A MEMBER OF THE ENVIRONMENTAL RESOURCES MANAGEMENT GROUP

915054

FEASIBILITY STUDY REPORT
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

Prepared For:

AlliedSignal Inc.
101 Columbia Road
Morristown, New Jersey 07962

January, 1995

ERM-NORTHEAST, INC.
5500 Main Street
Williamsville, New York 14221

409.005

ERM

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Our Quality Policy

We will fully understand and document our clients' requirements for each assignment.

We will conform to those requirements at all times and satisfy the requirements in the most efficient and cost-effective manner.

Our quality policy and procedures include an absolute commitment to provide superior service and responsiveness to our clients.

Our Quality Goals

To serve you.

To serve you well.

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Maintain a standing Quality Improvement Team to ensure continuous improvement.

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Chief Executive Officer

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Chief Operating Officer

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Brian J. Jacot, Principal

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STATE OF NEW YORK
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EXCUTIVE SUMMARY

ERM-Northeast (ERM) has completed a Feasibility Study (FS) for AlliedSignal Inc. at the Alltift Landfill Site (ALS) in Buffalo, New York. The Feasibility Study was conducted in general accordance with: 1) "United States Environmental Protection Agency (USEPA) Guidance for Conducting Remedial Investigation/Feasibility Studies Under CERCLA", October 1988; 2) the May 15, 1990 NYSDEC-TAGM entitled, "Selection of Remedial Actions at Inactive Hazardous Waste Sites"; and 3) the National Contingency Plan (NCP).

The Phase I FS involved the identification of broadly defined general response actions, where a response is deemed necessary to protect public health or the environment based on the Remedial Investigation (RI) Risk Assessment. Technologies for each general response action were identified and preliminarily screened solely on the basis of their effectiveness and technical feasibility. The technologies that were retained through this initial screening process were then used to develop media-specific remedial alternatives for the ALS.

The Phase II FS screening involved evaluating these media-specific remedial alternatives primarily on the basis of effectiveness and implementability. Those alternatives passing this second phase of screening were assembled into ten (10) comprehensive remedial alternatives for the contaminated media at the Site.

If necessary, upon completion of the Phase II FS, treatability studies can be performed to contribute additional data to the alternative selection process. Treatability studies were not performed for the ALS because the major components of the remedial alternatives do not include treatment but rather include soil movement and containment structures. Instead, an evaluation was conducted to identify the most cost-effective and technically feasible technologies/process options for inclusion in the comprehensive remedial alternatives. The selected options were incorporated into the remedial alternatives prior to the Detailed Analysis of Alternatives (Phase III FS).

During the Phase III FS, the potential remedial alternatives were subjected to a detailed qualitative evaluation which considered: 1) Overall protection of human health and the environment; 2) Compliance with New York State Standards, Criteria and Guidelines (SCGs); 3) Long-term effectiveness and performance; 4) Reduction of toxicity, mobility, and volume; 5) Short-term effectiveness; 6) Implementability; and 7) Cost. Alternatives were then compared to select an environmentally sound and cost-effective remedial action for the ALS. State and community acceptance of the results of the Phase III FS will be evaluated prior to the NYSDEC's Record of Decision (ROD).

The remedial costs associated with each alternative were estimated based on vendor information, conventional cost estimated guides, generic unit costs and prior experience. The total present worth costs for each alternative were estimated using a 5 percent discount rate for the time period associated with implementation of the specific alternative, not to exceed 30 years.

Based upon instruction from the NYSDEC, the Phase III FS did not include an evaluation and comparison of the ten comprehensive alternatives using the NYSDEC-TAGM scoring tables; however, and extensive qualitative evaluation were performed as part of the comprehensive remedial alternative selection process.

Based upon this evaluation, Alternative 3B (Consolidation of Soil and Sediment/Cap Landfill) is recommended for this Site, as summarized below:

1) Excavation of the soil/waste materials which are not currently underlain by the natural clay layer at the Site, and consolidation of this material into the landfill;

2) Excavation and dewatering of the sediment from the ponds and associated wetlands, and consolidation of this material into the landfill;

3) Capping of the landfill with a synthetic membrane composite cap;

4) Installation of a ground water extraction system utilizing a collection trench with extraction wells;

5) Activation, if necessary, of the ground water extraction system;

6) Operation, if necessary, of a ground water treatment system with discharge of treated ground water to the local POTW;

7) Site closure and wetlands restoration; and

8) Institutional Controls.

This alternative is recommended for this Site for the following reasons:

1) This alternative met the requirements for protection of human health and the environment, as well as satisfying almost all the SCGs for soil, sediment and ground water. Based upon the RI, soil/waste on the off-Site Skyway Auto Parts (Skyway) property in excess of SCGs is not impacting ground water and is isolated from potential exposure pathways.

2) The quantity of soil and sediment being disrupted as a result of the remedial actions is minimal, thereby limiting the effects of the remediation upon worker health and the surrounding community.

3) Alternative 3B greatly reduces scheduling delays associated with obtaining longterm access to the Skyway. Alternatives 3C, 3D, 3F and 3G all include some Skyway activities and negotiations with a third party. These negotiations could significantly delay implementation of remedial actions.

4) The area to be capped was minimized by the consolidation of the soil and waste materials into the landfill. The small cap decreases the level of longterm maintenance required to preserve the integrity of the remedial system.

5) The costs of implementing Alternatives 3C through 3G were greater than the costs for implementing Alternative 3B. However, the added benefit of Alternatives 3C through 3G is marginal and does not justify the additional costs.

In summary, Alternative 3B satisfies all of the remedial action objectives in a very cost-effective manner in comparison with the other alternatives evaluated in the Detailed Analysis Phase. All media requiring remediation that were identified in the RI are addressed. All exposure and migration pathways are eliminated or controlled.

Section 1

1.0 INTRODUCTION

1.1 FEASIBILITY STUDY OVERVIEW

This report summarizes the findings of the ERM-Northeast, Inc. (ERM) Phase I (Development of Alternatives), Phase II (Preliminary Screening of Alternatives) and Phase III (Detailed Analysis of Alternatives) Feasibility Study (FS) for the Alltift Landfill Site (ALS or "the Site") in Buffalo, New York. The FS was completed as part of the Remedial Investigation/ Feasibility Study (RI/FS) project at the ALS, which is being conducted by AlliedSignal Inc. (Allied) under an Order on Consent with the New York State Department of Environmental Conservation (NYSDEC).

The following guidance documents were used as the basis for the FS:

- 40 CFR Part 300 "National Oil and Hazardous Substances Pollution Contingency Plan (NCP); Final Rule
- "United States Environmental Protection Agency (USEPA) Guidance for Conducting Remedial Investigation/Feasibility Studies Under CERCLA", October 1988;
- The May 15, 1990 NYSDEC Technical and Administrative Guidance Memorandum (TAGM) entitled, "Selection of Remedial Actions at Inactive Hazardous Waste Sites";
- The October 1991 NYSDEC Draft Cleanup policy;
- NYCRR Parts 360 and 375; and,
- The January 24, 1994 NYSDEC TAGM entitled, "Determination of Soil Cleanup Objectives and Cleanup Levels".

These documents are in general agreement; however, the NYSDEC May 1990 TAGM states that cost should not be considered as an evaluation criteria in the Screening of Technologies (Phase I FS) or the Preliminary Screening of Alternatives (Phase II FS). In preparation of this FS report, ERM followed the NYSDEC-TAGM relative to this issue. However, cost was used in subsequent phases of remedy evaluation. Additionally, based on conversations with NYSDEC personnel, the NYSDEC requested that the May 15, 1990 TAGM scoring tables not be used in the Detailed Analysis of Alternatives phase.

This report identifies general response actions, evaluates remedial technologies, and formulates and evaluates potential remedial action alternatives. The Phase I FS involved the identification of broadly defined general response actions, where a response is deemed necessary to protect public health and the environment based on the Remedial Investigation (RI) Risk Assessment (RA). Technologies for each general response action were identified and preliminarily screened on the basis of their effectiveness and technical feasibility. The technologies that were retained through this initial screening process were used to develop media-specific remedial alternatives for the Site.

