	12	316	#1,0-6"	16/16	19.3	158	2R,0-6"	6/6	9.9	25.4
Beryllium	2/2	0.39	0.53	14D	3/3	0.23	0.39	17	4/4	0.31	0.43	9D	13/16	0.06	0.83	#3INLET	5/16	0.17	0.58	2R,0-6"	3/6	0.21	0.29
Cadmium	0/2				0/3				0/4				3/16	0.93	3.7	#1,0-6"	16/16	0.50	2.7	BD#2,6-12"	6/6	0.29	0.84
Calcium	2/2	12,800	63,400	13D	3/3	18,900	72,000	18	4/4	1,230	39,200	10D	16/16	1,740	56,300	#1,0-6"	16/16	3,020	22,900	SD(A),0-6"	6/6	17,400	106,000
Chromium(T)	2/2	5.9	11.8	14D	3/3	6.3	30.0	16	4/4	5.2	11.5	11D	16/16	1.9	33.8	#1,0-6"	16/16	2.8	18.5	#3IN,0-6"	6/6	29.3	1,820
Cobalt	2/2	1.9	3.0	14D	3/3	2.2	3.0	16	4/4	1.6	4.0	11D	14/16	2.5	39.3	#1,0-6"	16/16	1.7	13.1	2R,0-6"	5/6	2.2	8.5
Copper	2/2	4.5	10.1	14D	3/3	5.0	7.1	17	4/4	4.3	9.1	10D	15/16	1.4	43.2	#3INLET	15/16	0.61	26.4	#3IN,0-6"	6/6	5.4	17.2
Iron	2/2	4,890	9,710	14D	3/3	6,290	9,280	16	4/4	4,660	11,100	9D	16/16	6,100	121,000	#1,0-6"	16/16	5,290	39,700	2R,0-6"	6/6	5,840	8,640
Lead	2/2	1.7	3.8	14D	3/3	2.6	7.8	16	4/4	1.7	3.6	12D	16/16	2.7	17.8	#1,0-6"	16/16	2.8	62.4	#4,6-12"	6/6	3.3	53.4
Magnesium	2/2	3,100	5,780	14D	3/3	1,500	6,660	17	4/4	704	2,060	10D	16/16	602	3,910	#1,0-6"	16/16	536	3,510	MP,0-6"	6/6	1,590	2,880
Manganese	2/2	106	188	14D	3/3	120	188	17	4/4	78.5	224	12D	16/16	41.6	4,220	#1,6-12"	16/16	79.4	2,640	2R,0-6"	6/6	71.5	155
Mercury	0/2				0/3				0/4				0/16				6/16	0.10	0.43	#3IN,0-6"	2/6	0.14	0.22
Nickel	2/2	4.4	10.9	14D	3/3	4.5	7.1	16	4/4	4.0	6.6	9D	14/16	1.6	50.5	#1,0-6"	16/16	3.0	21.6	#1,6-12"	6/6	4.4	8.2
Potassium	2/2	1,080	1,610	14D	3/3	864	1,030	18	4/4	303	786	11D	16/16	279	1,790	#1,0-6"	16/16	160	817	SD(A),0-6"	6/6	276	594
Selenium	0/2				0/3				0/4				6/16	0.43	1.8	#1,6-12"	1/16		0.71	#1,6-12"	1/6		0.33
Silver	0/2				0/3				0/4				0/16				2/16	0.86	2.2	SD(A),0-6"	0/6		
Sodium	2/2	346	395	14D	3/3	343	507	17	4/4	239	365	10D	16/16	105	668	#1,0-6"	16/16	53.4	356	SD(A),0-6"	6/6	82.2	269
Thallium	1/2		0.21	14D	0/3				2/4	0.23	0.26	10D	1/16		0.3	#1,6-12"	0/16				1/6		0.24
Vanadium	2/2	7.1	17.3	14D	3/3	10.3	15.1	16	4/4	6.6	16.2	11D	16/16	7.1	45.7	#1,0-6"	16/16	4.9	29.8	BD#2,6-12"	6/6	4.9	10.0
Zinc	2/2	12.5	18.9	14D	3/3	13.5	32.6	16	4/4	11.3	22.3	9D	16/16	13.1	95.7	#1,0-6"	16/16	12	190	BD#2,6-12"	6/6	24.7	108
Cyanide	NT				0/3				NT				3/16	1.1	1.4	#2,0-6"	1/16		5.7	#3IN,0-6"	0/6		
Hexchrome	0/2				0/3				0/4				2/16	0.06	0.66	#1,0-6"	1/16		0.71	#1,0-6"	0/6		
INORG. (mg/Kg)																							
Sulfate	NT				1/3		250	17	0/4				12/16	81.8	577	#2,6-12"	0/16				3/6	274	337
COD	NT				3/3	5,420	80,800	17	4/4	2,810	11,000	12D	16/16	8,360	347,000	#1,0-6"	16/16	10,700	456,000	BD#2,0-6"	6/6	2,000	62,500
TOC	NT				NT								NT				11/16	7,370	>80,000	BD,SD	4/4	8,740	58,850
Ammonia-N	NT				NT								NT				16/16	18.6	987	2R,0-6"	4/4	23.8	36.3

Notes:

FREQ = Frequency of analyte detected above sample detection limits
LOW = Lowest concentration detected in each sampling category
HIGH = Highest concentration detected in each sampling category
MW,STATION = Sample location where highest concentration of analyte was detected
NT = Not tested

UPGRADIENT BORINGS: MWs 5,6,7,13,14
DOWNGRADIENT BORINGS MWs 1,2,3,4,8,9,10,11,12
LANDFILL BORINGS: MWs 16,17,18

Table · 2A : Nature and Source of Contaminants Profile
TCL Volatile Organic Compounds
Groundwater and Surface Water
Johnstown Landfill, Johnstown, New York