The Phase II FS involved evaluating these media-specific remedial alternatives on the basis of effectiveness and implementability. Those alternatives passing the second phase of screening were assembled into comprehensive remedial alternatives addressing contaminated media at the Site. It is these comprehensive alternatives that underwent a detailed evaluation during the Phase III FS.

The Phase III FS involved a detailed quantitative evaluation of comprehensive remedial alternatives which considered: 1) overall protection of human health and the environment; 2) compliance with New York State Standards, Criteria and Guidelines (SCGs); 3) long-term effectiveness and performance; 4) reduction of toxicity, mobility, and volume; 5) short-term effectiveness; 6) implementability; and 7) cost. Alternatives were compared to identify an environmentally sound and cost-effective remedial action for the ALS. State and community acceptance of the results of the Phase III FS will be evaluated prior to the NYSDEC's Record of Decision (ROD).

1.2 PURPOSE OF FEASIBILITY STUDY

The purpose of this FS is to evaluate and identify remedial action alternatives which cost-effectively limit the risks to human health and the environment resulting from contamination at the ALS. Additionally, the Phase I and II FS were completed prior to the Supplemental RI and were used to identify data needs so that appropriate information would be collected during the Supplemental RI.

1.3 REPORT ORGANIZATION

The information contained in this report is in general accordance with NYSDEC and USEPA requirements, and the format is in general accordance with "USEPA Guidance for Conducting RI/FS Under CERCLA" (Table 6-5 EPA/540/G-89/004, October, 1988). The organization of this report is as follows:

Section 1.0 - Introduction
Section 2.0 - Identification and Screening of Technologies
Section 3.0 - Development and Screening of Alternatives
Section 4.0 - Qualitative Evaluation of Applicable Technologies
Section 5.0 - Detailed Analysis of Alternatives
Section 6.0 - Conceptual Design of Recommended Remedial Action
Section 7.0 - Limitations and Use of Report
Section 8.0 - References

Section 2

Section 2

2.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

2.1 INTRODUCTION

This section discusses the identification and screening of remedial technologies considered for the ALS. Initially, this section summarizes the findings of the August 1994 AFI Environmental, Inc. (AFI) RI Report for the ALS, as it applies to the FS program. This summary is followed by a discussion of the remedial action objectives and general response actions for each of the various media (i.e., soil, sediment, ground water, and surface water). Finally, feasible technologies/process options are identified and screened to provide a basis for the subsequent development of media-specific remedial alternatives (Section 3.0).

2.2 SUMMARY OF MEDIA OF INTEREST

Based on the RI, the following media have been identified as containing concentrations of analytes that exceed SCGs resulting from previous Alltift Landfill disposal activities:

- Pond sediment in the west and south portions of the Site contains elevated (i.e., above SCGs) levels of volatile organics, semi-volatile organics, and inorganics.
- Surface and subsurface soil within the limits of the landfill contains elevated concentrations of volatile organics, semi-volatile organics, pesticides, PCBs and inorganics (e.g., heavy metals).
- Subsurface soil in portions of the Skyway Auto Parts property (Skyway) east of the landfill contains elevated levels of volatiles, semi-volatile organics and inorganics.
- Ground water in the shallow water bearing zone beneath the landfill contains elevated levels of volatile organics, semi-volatile organics, pesticides, PCBs and inorganics.
- Ground water in the deep water bearing zone contains elevated levels of volatile organics, but is comparable to levels that may be naturally

occurring.

- On-Site pond water contains elevated levels of semi-volatile organics and inorganics.

Note that the semi-volatile organics and the inorganics are the most prevalent groups of analytes in all media listed above and will be driving the cleanup in most areas of the Site. The specific analytes detected during the RI and the SCGs developed for this RI/FS are presented in the RI report.

2.3 REMEDIAL ACTION OBJECTIVES

General remedial goals are guided by the National Contingency Plan, 40 CFR 300.68, which specifies that the objective of every remedial action is to "mitigate and minimize damage to and provide adequate protection of public health, welfare or the environment". The following Site-specific remedial goals were developed for the ALS:

Soil/Waste:

- Prevent to the extent practicable incidental ingestion of soil/waste that exceeds SCGs presented in TAGM HWR-94-4046.
- Prevent to the extent practicable dermal/skin contact with soil/waste that exceeds SCGs presented in TAGM-94-4046.
- Prevent to the extent practicable releases of organics and inorganics to ground water and surface water that would result in an exceedance of water quality SCGs presented in 33 USC 466 Section 404 and 6NYCRR Parts 700-705.

Ground Water:

- Prevent to the extent practicable off-Site migration of shallow ground water containing organics and inorganics that exceed SCGs presented in 33 USC 466 Section 404 and 6NYCRR Parts 700-705.

Sediment:

- Prevent to the extent practicable incidental ingestion of organics and inorganics from sediments that exceed SCGs presented in TAGM-94-4046.
- Prevent to the extent practicable dermal/skin contact of sediments that exceed SCGs presented in TAGM-94-4046.
- Prevent to the extent practicable impacts on biota that would come in contact with sediments that exceed SCGs presented in TAGM-94-4046.
- Prevent to the extent practicable releases of organics and inorganics from sediments to surface water and groundwater that would result in an exceedance of water quality SCGs presented in 33 USC 466 Section 404 and 6NYCRR Parts 700-705.

Surface Water:

- Prevent to the extent practicable the concentrations of the organics and inorganics in the surface water by addressing the contaminants in the sediment.
- Prevent to the extent practicable environmental impact on biota
- Prevent to the extent practicable incidental ingestion of surface water that exceeds SCGs presented in 33 USC 466 Section 404 and 6NYCRR Parts 700-705.
- Prevent to the extent practicable dermal/skin contact with surface water that exceeds SCGs presented in 33 USC 466 Section 404 and 6NYCRR Parts 700-705.

Gases/Dust:

- Prevent to the extent practicable migration of on-Site fugitive dust that exceeds Air Guide 1, TAGM HWR-89-4031 and 6NYCRR Parts 200, 201, 211, 212 and 257.
- Prevent to the extent practicable migration of gases emanating from the landfill that exceed Air Guide 1, TAGM HWR-89-4031 and 6NYCRR

Parts 200, 201, 211, 212 and 257.

2.4 GENERAL RESPONSE ACTIONS

General response actions describe those actions that satisfy the remedial action objectives. Based on information gathered during the RI, general response actions, or classes of actions, were identified for each media of concern. The response actions are considered applicable if they generally address the environmental concerns identified in the previous section.

Table 2-1 summarizes the potential general response actions for each media of concern. General response actions considered include the "no action" alternative, which will serve as a baseline against which other remedial measures can be compared. The "no action" alternative is mandated for inclusion by the Superfund Amendments and Reauthorization Act (SARA). Additionally, potential remedial technologies are identified for each general response action.

2.4.1 General Response Actions for Soil

General response actions for soil, presumably contaminated by the disposal of waste, address the pathways of ingestion, dermal contact, leaching and fugitive dust transport. Institutional actions such as deed restrictions and fencing are possible responses to contamination in the soil. Containment would reduce the potential for exposure, leaching from percolation and limit the transport of contaminants by air. Excavation, treatment, and disposal of soil would immobilize or separate soil contaminants and would remove the source of contamination.

2.4.2 General Response Actions for Ground Water

General response actions appropriate for ground water contamination include: 1) monitoring; 2) containment; and 3) ground water recovery, treatment (on-site or

TABLE 2-1

SUMMARY OF GENERAL RESPONSE ACTIONS

Medium	Contamination Concern	General Response Actions
Soil.	Surface, Subsurface, and Air Contamination.	No Action. Institutional Action. Containment. Partial Removal. Complete Removal. On-Site or Off-Site Disposal. On-Site or Off-Site Treatment. In-Situ Treatment.
Ground Water.	Movement of Contaminated Ground Water Off-Site.	No Action. Institutional Action. Containment. Ground Water Recovery. On-Site or Off-Site Treatment. On-Site or Off-Site Disposal. In-Situ Treatment.
Sediment.	Surface and Subsurface Contamination.	No Action. Institutional Action. Containment. Partial Removal. Complete Removal. On-Site or Off-Site Disposal. On-Site or Off-Site Treatment. In-Situ Treatment.
Surface Water	Movement of contaminated surface water off-site.	No Action, Institutional Action, Surface Water Recovery, Containment, on-site treatment (or off-site),on- or off-site disposal, In situ treatment.

off-site), and disposal. These actions would limit contaminated plume migration, remove the contaminants from the ground water, and provide data on ground water quality.

2.4.3 *General Response Actions for Sediments*

General response actions for contaminated sediments generally involve: sediment removal, with subsequent treatment and disposal; sediment containment; or in-situ treatment. The process of removing bottom sediments from a water body is commonly known as dredging. After the collected contaminated sediments are dewatered, they can then be treated either independently or with the contaminated soil. Thus, for purposes of remedial action, the contaminated soil on the Site and the sediment can be considered as a single medium. The contaminated water generated during dewatering may also contain hazardous constituents which may be treated together with the ground water.

Sediment containment would involve sediment control measures (e.g., silt curtains, cofferdams, etc.) to limit the suspension and migration of contaminants. In-situ treatment would involve chemical treatment of the sediment in place.

2.4.4 *General Response Actions for Surface Waters*

Current levels of a very limited number of analytes in the surface waters exceed the NYSDEC ambient surface water quality standards for Class D streams. No VOCs were in excess of these standards and only one S-VOC (bis(2-ethylhexl) phthalate) was found at a concentration just slightly higher than the standard. Elevated levels of several metals were found in the surface water.

It appears that this situation is the result of landfill runoff and the suspension of contaminated sediments. Thus, remediating the soil and sediment would address the surface water conditions. Consequently, surface water general response actions have been covered under the general response actions for soil and sediments.

2.5 IDENTIFICATION OF APPLICABLE REMEDIAL TECHNOLOGIES

Table 2-2 lists the general response actions and potentially applicable remedial technologies for each media of concern. These applicable remedial technologies include the wide range of technologies available within each of the general remedial response actions identified above. For the purposes of this discussion, these technologies have been divided into two groups: 1) soil/sediment; and 2) ground water/surface water.

2.5.1 Soil/Sediment Remedial Technologies

Contaminated soil/sediment remedial technologies can be used to contain, remove, or treat the soil/sediment at the Site. The following soil/sediment remedial technologies were initially considered.

No Action

"No action" was considered for comparison purposes.

Institutional Actions

Institutional actions involve access restrictions. This technology would include deed restrictions and fencing-off areas of contaminated soil/sediment.

TABLE 2–2

SUMMARY OF APPLICABLE REMEDIAL TECHNOLOGIES

General Response Action	Applicable Remedial Technology	Process Options
Soil/Sediment		
No Action	None	None
Institutional Actions.	Access Restrictions	Fencing. Deed Restrictions.
Containment.	Surface Capping	Clay & Soil Cap. Synthetic Membrane. Composite.
	Surface Controls	Grading. Diversion/Collection. Soil Stabilization.
	Sediment Control Barriers	Coffer Dams. Silt Curtains. Channel Diversion. Vegetation.
	Dust Control	Revegetation. Capping. Watering.
Partial or Complete Removal.	Excavation and Removal	Solids Excavation.
	Sediment Dredging	Mechanical Dredging. Hydraulic Dredging. Pneumatic Dredging.
On-Site or Off-Site Disposal.	On-Site Landfill Off-Site Landfill	Solids Excavation and Disposal. Solids Excavation and Disposal.
On-Site or Off-Site Treatment.	Pretreatment	Dewatering Centrifuge. Gravity Thickener. Filtration. Solids Separation Screens and Sieves. Spiral Classifier. Cyclone and Hydroclone. Settling Basin.
	Thermal Treatment	Liquid Injection. Rotary Kiln. Multiple Hearth. Fluidized Bed. Pyrolysis.
	Chemical Treatment	Immobilization Soil Washing. Detoxification.
	Physical Treatment	Solidification/Stabilization. Encapsulation. Volatilization.
In-Situ Treatment.	In-Situ Treatment	Bioreclamation. Heating/Volatilization. Soil Flushing. Vitrification. Solidification/Stabilization.

TABLE 2-2(CONTINUED)

SUMMARY OF APPLICABLE REMEDIAL TECHNOLOGIES

General Response Action	Applicable Remedial Technology	Process Options
<u>Ground Water/Surface Water</u>		
No Action	No Action	None.
Institutional Actions.	Access Restrictions. Alternate Water Supply.	Deed Restrictions. City Water Supply. New Community Well.
	Monitoring	Ground Water Monitoring.
Containment.	Surface Capping	Clay & Soil Cap. Synthetic Membrane Composite Cap.
	Vertical Barriers	Slurry Wall. Sheet Piling. Grout Curtain. Vibrating Beam. Compacted Clay. Geomembrane.
	Horizontal Barriers	Grouting. Bottom Sealing.
Ground Water Recovery.	Pumping Plume Removal	Extraction Wells. Extraction/Injection Wells.
	Subsurface Drains	Interceptor Trenches.
On-Site or Off-Site Treatment (for ground water, process water, seepage and decontamination water).	Biological	Activated Sludge. Rotating Biological Discs. Fixed Film Bioreactor. Aerobic/Anaerobic Fluidized Bed. Sequencing Batch Reactor. Aerated Lagoon.
	Physical/Chemical	Activated Carbon. Precipitation/Flocculation/ Sedimentation. Ion Exchange. Resin Sorption. Filtration. Reverse Osmosis. Neutralization. Gravity Separation Air Stripping. Steam Stripping. Chemical Oxidation. Chemical Reduction. Sulfide Precipitation.
	Physical/Chemical/ Biological	Powdered Activated Carbon Treatment (PACT).
	Thermal Destruction.	Liquid Injection. Rotary Kiln. Multiple Hearth. Fluidized Beds. Pyrolysis.
	Off-Site Treatment	POTW. RCRA Facility.

TABLE 2-2 (CONTINUED)

SUMMARY OF APPLICABLE REMEDIAL TECHNOLOGIES

General Response Action	Applicable Remedial Technology	Process Options
Ground Water Disposal.	Off-Site Disposal	POTW.
	On-Site Disposal	Reinjection Deep Well Injection. Surface Water Discharge.
In-Situ Treatment.	In-Situ Treatment	Bioreclamation. Chemical. Physical. Permeable Treatment Bed.

Surface Capping

Capping techniques utilize materials such as synthetic membranes, asphalt, concrete, clay, bentonite and soil. In general, capping is performed when extensive subsurface contamination at a site precludes excavation and removal of wastes because of potential hazards and/or excessive costs. Clay and soil, concrete, bituminous concrete/asphalt, clay, and composite materials (e.g., geomembranes, geotextiles, CLAYMAX™, etc.) represent commonly used single and multi-layered cap designs.

Surface Controls

Diversion/collection, grading, and soil erosion controls limit infiltration and erosion by providing continuous surface grades, diversion ditches, and collection ditches to limit the ponding of surface water.

Sediment Control Barriers

Sediment control barriers, such as cofferdams, filter fabrics and curtain barriers, are used in some contaminated sediment situations. These technologies provide hydraulic isolation of sediments so that dewatering, followed by dry excavation may be implemented, or so that dredging may be conducted in a contained environment.

Dust Control

Dust control plays an important role in soil remediation, although the technology is very simple and easy to implement. Typical dust control measures include revegetation, capping and watering.

Excavation and Removal

Excavation and removal of soils and wastes is used extensively in the remediation of hazardous waste Sites. This technology includes excavating, loading and transporting soil and waste material off-Site or to an on-Site location for treatment or disposal. Generally, the excavated areas are backfilled with clean fill and graded. This technology usually involves the use of conventional heavy construction equipment with special procedures for worker safety and containment of contamination during excavation and transport.

Sediment Dredging

The process of removing bottom sediments from a water body is commonly known as dredging. Potential dredging methods include mechanical dredging, hydraulic dredging and pneumatic dredging. These technologies are typically used in conjunction with a sediment control technology to limit sediment transport during dredging. Sediment control technologies include coffer dams, silt curtains, channel diversion and vegetation.

On-Site Disposal

On-Site disposal of contaminated soils and sediments involves the on-Site construction of a new landfill or upgrading an existing landfill. This technology could include consolidation of soil/sediment to a specific area of the Site followed by capping and containment technologies. This new construction or upgrading would be completed in general accordance with NYSDEC Part 360 regulations. Part 360 requirements include, among other specifications, a composite capping system and long-term monitoring.