	GROUND WATER UPGRADIENT WELLS				GROUND WATER LANDFILL WELLS				GROUND WATER DOWNGRADIENT WELLS				GROUND WATER RESIDENTIAL WELLS				SURFACE WATER MATHEW CREEK				SURFACE WATER LaGRANGE PIT		
Parameter	FREQ	LOW	HIGH	MW	FREQ	LOW	HIGH	MW	FREQ	LOW	HIGH	MW	FREQ	LOW	HIGH	RESIDENCE	FREQ	LOW	HIGH	STAT#	FREQ	LOW	HIGH
VOC's (µg/L)																							
Acetone	12/27(B)	2	2,900	7D	1/3		130	16	22/51(B)	2	1,700	1D	6/52(B)	3	6	Gunnison	4/12(B)	12	24	#2	1/2		120
Methylene Chloride	8/27(B)	2	76	7D	1/3		26	16	14/51(B)	0.6	44	2D	3/52(B)	1	2	PTRC,Gunnison	3/12(B)	2	3	#1	1/2(B)		8
Trichloroethylene	0/27				0/3				0/51				1/52		2	LaGrange	1/12		1	#3	0/2		
1,1,1 Trichloroethane	1/27		3	5S	0/3				0/51				1/52		3	Schreppel	0/12				0/2		
Chloroform	4/27(B)	0.8	3	7D	0/3				9/51(B)	0.5	20	1M	0/52				0/12				0/2		
Vinyl Chloride	1/27		30	7S	0/3				1/51		3	3D	0/52				0/12				0/2		
Xylene	2/27	2	12	6D	2/3	5	230	16	5/51	0.3	4	3S	0/52				0/12				0/2		
Benzene	1/27		0.8	6D	2/3	0.9	9	16	7/51	0.2	2	3S,8D	0/52				0/12				1/2		2
Ethylbenzene	2/27	0.7	2	6D	2/3	7	110	16	4/51	0.6	2	3S	0/52				0/12				0/2		
Chlorobenzene	1/27		1	6D	0/3				2/51	0.7	2	3S	0/52				1/12		0.7	#4	0/2		
2-Butanone	0/27				0/3				1/51		41	1D	0/52				0/12				1/2		250
4-Methyl-2-Pentanone	0/27				0/3				1/51		7	3S	0/52				0/12				1/2		49
Vinyl Acetate	1/27		0.7	5D	0/3				0/51				0/52				0/12				0/2		
1,1-Dichloroethane	0/27				0/3				2/51		0.2	15D,3S	0/52				0/12				0/2		
Styrene	0/27				0/3				2/51	1	2	3M	0/52				0/12				0/2		
Carbon Disulfide	1/27		2	6D	0/3				5/51	0.1	2	3M,D	4/52	0.3	3	LaGrange	0/12				0/2		
Toluene	4/27	0.6	6	6D	0/3				5/51	0.7	62	3S	1/52		2	Schreppel	4/12(B)	1	2	#1,2R	1/2		18
Tetrachloroethylene	0/27				0/3				0/51				0/52				1/12		7	#3	0/2		
1,1-Dichloroethylene	0/27				0/3				0/51				0/52				0/12				0/2		
1,2-Dichloroethylene	1/27		2	6S	0/3				0/51				0/52				0/12				0/2		

Notes:
FREQ = Frequency of analyte detected above sample detection limits
LOW = Lowest concentration detected in each sampling category
HIGH = Highest concentration detected in each sampling category
MW,RESIDENCE,STAT# = Sample location where highest concentration of analyte was detected
(B) = Flag indicates analyte was detected in method blanks for one or more of the samples

UPGRADIENT WELLS : CLUSTER MWs 5,6,7,13,14
DOWNGRADIENT WELLS : CLUSTER MWs 1,2,3,4,8,9,10,11,12,15
LANDFILL WELLS : MWs 16,18,19

Table 2B : Nature and Source of Contaminants Profile
TCL Volatile Organic Compounds
Soil and Sediment Samples
Johnstown Landfill, Johnstown, New York

	SOIL BORINGS UPGRADIENT WELLS				SOIL BORINGS LANDFILL WELLS				SOIL BORINGS DOWNGRADIENT WELLS				SEDIMENT MATHEW CREEK ROUNDS 1 & 2				SEDIMENT MATHEW CREEK ROUND 3				SEDIMENT LaGRANGE PIT ROUNDS 2 & 3		
Parameter	FREQ	LOW	HIGH	MW	FREQ	LOW	HIGH	MW	FREQ	LOW	HIGH	MW	FREQ	LOW	HIGH	STATION	FREQ	LOW	HIGH	STATION	FREQ	LOW	HIGH
VOC's (μg/Kg)																							
Acetone	5/5(B)	5	160	7S	3/3(B)	13	440	16	9/9(B)	7	75	1D	16/16(B)	14	380	#1,0-6"	16/16(B)	18	130	#3INLET	6/6(B)	16	99
Methylene Chloride	3/5(B)	2	6	13D	3/3(B)	4	7	16	7/9(B)	2	5	2D	15/16(B)	2	28	#1,0-6"	15/16(B)	6	23	#3INLET	5/6(B)	4	8
Trichloroethylene	0/5				0/3				2/9	7	9	12D	0/16				1/16		18	SD(B),6-12"	0/6		
1,1,1 Trichloroethane	0/5				0/3				2/9	4	5	10D	0/16				0/16				0/6		
Chloroform	3/5	1	1	5,6,7	0/3				1/9		1	1D	4/16(B)	0.8	2	#1,6-12"	0/16				0/6		
Vinyl Chloride	0/5				0/3				0/9				0/16				0/16				0/6		
Xylene	0/5				2/3	10	15	16	2/9	3	9	12D	0/16				0/16				0/6		
Benzene	0/5				1/3		13	16	1/9		0.6	12D	1/16		3	#2,0-6"	0/16				0/6		2
Ethylbenzene	0/5				2/3	3	5	17	2/9	1	2	12D	0/16				0/16				0/6		
Chlorobenzene	0/5				0/3				0/9				0/16				0/16				0/6		
2-Butanone	3/5(B)	2	4	5D	2/3(B)	7	350	16	3/9(B)	2	3	12D	8/16	6	100	#3 INLET	11/16(B)	2	32	#3INLET	3/6(B)	3	96
4-Methyl-2-Pentanone	0/5				1/3(B)		14	16	0/9				0/16				0/16				1/6		15
Vinyl Acetate	0/5				0/3				0/9				0/16				0/16				0/6		
1,1-Dichloroethane	0/5				0/3				0/9				0/16				0/16				0/6		
Styrene	0/5				0/3				0/9				0/16				0/16				0/6		
Carbon Disulfide	0/5				0/3				0/9				1/16		31	#3 INLET	1/16				0/6		
Toluene	3/5(B)	0.5	2	14D	2/3	10	51	16	5/9	0.6	2	3D	3/16	2	3	#1,#3IN.	2/16	4	5	#4,0-6"	2/6	3	23
Tetrachloroethylene	1/5		3	7S	0/3				5/9	0.7	2	1D,3D	0/16				0/16				0/6		
1,1-Dichloroethylene	0/5				0/3				2/9		0.9	3D,11D	0/16				0/16				0/6		
1,2-Dichloroethylene	0/5				0/3				0/9				0/16				0/16				0/6		