Off-Site Disposal

Off-Site disposal of contaminated soil/waste involves the hauling of excavated soil/waste to a commercial sanitary or hazardous waste landfill for disposal.

Pretreatment (Dewatering and Solids Preparation)
On-Site or off-Site treatment of contaminated soils may require pretreatment such as dewatering and solids separation. Dewatering processes include centrifuge technologies, gravity thickening and filtration. The water generated during dewatering generally contains hazardous constituents, which would require additional treatment and could be treated together with ground water. Solid separation methods include screens and sieves (i.e., filtration), spiral classifiers, cyclones and hydroclone and settling basins.

Thermal Treatment

Thermal treatment, or incineration, can be used to destroy organic contaminants in liquid, gaseous and solid waste streams. The most common incineration technologies include liquid injection, rotary kiln, multiple hearth, fluidized bed and pyrolysis.

Chemical Treatment

Generally, organic and inorganic contaminants can be immobilized, chemically extracted, or detoxified using chemical treatment.

Soil washing extracts contaminants from soil matrices using an extracting solution. The washing fluid may be composed of water, organic solvents, chelating agents, surfactants, acids or bases, depending on the contaminant to be removed. The waste types that can be removed include heavy metals (e.g., lead, zinc), halogenated solvents (e.g., TCE, trichloroethane), aromatics (e.g., benzene, toluene, phenol), gasoline, fuel oils and PCBs.

Chemical detoxification techniques include neutralization, hydrolysis, oxidation/reduction, enzymatic degradation, and installation of permeable treatment beds. Operation involves the use of chemicals to destroy, degrade, or reduce the toxicity of contaminants.

Immobilization and Physical Treatment

A number of methods are currently being developed which involve physical manipulation of the soil in order to immobilize or detoxify waste constituents. These technologies include immobilization, solidification/stabilization, encapsulation, and volatilization.

Immobilization methods, which include precipitation, chelation, and polymerization, are designed to bind contaminants and render them less mobile, limit leaching of the contaminants from the soil matrix, and limit contaminant movement from the areas of contamination.

Solidification/stabilization involves mixing the wastes directly with a solidifying agent (e.g., portland cement, flyash and lime). The solidification/stabilization process produces a monolith with structural integrity or a crumbly solid. The contaminants do not necessarily interact chemically with the solidification agent, but are mechanically fixed within the solidified matrix. Solidification/stabilization methods usually involve the addition of chemicals in order to limit the solubility or mobility of waste constituents. This technology is well suited for solidifying soils containing heavy metals, organics (generally no more than 20% by volume), and solidified plastic. However, some constituents and soil characteristics may interfere with the use of cement-based methods, such as fine particles, silt, clay, and lignite. The advantages of cement-based methods include their low cost and the use of readily available mixing equipment.

Encapsulation methods physically microencapsulate wastes by sealing them in an organic binder or resin. These methods can be used for both organic and inorganic waste constituents.

Volatilization can be accomplished through thermal treatment or mechanical aeration. The direct heat rotary dryer is a proven thermal treatment unit and has been used for many years by the asphalt industry. This unit is best suited for use with free flowing granular solids.

In-Situ Treatment

In-situ treatment, an alternative to waste excavation and removal, entails in-place treatment of the soil through the use of chemical or biological agents or physical manipulations which degrade, remove, or immobilize contaminants. In-situ treatment processes include bioremediation, heating, soil flushing, and vitrification.

Bioremediation is a technique for treating zones of soil contamination by microbial degradation. The technology involves enhancing the natural biodegradation process by injecting nutrients, oxygen, and cultured bacterial strains or by introduction of genetically engineered microbes. Bioremediation can provide substantial reduction in organic contaminant levels in soils, without the cost of soil excavation. The technique is well suited for soil contaminated by petroleum by-products. A number of site-specific factors, such as site geology, soil characteristics, and aquifer characteristics, are critical in evaluating the implementability of this technology.

In-situ heating destroys or removes organic contaminants in the subsurface through thermal decomposition, vaporization, and distillation. Methods of in-situ heating are steam injection and radio frequency heating.

In-situ soil flushing is a process applied to in-place soils using a ground water extraction/reinjection system. In-situ soil flushing consists of injecting a solvent or surfactant solution to enhance the contaminant solubility, resulting in an increased recovery of contaminants in the leachate or ground water. The system includes extraction wells, reinjection wells and a wastewater treatment system.

In-situ vitrification involves electric melting of contaminated soil, converting it into durable glass. The advantages of vitrification processes are: 1) the limited amount of oxidation products and air emissions; and 2) the reduced leachability of inorganic materials, such as heavy metals.

2.5.2 Ground Water Remedial Technologies

Ground water remedial technologies contain, collect, divert, recover/reclaim treat or remove contaminated ground water to limit further migration of contaminants from the Site and manage the migration that has already occurred.

No Action

The no action alternative is used to assess the effectiveness of other ground water alternatives in achieving remedial objectives.

Institutional Actions

Institutional actions include supply well restrictions, replacing water supplies from affected wells with public water supply, if such wells exist, and ground water monitoring.

Surface Capping

Surface capping is discussed under Soil/Sediment Remedial Technologies, Section 2.5.1. This remedial technique limits the infiltration of precipitation through contaminated materials and reduces the subsequent contributions from the leachate to groundwater.

Vertical/Horizontal Barriers

Subsurface barriers are installed below ground to contain, capture, or redirect ground water or leachate flow in the vicinity of a site. Subsurface barriers include slurry walls, grouting, sheet piling, vibrating beams, grout curtains, compacted clay, geosynthetics and bottom sealing. These barriers can be used both to redirect the ground water flow upgradient of the Site, and to prevent ground water from leaving the Site on the downgradient side.

Ground Water Recovery

Extraction wells, interceptor trenches or extraction/ injection well systems and ground water pumping techniques, involve the active manipulation and management of ground water in order to: 1) contain or remove a plume; or 2) adjust ground water levels to limit the formation of a plume. Pumping methods are most effective at sites where the contaminated aquifer has a high intergranular hydraulic conductivity, is confined at the top and/or bottom and contaminants move readily in water. When used in conjunction with a cut-off wall and a cap, hydrologic isolation of a site can essentially be achieved. Plume removal implies a complete purging of the affected ground water system. Removal techniques are often suitable when contaminant sources have been removed and aquifer restoration is desired.

Interceptor trenches include buried conduits used to collect and convey contaminated ground water. They function like a line of horizontal extraction wells and can be used to contain or remove a plume, or to lower the ground water table to limit groundwater/waste material contact. One of the drawbacks of interceptor trenches is that they are generally limited to shallow depths.

Biological Ground Water Treatment

Biological treatment removes organic matter/chemicals from the waste stream through microbial degradation. Biological treatment processes which may be applicable to the treatment of aqueous wastes from hazardous waste sites include activated sludge, rotating biological discs, fixed film bioreactors, aerobic/anaerobic fluidized beds, batch reactors and aerated lagoons.

Physical/Chemical Treatment

Physical and chemical treatment processes are utilized to treat both inorganic and organic hazardous wastes which are either nonbiodegredable or resistant to biodegradation. Several physical/chemical treatment processes are summarized in the following paragraphs.

Activated carbon is well suited for removal of mixed organics from aqueous wastes. The process has been successfully demonstrated on volatile organics, organic nitrogen compounds, and chelated heavy metals.

Precipitation/flocculation/sedimentation is applicable for the removal of soluble metallic ions and certain anions. Process performance is affected by chemical interactions, temperature, pH, solubility variances and mixing effects. Organic compounds may also interfere with precipitation by forming organo-metallic complexes.

Ion exchange is a well-established technology for removal of heavy metals and hazardous anions from dilute solutions. This process involves the substitution of innocuous cations and anions, such as hydrogen and hydroxide, for more toxic cations and anions, such as cadmium and cyanides.

Resin sorption involves the use of sorptive resins for removal of organics. In this process, the contaminant is transferred from a dissolved state in an aqueous solution to the surface of a resin.

Filtration is frequently installed ahead of other treatment units to reduce the suspended solids load, the potential for biological growth, and clogging. Filtration could also be used as part of a polishing unit to remove residual floc from the effluent of a precipitation, flocculation, and sedimentation process.

Reverse osmosis involves using high pressure to force water through a synthetic membrane, leaving the contaminants behind the membrane. To avoid membrane plugging, it is important to remove suspended solids and oils through pretreatment. The application of membrane processes must be carefully evaluated on a pilot-scale basis, due to the potential for chemicals to react with the membrane.

Neutralization consists of adding an acid or base to a waste in order to adjust the pH. The selection of neutralizing agents should take into account the type, buffer capacity, and concentration of the waste.

Gravity separation is used to treat two-phased aqueous wastes, solid/liquid or liquid/liquid. Oil separation, centrifugation, and dissolved air flotation have been used for this purpose. Immiscible oily liquids, suspended solids, and hydrophobic chemicals can be treated with this technology. However, dissolved contaminants will not be removed by this process.

Air stripping is typically applied to ground water or wastewater contaminated with low levels of volatile organics. It is often followed by another process such as biological treatment or carbon adsorption and treatment of the discharge is frequently required.

Steam stripping is effective in the removal of high concentrations of organics dissolved in water. Those organic compounds such as volatile organics, phenols, ketones, and phthalates ranging from 1 to 20 percent can be removed by steam stripping.

Chemical oxidation can be used for detoxification of arsenic cyanide and for treatment of dilute waste streams containing oxidizable organics. Aldehyde, benzene, mercaptans, phenols, benzidine, unsaturated acids, and certain pesticides have been treated by this method. Common commercially available oxidants include potassium permanganate, hydrogen peroxide, calcium or sodium hypochlorite, ozone, and chlorine gas. Chemical oxidation of VOCs can be achieved with a UV-peroxidation system using ultra-violet light and or hydrogen peroxide.

Chemical reduction is well demonstrated for the treatment of lead, mercury, chromium (VI), PCBs, and unsaturated hydrocarbons. Narrow pH ranges need to be maintained to achieve optimum reaction rates. Common commercially available reducing agents include ferrous ions, sulfur dioxide, and sodium bisulfite. The reduced heavy metals would be treated in the precipitation/flocculation/ sedimentation treatment stage.

Sulfide precipitation involves the use of hydrogen sulfide or soluble sulfide salts to precipitate heavy metals. Most metal sulfides are less soluble than metal hydroxides at alkaline pH levels. Thus, heavy metal removal can be more readily accomplished through the use of sulfide rather than hydroxide as a chemical precipitant prior to sedimentation.

Powdered Activated Carbon Treatment (PACT)

The Powdered Activated Carbon Treatment (PACT) process is one of the most popular physical/chemical/biological treatment methods. PACT has been shown to upgrade effluent quality in conventional activated sludge treatment facilities. Pilot studies are necessary to evaluate PACT feasibility on specific wastes. Settled sludge from PACT may contain elevated levels of organics or heavy metals.

Thermal Destruction

Thermal destruction is discussed under Soil Remedial Technologies in Section 2.5.1 Thermal Treatment.

Off-Site Treatment and Disposal

Off-Site treatment involves transferring the liquid wastes at the Site to either a Publicly Owned Treatment Works (POTW) or a RCRA-TSD facility for treatment and disposal. Discharge to the POTW for the ALS would involve discharging the water to the Buffalo Sewer Authority (BSA) for final treatment and disposal, with or without pretreatment.

On-Site Disposal

On-Site disposal can be performed as a treatment/disposal technique, such as deep well injection, or as a method of handling groundwater which was extracted and treated in an on-Site water treatment unit. These methods are discussed further below.

Deep well injection is a method frequently used for disposal of contaminated or very toxic wastes not easily treated or disposed of by other methods. Deep well injection is limited by on-Site geological conditions. There must be a substantial and extensive impervious caprock strata, overlying a porous strata which is not used as a water supply or for other withdrawal purposes.

Reinjection to ground water involves the injection of treated ground water into the aquifer from which it was withdrawn. This approach can be used to help direct the flow of contaminated ground water toward the extraction wells or recovery trenches.

Surface water discharge involves the discharge of treated ground water to a nearby surface water body.

In-Situ Treatment

In-situ treatment entails the injection of chemical or biological agents or in-place physical treatment which degrade or immobilize contaminants. The most promising technologies are bioremediation and permeable treatment beds.

Bioremediation is a technique for treating zones of contamination by microbial degradation. The basic concept involves altering environmental conditions to enhance microbial catabolism of organic contaminants, resulting in the breakdown and detoxification of those contaminants. The bioremediation method that has received the most attention, and is the most feasible for in-situ treatment, is aerobic bioremediation which has been discussed previously.

Permeable treatment beds involve the addition of activated carbon or lime in a drainage collection trench or gravel bed. This technology has applicability to aquifers with shallow confining layers.

2.6 SCREENING OF TECHNOLOGIES

An initial screening of potentially applicable remedial technologies, or "process options", for the ALS was completed based on technical implementability (i.e., cost criteria were not considered in this evaluation). The results of this screening are presented on Table 2-3. Technical implementability, as per USEPA/540/G-89/004, involves an evaluation of each technology based on the following:

- Site conditions and characteristics;
- Physical and chemical characteristics of contaminants to evaluate the compatibility of various technologies; and
- Performance, reliability, and operating problems.

This initial screening process eliminated those remedial technologies which are unproven, or not expected to achieve an acceptable level of performance. Remedial technologies which could be extremely difficult to implement were also discarded. The technologies with the greatest potential for applicability to the Site characteristics and constituents of concern have been retained and are evaluated further in the subsequent sections of this report.

TABLE 2-3
PROCESS OPTIONS PRELIMINARY SCREENING

General Response Actions	Remedial Technology	Process Options	Description	Screening Comments
<u>SOIL/SEDIMENT</u>				
No action	None	Not Applicable	No action	Required for consideration by NCP
Institutional Actions	Access Restrictions	Deed Restrictions	Deeds for property in the area of influence would include restrictions	Potentially applicable
		Fencing	Fence-off areas of contaminated soil	Potentially applicable
Containment	Capping	Clay & Soil	Compacted clay covered with soil over areas of contamination	Potentially applicable
		Concrete	Installation of a concrete slab over contaminated area	Potentially applicable
		Bituminous Concrete/ Asphalt	Installation of asphalt pavement over contaminated area	Potentially applicable
		Composite	Clay & geomembrane covered with soil over contaminated area	Potentially applicable
		Geomembrane	Geomembrane covered with soil over contaminated area	Potentially applicable

TABLE 2-3 (CONTINUED) SOIL/SEDIMENT

General Response Actions	Remedial Technology	Process Options	Description	Screening Comments
Containment (continued)	Capping (continued)	Bentonite	Bentonite Geomembrane (e.g., Clamax ™) covered with soil over contaminated area	Potentially applicable
	Surface Controls	Diversion/Collection	Surface water diversion and collection to limit infiltration	Potentially applicable
		Grading	Changing topography of site to reduce migration of contaminants	Potentially applicable
		Soil Erosion Control	Revegetation or compaction to reduce erosion	Potentially applicable
	Sediment Control Barriers	Cofferdams	Small barriers to limit movement of suspended solids during treatment	Potentially applicable
		Curtain Barriers	Silt curtains used to limit migration of suspended solids	Potentially applicable
	Dust Controls	Revegetation	Reseeding of contaminated surface soils susceptible to erosion	Potentially applicable
		Capping	See under "Capping" above	

TABLE 2–3 (CONTINUED) SOIL/SEDIMENT

General Response Actions	Remedial Technology	Process Options	Description	Screening Comments
Containment (continued)	Dust Controls (continued)	Watering	Loose contaminated soils are watered during other remedial actions	Potentially applicable
Partial or Complete Removal	Excavation	Solids Removal	Excavate contaminated soils with a mechanical device	Potentially applicable
	Sediment Removal/ Dredging	Mechanical Dredging	Excavate contaminated sediment with a mechanical device	Potentially applicable
		Hydraulic Dredging	Excavate contaminated sediment in the form of a slurry	Potentially applicable
		Pneumatic Dredging	Excavate contaminated sediment using a pump and compressed air	Potentially applicable
Treatment	In-Situ Treatment	Bioremediation	Treating zones of contamination by microbial degradation	Not feasible for heavy metals. Difficult to implement
		Heating	Destroy or removes contaminants through thermal decomposition, vaporization and distillation	Not applicable for heavy metals. Difficult to implement
	In-Situ Treatment (continued)	Soil Flushing	Injecting a solvent to enhance the solubility of contaminants	Potentially applicable.
		Vitrification	Electric melting of soil	Unable to implement due to extensive waste area and shallow water table.