Notes:
FREQ = Frequency of analyte detected above sample detection limits
LOW = Lowest concentration detected in each sampling category
HIGH = Highest concentration detected in each sampling category
MW,STATION = Sample location where highest concentration of analyte was detected
(B) = Flag indicates analyte was detected in method blanks for one or more of the samples

UPGRADIENT BORINGS : MWs 5,6,7,13,14
DOWNGRADIENT BORINGS : MWs 1,2,3,4,8,9,10,11,12
LANDFILL BORINGS : MWs 16,17,18

Table 3A : Nature and Source of Contaminants Profile
TCL Semi-Volatile Organics and Pesticides
Groundwater and Surface Water
Johnstown Landfill, Johnstown, New York

	GROUND WATER UPGRADIENT WELLS				GROUND WATER LANDFILL WELLS				GROUND WATER DOWNGRADIENT WELLS				GROUND WATER RESIDENTIAL WELLS				SURFACE WATER MATHEW CREEK				SURFACE WATER LaGRANGE PIT		
Parameter	FREQ	LOW	HIGH	MW	FREQ	LOW	HIGH	MW	FREQ	LOW	HIGH	MW	FREQ	LOW	HIGH	RESIDENCE	FREQ	LOW	HIGH	STAT#	FREQ	LOW	HIGH
SVOC's (µg/L)																							
Phenol	0/19				0/3				0/37				0/39				0/8				1/1		41
Benzyl alcohol	0/19				0/3				0/37				0/39				0/8				1/1		4
1,2-Dichlorobenzene	0/19				1/3		2	16	0/37				0/39				0/8				0/1		
4-Methylphenol	0/19				0/3				1/37		4	3S	0/39				0/8				1/1		10
Benzoic acid	0/19				2/3	2	6	19	7/37	2	4	15S,9	0/39				0/8				1/1		190
Naphthalene	1/19		0.6	6D	2/3	1	21	16	0/37				0/39				0/8				0/1		
2-Methylnaphthalene	0/19				1/3		2	16	0/37				0/39				0/8				0/1		
Dimethylphthalate	1/19		0.7	6S	0/3				1/37		0.4	2S	0/39				0/8				0/1		
Diethylphthalate	6/19(B)	0.8	2	5S,D	1/3		2	19	15/37(B)	0.6	6	11D	1/39		2	Forester	7/8(B)	0.4	1	#1,3	1/1(B)		21
N-Nitrosodiphenylamine(1)	0/19				0/3				1/37		4	11D	0/39				0/8				0/1		
Phenanthrene	0/19				1/3		1	16	2/37	0.5	3	11D	0/39				0/8				0/1		
Anthracene	0/19				0/3				2/37	0.6	3	11D	0/39				0/8				0/1		
Di-n-butylphthalate	6/19(B)	0.5	3	5D	2/3	1	2	16	16/37(B)	0.4	11	11D	6/39(B)	0.8	2	Forester	5/8(B)	0.4	0.7	#4	1/1(B)		2
Fluoranthene	0/19				1/3		2	16	2/37	0.7	7	11D	0/39				0/8				0/1		
Pyrene	0/19				1/3		2	16	2/37(B)	1	7	11D	0/39				0/8				0/1		
Butylbenzylphthalate	2/19	0.2	0.4	6D	0/3				4/37(B)	0.3	7	11D	0/39				0/8				1/1		0.2
3,3'-Dichlorobenzidine	0/19				0/3				1/37		7	11D	0/39				0/8				0/1		
Benzo(a)anthracene	0/19				0/3				2/37	0.8	4	11D	0/39				0/8				0/1		
Chrysene	0/19				0/3				2/37	1	2	11D	0/39				0/8				0/1		
bis(2-Ethylhexyl)phthalate	18/19(B)	2	33	6S	3/3(B)	9	24	16	37/37(B)	2	150	3D	34/39(B)	2	66	Palmateer	7/8(B)	0.7	16	#1	1/1(B)		9
Di-n-octylphthalate	4/19	0.3	4	5M	1/3		0.6	19	8/37(B)	0.3	8	11D	5/39	3	16	Paul	0/8				1/1		0.2
Benzo(b)fluoranthene	0/19				0/3				2/37(B)	0.6	5	11D	0/39				0/8				0/1		
Benzo(k)fluoranthene	0/19				0/3				1/37(B)		0.8	15S	0/39				0/8				0/1		
Benzo(a)pyrene	0/19				0/3				2/37(B)	0.7	4	11D	0/39				0/8				0/1		
Indeno(1,2,3-cd)pyrene	0/19				0/3				1/37(B)			11D	0/39				0/8				0/1		
PESTICIDES (µg/L)																							
delta-BHC	0/19				0/3				1/37		0.04	9S	0/39				0/8				0/1		
Endosulfan 1	0/19				0/3				1/37		0.05	11D	0/39				0/8				0/1		
Dieldrin	0/19				1/3		0.01	16	0/37				0/39				0/8				0/1		
4,4'-DDE	0/19				1/3		0.19	16	0/37				0/39				0/8				0/1		
4,4'-DDD	0/19				1/3		0.35	16	0/37				0/39				0/8				0/1		
4,4'-DDT	0/19				1/3		0.03	16	0/37				0/39				0/8				0/1		
alpha-Chlordane	0/19				1/3		0.06	16	0/37				0/39				0/8				0/1		
gamma-Chlordane	0/19				1/3		0.05	16	0/37				0/39				0/8				0/1		
gamma-BHC	0/19				0/3				0/37				0/39				0/8				0/1		
Heptachlor	0/19				0/3				0/37				0/39				0/8				0/1		
Aldrin	0/19				0/3				0/37				0/39				0/8				0/1		
Heptachlor Epoxide	0/19				0/3				0/37				0/39				0/8				0/1		
Endrin	0/19				0/3				0/37				0/39				0/8				0/1		

Notes:
FREQ = Frequency of analyte detected above sample detection limits
LOW = Lowest concentration detected in each sampling category
HIGH = Highest concentration detected in each sampling category
MW,RESIDENCE,STAT# = Sample location where highest concentration of analyte was detected
(B) = Flag indicates analyte was detected in method blanks for one or more of the samples

UPGRADIENT WELLS : CLUSTER MWs 5,6,7,13,14
DOWNGRADIENT WELLS : CLUSTER MWs 1,2,3,4,8,9,10,11,12,15
LANDFILL WELLS : MWs 16,18,19

Table 3B : Nature and Source of Contaminants Profile
TCL Semi-Volatile Organics and Pesticides
Soil and Sediment Samples
Johnstown Landfill, Johnstown, New York

	SOIL BORINGS LANDFILL WELLS				SEDIMENT SAMPLES MATHEW CREEK ROUND 1				SEDIMENT SAMPLES MATHEW CREEK ROUND 2				SEDIMENT SAMPLES LaGRANGE PIT ROUNDS 1 & 2		
Parameter	FREQ	LOW	HIGH	MW	FREQ	LOW	HIGH	STAT	FREQ	LOW	HIGH	STAT	FREQ	LOW	HIGH
SVOC's (µg/Kg)															
Acenaphthene	0/3				0/3				0/3				1/2		44
Dibenzofuran	0/3				0/3				0/3				1/2		48
Fluorene	0/3				0/3				0/3				2/2	15	91
Acenaphthylene	0/3				0/3				1/8		12	#4,6-12	2/2	11	42
Benzoic acid	2/3	120	380	16	6/8	32	4,500	#1,0-6	7/8	28	480	#1,6-12	0/2		
Naphthalene	1/3		410	16	0/3				1/8		15	#4,6-12	2/2	170	1,400
2-Methylnaphthalene	0/3				0/3				1/8		9	#4,6-12	2/2	40	320
Dimethylphthalate	0/3				0/3				1/8		18	#3,OUT	0/2		
Diethylphthalate	1/3		700	16	2/8	80	82	#4,6-12	6/8(B)	19	58	#1,0-6	2/2(B)	62	71
N-Nitrosodiphenylamine(1)	0/3				0/3				0/3				0/2		
Phenanthrene	0/3				2/8(B)	31	160	#1,0-6	4/8	37	220	#4,6-12	2/2	56	170
Anthracene	0/3				0/3				3/8	20	51	#4,6-12	2/2	16	51
Di-n-butylphthalate	1/3		760	16	1/8(B)		67	#4,6-12	8/8(B)	23	90	#1,0-6	1/2(B)		41
Fluoranthene	0/3				3/8(B)	40	370	#1,0-6	8/8	16	260	#4,6-12	2/2	69	150
Pyrene	0/3				4/8(B)	21	210	#1,0-6	6/8(B)	16	210	#4,6-12	2/2	71	150
Butylbenzylphthalate	1/3		700	17	0/8				3/8(B)	9	35	#3,IN	0/2		
3,3'-Dichlorobenzidine	0/3				0/8				0/8				0/2		
Benzo(a)anthracene	0/3				1/8(B)		170	#1,0-6	4/8	22	93	#4,6-12	2/2	46	84
Chrysene	0/3				1/8(B)		170	#1,0-6	4/8	22	110	#4,6-12	2/2	45	99
bis(2-Ethylhexyl)phthalate	3/3(B)	400	1,100	18	8/8(B)	44	180	#4,6-12	8/8(B)	69	140	#3,IN	2/2(B)	430	850
Di-n-octylphthalate	1/3		42	16	1/8		15	#4,6-12	8/8	12	190	#3,IN	2/2(B)	45	270
Benzo(b)fluoranthene	0/3				2/8(B)	16	150	#1,0-6	3/8	48	75	#4,0-6	2/2	43	240
Benzo(k)fluoranthene	0/3				0/8				2/8	56	59	#3,OUT	1/2		160
Benzo(a)pyrene	0/3				1/8		15	#4,6-12	3/8	48	70	#4,6-12	1/2		43
Indeno(1,2,3-cd)pyrene	0/3				1/8		8	#4,6-12	0/8				0/2		
Benzo(g,h,i)perylene	0/3				0/8				1/8		4	#4,6-12	0/2		
Isophorone	0/3				0/8				2/8	7	8	#3,OUT	0/2		
PESTICIDES (µg/Kg)															
gamma-BHC	1/3		4.1	18	0/8				0/8				0/2		
delta-BHC	1/3		4.5	18	1/8		13	#3,IN	0/8				0/2		
Endosulfan 1	1/3		14	18	0/8				0/8				0/2		
Dieldrin	1/3		17	18	0/8				0/8				0/2		
4,4'-DDE	2/3	11	25	16	4/8	2.1	9.8	#1,0-6	4/8	2.5	12	#1,0-6	2/2	38	170
4,4'-DDD	1/3		37	16	0/8				0/8				2/2	13	69
4,4'-DDT	2/3	14	18	16	0/8				0/8				0/2		
alpha-Chlordane	0/3				0/8				0/8				0/2		
gamma-Chlordane	0/3				0/8				0/8				0/2		
Heptachlor	1/3		4.4	18	0/8				0/8				1/2		3.7
Aldrin	1/3		5.8	18	0/8				0/8				1/2		1.8
Heptachlor Epoxide	1/3		14	18	0/8				0/8				0/2		
Endrin	1/3		21	18	0/8				0/8				0/2		