TABLE 2-3 (CONTINUED) SOIL/SEDIMENT

General Response Actions	Remedial Technology	Process Options	Description	Screening Comments
Treatment (continued)	Pretreatment - Dewatering	Centrifuge	Rotating auger that separates coarse material from centrate	Potentially applicable.
		Gravity Thickener	Circular tank used to concentrate slurries	Potentially applicable.
		Filtration	Solids are separated from aqueous by mechanical filtering process	Potentially applicable.
	Pretreatment -Solids Separation	Screens and Sieves	Mechanical Filters used to segregate soils	Potentially applicable
		Spiral Classifier	Rotating screens used to wash adhering clay and silt from sand & gravel	Potentially applicable
		Cyclone and Hydroclone	Separates solids that are heavier than water by centrifugal force	Potentially applicable
		Settling Basin	Allows solids to settle out by gravity	Potentially applicable
	Aqueous Waste Treatment for By-Products of Solids Treatment	See "Ground Water Treatment" Options		
	Thermal Treatment	Liquid Injection	Refractory lined combustion chamber(s) incinerate pumpable waste	Not applicable to inorganics. Difficult to implement.
		Rotary Kiln	Incinerates all forms of wastes (solid, liquid, gas)	Not applicable to inorganics. Difficult to implement.
		Multiple Hearth	Series of solid flat hearths incinerate all forms of waste, particularly sludges	Not applicable to inorganics. Difficult to implement.

TABLE 2–3 (CONTINUED) SOIL/SEDIMENT

General Response Actions	Remedial Technology	Process Options	Description	Screening Comments
Treatment (continued)	Thermal Treatment (continued)	Fluidized Bed	Waste injected into an agitated bed of sand where combustion occur	Not applicable to inorganics. Difficult to implement.
		Pyrolysis	Thermal conversion of waste into solid, liquid and gas components	Not applicable to inorganics. Difficult to implement
	Chemical Treatment	Immobilization	Render contaminants insoluble and limit leaching of the contaminants through metals precipitation	Not implementable due to soil properties at site. Requires homogeneous sand or coarse silt strata.
		Soil Washing	Extracts contaminants from soil using solvents or water	Potentially applicable.
		Detoxification	Destroy, degrade or otherwise reduce the toxicity of contaminants	Not implementable due to wide range of contaminant types.
	Physical Treatment	Solidification/ Stabilization	Contaminants are mechanically located within a solidified matrix	Potentially applicable
		Encapsulation	Sealing the wastes in an organic binder or resin	Potentially applicable
		Volatilization	Thermal treatment or mechanical aeration	Not applicable for heavy metals
Disposal	On-Site Land Disposal	On-Site Landfill	Improvement of existing on-site landfill	Potentially applicable.
	Off-Site Land Disposal	Landfilling	Dispose of waste in an off-site facility	Potentially applicable

TABLE 2-3 (CONTINUED) GROUND WATER

General Response Action	Remedial Technology	Process Options	Descriptions	Screening Comments
GROUND WATER/SURFACE WATER				
No Action	None	Not Applicable	No Action	Required for consideration by NCP
Institutional Actions	Access Restrictions	Deed Restrictions	Supply well usage in the area of influence would include deed restrictions	Potentially applicable
	Alternate Water Supply	City Water Supply	Extension of existing municipal water system to serve residents in area of influence	Not Applicable Municipal water already used by residents
	Monitoring	Ground Water Monitoring	Monitoring of on-site wells	Potentially applicable
Ground Water/Control	Extraction	Extraction Wells	System of well(s) to extract contaminated ground water	Potentially applicable
	Plume Removal	Extraction/ Injection Wells	Inject uncontaminated water to increase flow to extraction well(s)	Potentially applicable
	Subsurface Drains	Interceptor Trenches	Perforated pipe in trenches to collect contaminated ground water	Potentially Applicable
	Vertical Barriers	Slurry Wall	Trench around contaminated area is filled with soil or cement/bentonite slurry	Potentially applicable
		Sheet Piling	Ground water barrier made of wood, precast concrete or steel	Not feasible. Obstruction within waste will limit sheet pile advancement.

TABLE 2-3(CONTINUED) GROUND WATER

General Response Action	Remedial Technology	Process Options	Descriptions	Screening Comments
Ground Water Control (continued)	Vertical Barriers (continued)	Grout Curtain	Pressure injection of grout in a regular pattern of drilled holes	Potentially applicable.
		Vibrating Beam	Vibrating force to advance beams followed by injection of grout as beams are removed	Not feasible. Obstructions within waste limit beam advancement.
		Geomembrane Curtain	Ground water barrier made of geosynthetic materials	Potentially applicable.
		Compacted Clay	Ground water barrier constructed by compaction of clay in excavated trench	Potentially applicable.
	Horrizontal Barriers	Grouting	Injection of grout into a rock or soil mass	Not feasible. Performance and operating problems anticipated due to site conditions.
		Bottom Sealing	Horizontal barrier beneath the site	Not feasible. Performance and operating problems anticipated due to site conditions.
On-Site/Off-Site Treatment	Biological	Aerobic Treatment	Degradation of inorganics in the presence of oxygen	Not feasible for organics
		Anaerobic Treatment	Degradation of organics in the absence of oxygen	Not feasible for inorganics
	Physical/Chemical	Activated Carbon	Adsorption of contaminants onto activated carbon	Potentially applicable for organics and some inorganics
		Precipitation/ Flocculation/ Sedimentation	Removal of soluble metallic ions	Potentially applicable

TABLE 2-3 (CONTINUED) GROUND WATER

General Response Action	Remedial Technology	Process Options	Descriptions	Screening Comments
On-Site/Off Site Treatment (continued)	Physical/Chemical (continued)	Ion Exchange	Toxic ions are exchanged with harmless ions held by ion exchange material	Potentially applicable
		Resin Sorption	Contaminant is transferred from dissolved state to the surface of the resin	Potentially applicable
	Physical/Chemical	Filtration	Suspended solids are removed by passing through a bed of filter media	Potentially applicable
		Reverse Osmosis	Use of high pressure to force water through the membrane leaving contaminants behind	Potentially applicable
		Neutralization	Adding acid or base in order to adjust the pH	Potentially applicable
		Gravity Separation	Separate two-phased aqueous waste	Not feasible for soluble organics
	Physical/Chemical	Air Stripping	Mixing air with water in a packed column to promote transfer of VOCs to air	Potentially applicable
		Steam Stripping	Mixing steam with volatile organic contaminated water to promote transfer of VOCs to air	Potentially applicable
		Chemical Oxidation (UV-Peroxidation)	Addition of an oxidizing agent	Potentially applicable for a treatment of organics
		Chemical Reduction	Addition of a reducing agent	Potentially feasible for Cr(VI) reduction

TABLE 2-3 (CONTINUED) GROUND WATER

General Response Action	Remedial Technology	Process Options	Descriptions	Screening Comments
On-Site/Off-Site Treatment (continued)	Physical/Chemical (continued)	Sulfide Precipitation	Hydrogen sulfide or sodium sulfide used to precipitate heavy metals	Potentially applicable
	Physical/Chemical/ Biological	Powdered Activated Carbon Treatment (PACT)	Addition of carbon to the aeration basin	Potentially applicable for benzene, toluene, ethylbenzene and PCE
	Thermal Destruction	Liquid Injection	Refractory lined combustion chamber(s) incinerate pumpable waste	Not applicable for low levels of toxic organic pollutants and/or inorganics in liquid wastes
		Rotary Kiln	Incinerates all forms of wastes	Not applicable for low levels of toxic organic pollutants and/or inorganics in liquid wastes
		Multiple Hearth	Series of solid flat hearths incinerate all forms of waste, particularly sludges	Not applicable for low levels of toxic organic pollutants and/or inorganics in liquid wastes
	Thermal Destruction	Fluidized Bed	Waste injected into an agitated bed of sand where combustion occurs	Not applicable for low levels of toxic organic pollutants and/or inorganics in liquid wastes
		Pyrolysis	Thermal conversion of waste into solid, liquid and gas components	Not applicable for low levels of toxic organic pollutants and/or inorganics in liquid wastes
	Off-Site Treatment and Disposal	POTW	Extracted ground water discharge to BSA	Potentially applicable