Notes:
FREQ = Frequency of analyte detected above sample detection limits
LOW = Lowest concentration detected in each sampling category
HIGH = Highest concentration detected in each sampling category
MW,STAT# = Sample location where highest concentration of analyte was detected

UPGRADIENT BORING : MWs 5,6,7,13,14
DOWNGRADIENT BORING : MWs 1,2,3,4,8,9,10,11,12
LANDFILL BORING : MWs 16,17,18
(B) = Flag indicates analyte was detected in method blanks for one or more of the samples

Table 4 : Summary Results of 3-Hour Air Quality Sampling For VOCs
Johnstown Landfill, Johnstown, New York, September, 1989.

	Station No. ST-1				Station No. ST-2				Station No. ST-3					
Date Sampled	9/13	9/13	9/21	9/21	9/13	9/13	9/21	9/21	9/13	9/13	9/21	9/21	Occupat.	
Sample Number	T-2	T-3	T-8	T-9	T-4	T-5	T-10	T-11	T-6	T-7	T-12	T-13	Value*	AGC**
Pump Flow Rate (L/min)	0.104	0.251	0.100	0.251	0.100	0.253	0.102	0.253	0.102	0.252	0.104	0.252	(24-HR)	(annual)
Parameter														
Acetone	3.05	2.44	6.11	ND	ND	1.00	1.22	ND	4.44	20.56	ND	ND	1.78E6	35,600(c)
Benzene	1.84	1.02	1.11	0.64	1.89	0.74	ND	ND	0.69	1.44	1.53	0.62	30,000	100(a)
Toluene	1.26	1.00	ND	0.49	1.17	0.61	1.22	0.57	0.62	ND	ND	0.62	375,000	7,500(c)
2-Butanone	ND	ND	ND	ND	1.61	0.63	ND	ND	ND	ND	ND	ND	590,000	1,967(b)
1,1,1-Trichloroethane	1.05	0.84	ND	0.69	1.39	0.83	1.50	0.98	0.69	1.22	ND	0.62	1.90E6	38,000(c)
Carbon Tetrachloride	ND	ND	ND	0.47	ND	ND	ND	ND	ND	ND	ND	ND	30,000	100(a)
Totals	7.20	5.30	7.22	2.29	6.06	3.81	3.94	1.57	6.44	23.22	1.53	1.86		

Notes :
All concentration values expressed in micrograms per cubic meter (ug/cu. m)
(a) = High Toxicity Air Contaminants
(b) = Moderate Toxicity Air Contaminants
(c) = Low Toxicity Air Contaminants
* = Short Term 1989 ACGIH TWA-TLV
** = Long Term Ambient Guideline Concentration – (derived from ACGIH TWA-TLV)
ND = Not Detectable

Table 5 : Summary Results of Airborne Chromium Sampling
Johnstown Landfill, Johnstown, New York
September and October, 1989.

Station Number	Date	Filter Number	Total Chromium (µg)	Total Flow (cu. m)	Chromium Concentration (µg/cu. m)	Average Chromium Concentration (µg/cu. m)	AGC* (µg/cu. m)	Occupational Value** (µg/cu. m)
HV-1-P	9/14/89	2872	6.0	1,898.9	0.003	0.004	0.167	50
	10/1/89	2881	9.9	1,929.3	0.005			
	10/6/89	2885	6.9	1,937.6	0.004			
HV-1-C	9/14/89	2873	5.9	1,815.1	0.003	0.004	0.167	50
	10/1/89	2882	9.2	1,875.4	0.005			
	10/6/89	2886	6.4	1,821.3	0.004			
HV-2	9/14/89	2875	4.6	1,592.3	0.003	0.003	0.167	50
	10/1/89	2883	4.6	1,672.2	0.003			
	10/6/89	2887	5.5	1,670.7	0.003			
HV-3	9/14/89	2874	5.3	1,569.9	0.003	0.003	0.167	50
	10/1/89	2884	3.5	1,705.3	0.002			
	10/6/89	2889	6.8	1,692.7	0.004			

Notes :
* = Ambient Guideline Concentration - Annual Average - derived from 1989 ACGIH TWA-TLV
** = 1989 ACGIH Short Term TWA-TLV