TABLE 2-3 (CONTINUED) GROUND WATER

General Response Action	Remedial Technology	Process Options	Descriptions	Screening Comments
On-Site/Off-Site Treatment (continued)	Off-Site Treatment and Disposal (continued)	RCRA Facility	Extracted ground water transported to RCRA facility for treatment	Potentially applicable
	In-Situ Treatment	Bioremediation	Treating zones of contamination by microbial degradation	Applicable for organics
		Chemical	Immobilizationsoil flushing and detoxification used to decontaminate soil	Potentially applicable
		Physical	Heating, vitrification and ground freezing to demobilize contaminants	Potentially applicable
On-Site/Off-Site Treatment (continued)	In-Situ Treatment (continued)	Permeable Treatment Beds	Downgradient trenches filled with activated carbon or lime to treat contaminants	Potentially applicable
Ground Water Disposal	Off-Site Disposal	POTW	Extracted water discharged to Olean Waste Water Treatment Plant	Potentially applicable
		Surface Water	Discharge to nearby water body following pretreatment	Potentially applicable
	On-Site Disposal	Deep Well Injection	Extracted water discharged to deep well system	Extremely difficult to implement due to regulatory controls.
		Reinjection to Ground Water	Discharge to ground water following treatment	Potentially applicable

2.7 EVALUATION OF TECHNOLOGIES/PROCESS OPTIONS

The technologies considered to be implementable were evaluated in greater detail. The results of the second level of screening are summarized in this section. These remedial technologies were evaluated on the basis of effectiveness and implementability. A relative cost comparison was also completed; however, cost was not used as the sole criteria to screen-out any of the technologies. Table 2-4 summarizes the results of the evaluation process and Table 2-5 summarizes the technologies that were subsequently retained for further consideration. A discussion of each of the evaluation categories is presented below.

Effectiveness

Effectiveness refers to the degree to which a technology achieves the remedial action objectives. As this evaluation pertains to technologies rather than overall remedial alternatives, a technology need not achieve the remedial objective in its entirety to be considered effective. Effective technologies may be combined with other complementary technologies, if required, to form effective alternatives which address the remedial objectives. This evaluation therefore is based upon the effectiveness of each technology at its intended site-specific function.

Implementability

Implementability encompasses both the technical and administrative feasibility of implementing a technological process. As discussed in Section 2.6, technical implementability is used to initially screen technologies and to eliminate those that are clearly ineffective or unworkable at a site. Therefore, this subsequent, more detailed evaluation of technologies places greater emphasis on the institutional aspects of implementability, such as the ability to obtain necessary permits for off-Site actions, the availability of treatment, storage and disposal services

TABLE 2-4 EVALUATION OF PROCESS OPTIONS

Process Options	Effectiveness	Implementability	Cost	Retain Action/ Screen Comments
<u>SOIL/SEDIMENT</u>				
No Action.	Does not achieve remedial action objectives.	Not acceptable to local government/public.	None.	Yes. Required as a baseline to evaluate other alternatives.
Fencing.	Effective in limiting contact with contaminated soil. Does not achieve all remedial action objectives.	Readily implementable.	Negligible.	Yes. Must be combined with other remedial actions.
Deed Restrictions.	Effective in restricting the land use. Does not achieve all remedial action objectives.	Depends on legal requirements and authorities.	Negligible.	Yes. Must be combined with other remedial actions.
Clay & Soil Capping.	Effective in limiting contact with contaminated soil. Susceptible to weathering and cracking. No contaminant reduction.	Implementable. Restriction on future land use.	Low capital, moderate O & M.	No. Fails effectiveness criteria.
Concrete Capping.	Effective in limiting contact with contaminated soil. Susceptible to weathering and cracking. No contaminant reduction.	Implementable. Restrictions on future land use.	Moderate capital, moderate O & M.	No. Fails effectiveness criteria.
Bituminous Concrete/ Asphalt Capping.	Effective in limiting contact with contaminated soil. Susceptible to weathering and cracking. No contaminant reduction.	Implementable. Restrictions on future land use.	Low capital, moderate O & M.	No. Fails effectiveness criteria.

TABLE 2-4 EVALUATION OF PROCESS OPTIONS

Process Options	Effectiveness	Implementability	Cost	Retain Action/ Screen Comments
Composite Capping.	Effective in limiting contact with contaminated soil. No contaminant reduction.	Implementable. Restrictions on future land use.	Moderate capital, low O & M.	Yes, if combined with other option(s).
Geomembrane Capping.	Effective in limiting contract with contaminated soil. No contaminant reduction.	Implementable. Restrictions on future land use.	Moderate capital, low O & M.	Yes. if combined with other options.
Bentonite Capping.	Effective in limiting contract with contaminated soil. No contaminant reduction.	Implementable. Restrictions on future land use.	Moderate capital, low O & M.	Yes, if combined with other options.
Diversion/Collection.	Effective in limiting infiltration of surface water in contaminated area. Supplements other options (i.e., capping options).	Implementable.	Low capital, low O & M.	Yes.
Grading.	Effective in limiting infiltration of surface water in contaminated areas. Supplements other options (i.e. excavation/ capping).	Implementable.	Low capital, low O & M.	Yes.
Soil Erosion Control.	Effective in reducing erosion of contaminated soil. Supplements other options.	Implementable.	Low capital, low O & M.	Yes.
Cofferdams.	Effective in limiting movement of suspended solids during treatment. Supplements other options.	Implementable.	Moderate capital.	Yes.

TABLE 2-4 EVALUATION OF PROCESS OPTIONS

Process Options	Effectiveness	Implementability	Cost	Retain Action/ Screen Comments
Curtain Barriers.	Effective in limiting movement of suspended solids during dredging. Supplements other options.	Readily implementable.	Moderate capital.	Yes.
Revegetation/ Restoration.	Effective in reducing erosion of contaminated soil. Supplements other options (i.e., excavation, capping).	Readily implementable.	Low capital, Low O & M.	Yes.
Watering.	Effective in reducing fugitive dust during implementation of other remedial options. Supplements other options (i.e., excavation).	Readily implementable.	Negligible.	Yes.
Solids Excavation.	Effective in removing contaminated soils/ sediments.	Implementable with proper health and safety measures.	Moderate capital.	Yes.
Mechanical Dredging.	Effective in removing contaminated sediments. Used with sediment control. Should be done during low flow conditions.	Implementable with proper health and safety measures and sediment controls.	Moderate capital.	Yes.
Hydraulic Dredging.	Effective in removing contaminated sediments. Does not require channel rerouting.	Implementable. Requires disposal/treatment option.	Moderate capital.	Yes.
Pneumatic Dredging.	Effective in removing contaminated sediments. Does not require channel rerouting.	Not a common technology in the U.S. Requires disposal/ treatment option.	High capital.	No. Fails implementability criteria.

TABLE 2-4 EVALUATION OF PROCESS OPTIONS

Process Options	Effectiveness	Implementability	Cost	Retain Action/ Screen Comments
Centrifugation.	Effective for separation of soils.	Implementable.	Moderate capital, low O & M.	Yes.
Gravity Thickening.	Effective with other options for concentration of slurries.	Implementable.	Moderate capital low O & M.	Yes.
Filtration	Effective for soil/water separation.	Implementable.	Moderate capital, high O & M.	Yes.
Screens & Sieves.	Effective for segregation of soils. Supplements other options.	Implementable.	Moderate capital, high O & M.	Yes.
Spiral Classifier.	Effective for separation of coarse soils from fines.	Implementable.	High capital, moderate O & M.	Yes.
Cyclone and Hydroclone.	Effective for separation of solids heavier than water.	Implementable.	High capital, low O & M.	Yes.
Settling Basin.	Effective for separation of suspended solids from liquids.	Implementable. Takes longer than other solids separation processes.	Moderate capital, low O & M.	Yes.
Soil Washing.	Effective in extraction of contaminants from soil.	Implementable. May require site-specific treatability study.	Moderate capital, moderate O & M.	Yes.
Solidification/ Stabilization.	Effective for limiting leaching of wastes. No contaminant reduction.	Implementable. May require site-specific treatability study.	Moderate capital, no O & M.	Yes.
Encapsulation.	May not be compatible with on-site organic contamination. No long term data available.	Implementable.	High capital, no O & M.	No. Fails effectiveness criteria.