Table 6

Study Chemicals, with Abbreviations and Common Synonyms

Johnstown Landfill, Johnstown, NY

Chemical	Abbreviation	Synonym 1	Synonym 2	CAS Number
Metals and Cyanide				
aluminum	Al			7429-90-5
antimony	Sb			7440-36-0
arsenic	As			7440-38-2
barium	Ba			7440-39-3
beryllium	Be			7440-41-7
cadmium	Cd			7440-43-9
chromium	Cr (III)			
chromium VI	Cr (VI)			18540-29-9
cobalt	Co			7440-48-4
copper	Cu			7440-50-8
lead	Pb			7439-92-1
mercury	Hg			7439-97-6
nickel	Ni			7440-02-0
selenium	Se			7782-49-2
silver	Ag			7440-22-4
strontium	Sr			7440-24-6
thallium	Tl			7440-28-0
titanium	Ti			7440-32-6
vanadium	V			7440-62-2
zinc	Zn			7440-66-6
cyanide				57-12-5
Volatile Organic Compounds				
methylene chloride	DCM	dichloromethane		75-09-2
chloroform		trichloromethane		67-66-3
carbon tetrachloride		perchloromethane		56-23-5
carbon disulfide				75-15-0
1,1,1-trichloroethane	1,1,1-TCA	methyl chloroform		71-55-6
vinyl chloride		chloroethene	chloroethylene	75-01-4
trichloroethylene	TCE	trichloroethene		79-01-6
tetrachloroethylene	PCE	tetrachloroethene	perchloroethylene	127-18-4
acetone		dimethyl ketone	2-propanone	67-64-1
2-butanone	MEK	methyl ethyl ketone		78-93-3
4-methyl-2-pentanone	MIBK	methyl isobutyl ketone		108-10-1
benzene		benzol		71-43-2
ethylbenzene		phenylethane		100-41-4
toluene		methylbenzene		108-88-3
xylenes (total)		xylene, mixed	xylenes [total]	1330-20-7
styrene		vinylbenzene		100-42-5
Semi-Volatile Organic Compounds				
benzoic acid		benzene carboxylic acid		65-85-0
phenol		carbolic acid		108-95-2
4-methylphenol		p-cresol	4-cresol	106-44-5
di-n-butylphthalate				84-74-2
di-n-octylphthalate				117-84-0
bis(2-ethylhexyl)phthalate	DEHP	di(2-ethylhexyl)phthalate		117-81-7
butylbenzylphthalate				85-68-7
naphthalene				91-20-3
Pesticides and PCBs				
ΣDDTR		Total DDT Residue (sum of DDT, DDD, DDE)		

Table 7
Summary of Exposure Scenarios
Johnstown Landfill, Johnstown, NY

	Scenario 1: Nearby Residents Current Conditions (Landfill Closed and Unremediated)			Scenario 2: Nearby Residents Future Conditions (Landfill Capped and Fenced, with no Ground Water Interception and Treatment)			Scenario 3: Nearby Residents Future Conditions (Landfill Capped and Fenced, with Ground Water Interception and Treatment)		
	1a Trespassing on the Landfill	1b Wading/ Fishing in Matthew Creek	1c Living at Home	2a Trespassing on the Landfill	2b Wading/ Fishing in Matthew Creek	2c Living at Home	3a Trespassing on the Landfill	3b Wading/ Fishing in Matthew Creek	3c Living at Home
Exposures to Soil from the Landfill									
Incidental Ingestion of Soil on Landfill	Yes	No	No	No	No	No	No	No	No
Dermal Contact with Soil on Landfill	Yes	No	No	No	No	No	No	No	No
Inhalation of Fugitive Dust on Landfill	Yes	No	No	No	No	No	No	No	No
Exposures to Matthew Creek									
Incidental Ingestion of Sediments	No	Yes	No	No	Yes	No	No	Yes	No
Dermal Contact with Sediments	No	Yes	No	No	Yes	No	No	Yes	No
Incidental Ingestion of Surface Water	No	Yes	No	No	Yes	No	No	Yes	No
Dermal Contact with Surface Water	No	Yes	No	No	Yes	No	No	Yes	No
Ingestion of Fish	No	Yes	No	No	Yes	No	No	Yes	No
Exposures to Ground Water									
Use of Ground Water as Household Water	No	No	Yes	No	No	Yes	No	No	Yes
Exposures to Outdoor Air									
Inhalation of Outdoor Air	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 8
Summary of Key Toxicological Properties of Study Chemicals
Johnstown Landfill, Johnstown, NY

Chemical	Chronic Noncarcinogenic Toxicity by Ingestion: Reference Dose (RfD) (mg/(kg-day))	Chronic Noncarcinogenic Toxicity by Ingestion: Confidence in RfD	Chronic Noncarcinogenic Toxicity by Ingestion: Species Tested in Critical Study	Chronic Noncarcinogenic Toxicity by Inhalation: Reference Concentration (RfC) (mg/m3)	Chronic Noncarcinogenic Toxicity by Inhalation: Reference Dose (RfD) (mg/(kg-day))	Chronic Noncarcinogenic Toxicity by Inhalation: Confidence in RfD	Chronic Noncarcinogenic Toxicity by Inhalation: Species Tested in Critical Study
Metals and Cyanide							
aluminum							
antimony	4E-04	low	rat				
arsenic	3E-04	med	human				
barium	7E-02	med	human	5E-04	1E-04		rat
beryllium	5E-03	low	rat				
cadmium	5E-04	high	human				
chromium III	1E+00	low	rat	2E-06	6E-07		human
chromium VI	5E-03	low	rat	2E-06	6E-07		human
cobalt							
copper	~~4E-02~~		human				
lead	5E-04						
mercury	3E-04		rat	3E-04	9E-05		human
nickel	2E-02	med	rat				
selenium	5E-03	high	human				
silver	5E-03	low	human				
strontium							
thallium	7E-05		rat				
titanium							
vanadium	7E-03		rat				
zinc	2E-01		human				
cyanide	2E-02	med	rat				
Volatile Organic Compounds							
methylene chloride	6E-02	med	rat	3E+00	9E-01		rat
chloroform	1E-02	med	dog		1E-02		
carbon tetrachloride	7E-04	med	rat		7E-04		
carbon disulfide	1E-01	med	rabbit	1E-02	3E-03		rat
1,1,1-trichloroethane	9E-02		guinea pig	1E+00	3E-01		guinea pig
vinyl chloride							
trichloroethylene							
tetrachloroethylene	1E-02	med	mouse; rat		1E-02		
acetone	1E-01	low	rat		1E-01		
2-butanone							
4-methyl-2-pentanone							
benzene							
ethylbenzene	1E-01	low	rat	1E+00	3E-01	low	rat, rabbit
toluene	2E-01	med	rat	2E+00	6E-01		human
xylenes (total)	2E+00	med	rat	3E-01	9E-02		human
styrene	2E-01	med	dog		2E-01		
Semi-Volatile Organic Compounds							
benzoic acid	4E+00	med	human		4E+00		
phenol	6E-01	low	rat		6E-01		
4-methylphenol							
di-n-butylphthalate	1E-01	low	rat		1E-01		
di-n-octylphthalate							
bis(2-ethylhexyl)phthalate	2E-02	med	guinea pig		2E-02		
butylbenzylphthalate	2E-01		rat		2E-01		
naphthalene	4E-03		rat		4E-03		
Pesticides and PCBs							
ΣDDTR	5E-04				5E-04		
4,4'-DDD							
4,4'-DDE							
4,4'-DDT	5E-04	med	rat		5E-04		

Table 9
Summary of Noncancer Risks
Current Land Use Scenario

Chemical	Total HI as a Child	Total HI as a Youth			Total HI as an Adult	
	Living at Home	Trespassing	Wading / Fishing	Living at Home	Wading / Fishing	Living at Home
	(ratio)	(ratio)	(ratio)	(ratio)	(ratio)	(ratio)
Metals and Cyanide						
aluminum						
antimony	2.4E+00		4.5E-04	1.2E+00	2.7E-04	9.5E-01
arsenic	2.1E-01	3.2E-04	2.1E-03	1.1E-01	1.3E-03	8.6E-02
barium	1.6E-01	6.0E-05	5.1E-02	7.9E-02	4.5E-02	6.3E-02
beryllium	4.3E-03	1.8E-06	7.1E-06	2.1E-03	4.3E-06	1.7E-03
cadmium		6.2E-05	2.5E-04		1.5E-04	
chromium	1.1E-04	7.3E-01	6.7E-04	5.3E-05	6.0E-04	4.3E-05
chromium VI			3.9E-05		2.4E-05	
cobalt						
copper	1.5E-02	1.6E-05	1.1E-02	7.6E-03	1.0E-02	6.1E-03
lead	2.2E-01	2.8E-03	8.6E-01	1.1E-01	7.7E-01	8.7E-02
mercury		2.0E-05	1.3E-01		1.2E-01	
nickel	1.5E-02	1.6E-05	6.4E-05	7.3E-03	3.9E-05	5.9E-03
selenium	1.2E-02	2.5E-06	1.3E-05	6.0E-03	8.1E-06	4.8E-03
silver	2.3E-02			1.2E-02		9.4E-03
strontium						
thallium	2.5E+00			1.3E+00		1.0E+00
titanium						
vanadium	2.8E-02	5.1E-05	2.9E-04	1.4E-02	1.7E-04	1.1E-02
zinc	4.0E-02	1.9E-05	4.4E-02	2.0E-02	3.9E-02	1.6E-02
cyanide	2.2E-02		2.7E-05	1.1E-02	1.6E-05	8.9E-03
Volatile Organic Compounds						
methylene chloride		1.5E-07	3.7E-07		2.6E-07	
chloroform						
carbon tetrachloride	6.8E-01	2.9E-03	1.3E-04	3.8E-01	6.7E-05	1.9E-01
carbon disulfide	5.3E-02		1.7E-07	2.6E-02	1.2E-07	2.1E-02
1,1,1-trichloroethane	3.5E-03	1.5E-05	6.9E-07	1.9E-03	3.5E-07	9.7E-04
vinyl chloride						
trichloroethylene						
tetrachloroethylene	3.0E-02		9.3E-06	1.5E-02	6.1E-06	1.2E-02
acetone	6.0E-02	2.6E-04	1.3E-05	3.3E-02	7.0E-06	1.7E-02
2-butanone						
4-methyl-2-pentanone						
benzene						
ethylbenzene						
toluene	1.6E-03	6.8E-06	3.8E-07	8.7E-04	2.1E-07	4.3E-04
xylenes (total)						
styrene						
Semi-Volatile Organic Compounds						
benzoic acid			1.5E-07		1.0E-07	
phenol						
4-methylphenol						
di-n-butylphthalate						
di-n-octylphthalate						
bis(2-ethylhexyl)phthalate			3.9E-04		2.7E-04	
butylbenzylphthalate						
naphthalene		5.0E-05				
Pesticides and PCBs						
ΣDDTR		6.6E-05	1.4E-01		1.2E-01	
	6.5E+00	7.3E-01	1.2E+00	3.3E+00	1.1E+00	2.5E+00

Table 10
Carcinogenic Toxicity Values

Chemical	Carcinogenicity by Ingestion: Weight-of-Evidence Classification	Carcinogenicity by Ingestion: Drinking Water Unit Risk ((µg/l)-1)	Carcinogenicity by Ingestion: Cancer Potency Factor (CPF) (mg/(kg•day))-1	Carcinogenicity by Inhalation: Weight-of-Evidence Classification	Carcinogenicity by Inhalation: Inhalation Unit Risk (µg/m3)-1	Carcinogenicity by Inhalation: Cancer Potency Factor (CPF) (mg/(kg•day))-1
Metals and Cyanide						
aluminum						
antimony						
arsenic	A			A	4.3E-03	5.0E+01
barium						
beryllium	B2	1.2E-04	4.3E+00	B2	2.4E-03	8.4E+00
cadmium				B1	1.8E-03	6.3E+00
chromium III						
chromium VI				A	1.2E-02	4.1E+01
cobalt						
copper	D			D		
lead	B2			B2		
mercury	D			D		
nickel				A	2.4E-04	8.4E-01
selenium	D			D		
silver	D			D		
strontium						
thallium						
titanium						
vanadium						
zinc	D			D		
cyanide	D			D		
Volatile Organic Compounds						
methylene chloride	B2	2.1E-07	7.5E-03	B2	4.7E-07	1.6E-03
chloroform	B2	1.7E-07	6.1E-03	B2	2.3E-05	8.1E-02
carbon tetrachloride	B2	3.7E-06	1.3E-01	B2	1.5E-05	1.3E-01
carbon disulfide						
1,1,1-trichloroethane	D			D		
vinyl chloride	A	5.4E-05	1.9E+00	A	8.4E-05	2.9E-01
trichloroethylene	B2	3.2E-07	1.1E-02	B2	1.7E-06	1.7E-02
tetrachloroethylene	B2	1.5E-06	5.1E-02	B2	5.2E-07	1.8E-03
acetone	D			D		
2-butanone						
4-methyl-2-pentanone						
benzene	A	8.3E-07	2.9E-02	A	8.3E-06	2.9E-02
ethylbenzene	D			D		
toluene	D			D		
xylenes (total)	D			D		
styrene	B2	8.6E-07	3.0E-02	B2	5.7E-07	2.0E-03
Semi-Volatile Organic Compounds						
benzoic acid	D			D		
phenol	D			D		
4-methylphenol	C			C		
di-n-butylphthalate	D			D		
di-n-octylphthalate						
bis(2-ethylhexyl)phthalate	B2	4.0E-07	1.4E-02	B2		1.4E-02
butylbenzylphthalate	C					
naphthalene	D			D		
Pesticides and PCBs						
ΣDDTR	B2	9.7E-06	3.4E-01	B2	9.7E-05	3.4E-01
4,4'-DDD	B2	6.9E-06	2.4E-01			2.4E-01
4,4'-DDE	B2	9.7E-06	3.4E-01	B2		3.4E-01
4,4'-DDT	B2	9.7E-06	3.4E-01	B2	9.7E-05	3.4E-01

Table 11
Summary of Cancer Risks
Current Land Use Scenario

	Total ILCR				
	Trespassing	Wading / Fishing	Living at Home	All Activities	Percent of Summary ILCR
Chemical	(prob)	(prob)	(prob)	(prob)	(%)
Metals and Cyanide					
aluminum					
antimony					
arsenic	2.8E-09			2.8E-09	0.0%
barium					
beryllium	4.6E-09	4.2E-08	2.2E-05	2.2E-05	40.7%
cadmium	1.1E-10			1.1E-10	0.0%
chromium					
chromium VI					
cobalt					
copper					
lead					
mercury					
nickel	1.5E-10			1.5E-10	0.0%
selenium					
silver					
strontium					
thallium					
titanium					
vanadium					
zinc					
cyanide					
Volatile Organic Compounds					
methylene chloride	7.6E-12	4.9E-11		5.6E-11	0.0%
chloroform					
carbon tetrachloride	3.0E-08	3.1E-09	1.4E-05	1.4E-05	25.9%
carbon disulfide					
1,1,1-trichloroethane					
vinyl chloride					
trichloroethylene		4.9E-11		4.9E-11	0.0%
tetrachloroethylene		1.3E-09	2.1E-06	2.1E-06	3.9%
acetone					
2-butanone					
4-methyl-2-pentanone					
benzene	1.8E-08	1.9E-09	8.4E-06	8.4E-06	15.4%
ethylbenzene					
toluene					
xylenes (total)					
styrene					
Semi-Volatile Organic Compounds					
benzoic acid					
phenol					
4-methylphenol					
di-n-butylphthalate					
di-n-octylphthalate					
bis(2-ethylhexyl)phthalate		3.2E-08		3.2E-08	0.1%
butylbenzylphthalate					
naphthalene					
Pesticides and PCBs					
ΣDDTR	1.3E-09	7.7E-06		7.7E-06	14.1%
	5.7E-08	7.7E-06	4.7E-05	5.5E-05	100.0%
	0.1%	14.2%	85.7%	100.0%	

APPENDIX IV

NYSDEC LETTER OF CONCURRENCE

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

Callahan
— cc: Pavlou
caspe
Olbey

Thomas C. Jorling
Commissioner

MAR 2 3 1993

93 MAR 29 PM 4:21
US EPA
PPIB

Mr. William J. Muszynski
Acting Regional Administrator
United States Environmental
Protection Agency, Region II
26 Federal Plaza
New York, New York 10278

Dear Mr. Muszynski:

RE: Johnstown City Landfill - Site No. 518002
Record of Decision

Concerning the draft Record of Decision at the Johnstown City Landfill Site, the New York State Department of Environmental Conservation (NYSDEC) concurs with the United States Environmental Protection Agency's (USEPA) selection of Alternative SC-3, which will include the following major components:

1. Excavation of the LaGrange Gravel Pit sediments, placing the excavated materials on the existing landfill. The pit would then be filled with clean fill to eliminate any standing water.

2. Construction of a multi-layer closure cap over the landfill mound and excavated sediments per New York State 6NYCRR Part 360 regulations.

3. Expansion of the Johnstown City water supply system to provide potable water to all private water supplies potentially impacted by the landfill.

4. Erection of approximately 6800 feet of conventional chain link fencing surrounding the entire landfill mound, with placement of appropriate warning signs.

5. Performance of air monitoring prior to, during, and following construction at the site. Perimeter subsurface gas monitoring between the landfilled area and adjacent properties will be conducted and landfill gas emissions controlled as needed.

6. Performance of a maintenance and monitoring program which at a minimum will fulfill the requirements of 6NYCRR Part 360 for post closure monitoring.

7. Performance of a Stage 1A cultural resources survey in on-site and in off-site areas where there is a potential impact to cultural resources.

8. Imposition of property deed restrictions which will include measures to prevent the installation of drinking water wells at the site and restrict activities which could affect the integrity of the cap.

The NYSDEC also concurs with the contingent remedy, Alternative SC-6, which may be implemented should monitoring results show that groundwater and/or surface water quality is not being restored to acceptable levels through natural attenuation after construction of the landfill cap required in Alternative SC-3. Alternative SC-6 would include all of the major components of Alternative SC-3 described above, and in addition groundwater extraction, treatment and discharge.

If you have any questions, please contact Mr. Robert Cozzy at 518-457-1641.

Sincerely,

Ann Hill DeBarbieri
Deputy Commissioner
Office of Environmental
Remediation

APPENDIX V

RESPONSIVENESS SUMMARY