TABLE 2-4 EVALUATION OF PROCESS OPTIONS

Process Options	Effectiveness	Implementability	Cost	Retain Action/ Screen Comments
In-Situ Soil Flushing.	Difficult to predict effectiveness. Hasn't been adequately demonstrated.	Implementable.	Moderate capital, moderate O & M.	No. Fails effectiveness criteria.
Vitrification.	Difficult to predict effectiveness. Hasn't been adequately demonstrated.	Difficult to Implement. Insufficient field test information.	Very high capital, no O & M.	No. Fails effectiveness and implementability criteria.
On-Site Landfilling.	Effective in containing waste material.	Implementable.	Moderate capital, moderate O & M.	Yes.
Off-Site Landfill.	Effective in removing contaminants from the site.	Implementable for a portion of the waste material on-site. Requires transport and handling.	High capital, no O & M.	Yes
<u>GROUND WATER/ SURFACE WATER</u>				
No Action.	Does not achieve remedial action objectives.	Not acceptable to local government/public.	None.	Yes.
Supply Well Restrictions.	Effective in restricting the water use. Does not achieve all remedial action objectives.	Depends on legal requirements and authorities.	Negligible.	Yes. Must be combined with other remedial actions.
Ground Water Monitoring.	Useful for documenting conditions. No contaminant reduction.	Alone, not acceptable to local government/public.	Low capital, low O & M.	Yes. Must be combined with other remedial actions.
Capping.	Addressed above under "Soil/ Sediment".			
Extraction Wells.	Effective if used in conjunction with other remedial measures.	Implementable. May pull in contaminants from off-site sources.	Moderate capital, moderate O & M.	Yes.
Extraction/Injection Wells.	May increase efficiency of the extraction process.	Potentially implementable in overburden.	Moderate capital moderate O & M.	Yes.

TABLE 2-4 EVALUATION OF PROCESS OPTIONS

Process Options	Effectiveness	Implementability	Cost	Retain Action/ Screen Comments
Interceptor Trenches/Drainage Collection System.	Effective at site due to shallow confining layer.	Potentially implementable in overburden.	Moderate capital, Moderate O&M.	Yes.
Slurry Wall	Effective for limiting lateral migration of landfill contaminants.	Implementable. Restrictions on future land use.	Moderate capital, low O & M.	Yes, if combined with other options.
Grout Curtain	Not effective for limiting lateral migration of landfill contaminants in unconsolidated soils.	Implementable. Restrictions on future land use.	High capital, low O & M.	No, fails effectiveness criteria
Geomembrane Curtain	Effective for limiting lateral migration of landfill contaminants.	Implementable. Restrictions on future land use.	Moderate capital, low O & M.	Yes, if combined with other options.
Compacted Clay	Effective for limiting lateral migration of landfill contaminants.	Implementable. Restrictions on future land use.	Moderate capital, low O & M.	Yes, if combined with other options.
Anaerobic Treatment	Potentially effective to treat some VOCs, however, ineffective on other contaminants.	Difficult to implement at site due to the low organic waste concentration.	Moderate capital, high O & M.	No. Fails effectiveness and implementability criteria.
Activated Carbon.	Proven technology for treating VOCs and Cr(VI).	Readily implementable.	Moderate capital, high O & M.	Yes.
UV-Peroxidation	Potentially effective to treat organics.	Readily implementable.	Moderate capital, moderate O & M.	Yes.
Precipitation/ Flocculation/ Sedimentation.	Effective and reliable. Requires sludge disposal.	Readily implementable.	Low capital, moderate O & M.	Yes.
Ion Exchange	Effective for removal of metals/organics from groundwater.	Readily implementable.	Moderate capital, moderate O & M.	Yes.
Resin Sorption	Effective for removal of metals/organics from groundwater.	Readily implementable.	Moderate capital, moderate O & M.	Yes.

TABLE 2-4 EVALUATION OF PROCESS OPTIONS

Process Options	Effectiveness	Implementability	Cost	Retain Action/ Screen Comments
Filtration.	Effective for removing suspended solids. Can be used as pretreatment to other options.	Readily implementable.	Moderate capital, moderate O & M.	Yes.
Reverse Osmosis.	Limited effectiveness for removal of charged ions (EQ): Cr(VI), some organics and metals. Unproven technology for high volume treatment applications.	Difficult to Implement. May require extensive pretreatment.	Moderate capital, high O & M.	No. Fails implementability and effectiveness criteria.
Neutralization.	Effective for pH adjustment. Used as pretreatment options.	Readily implementable.	Low capital, low O & M.	Yes.
Process Option	Effectiveness	Implementability	Cost	Retain Action/ Screen Comments
Air Stripping.	Proven effective technology for treating PCE & TCE. Results in VOC air emissions.	Readily implementable.	Moderate capital, moderate O & M.	Yes
Steam Stripping.	Effective for concentrated waste.	Difficult to contain contaminated water generated during cleaning process.	Very high O & M cost.	No. Fails implementability criteria.
Chemical Reduction.	Effective for reduction of Cr(VI) to Cr(III) by using reducing agents.	Readily implementable.	Moderate capital, moderate O & M.	Yes.
Sulfide Precipitation.	Effective for precipitation of heavy metals.	Readily implementable.	Moderate capital, moderate O & M.	Yes.
Powdered Activated Carbon Treatment (PACT).	Not effective for low level organics and/or inorganics.	Readily implementable.	High capital, high O & M.	No. Fails effectiveness criteria.

TABLE 2-4 EVALUATION OF PROCESS OPTIONS

Process Options	Effectiveness	Implementability	Cost	Retain Action/ Screen Comments
Disposal/Treatment at RCRA Facility.	Effective.	Implementable at nearby treatment facilities.	High capital.	Yes.
In-Situ Treatment Bioremediation.	May be effective for organics, but not effective for inorganics. Unproven technology.	Difficult to implement due to low levels of organics.	Moderate capital, high O & M	No. Fails effectiveness and implementability criteria.
Permeable Treatment Beds.	May be effective.	Implementable.	Moderate capital, high O & M	Yes
In-Situ Chemical Treatment.	Not a proven technology.	Implementable.	Moderate capital, moderate O & M.	No. Fails effectiveness criteria.
In-Situ Physical Treatment.	Effective for organics and immobilizing contaminants. Does not lower contamination levels.	Difficult to implement.	High capital, high O & M.	No. Fails effectiveness and implementability criteria.
Discharge to POTW.	Effective and reliable method.	Implementable. Discharge permits required.	Low capital, low O & M.	Yes.
Discharge to Surface Water.	Effective and reliable method. requires extensive pretreatment.	Implementable. Discharge permits required.	Low capital, low O & M.	Yes.
Deep Well Injection.	Effective. Does not eliminate contaminants.	Implementable. May impact downgradient municipal well.	Moderate capital, moderate O & M.	Yes.
Reinjection to Groundwater.	Potentially effective. Requires pretreatment.	Implementable. May impact municipal supply wells.	Moderate capital, moderate O & M.	Yes.

TABLE2-5 SUMMARY OF APPLICABLE TECHNOLOGIES

Type of Media	Applicable Technologies
Soil/Sediment.	No Action Fencing Deed Restrictions Composite Capping (Geomembrane, Geotextile, Bentonite, Clay & Soil) Diversion/Collection Grading Soil Erosion Control Cofferdams Curtain Barriers Revegetation/Restoration Watering Solids Excavation Mechanical/Hydraulic Dredging Off-Site Landfill On-Site Landfill Centrifugation Gravity Thickening Filtration Screens and Sieves Settling Basin Spiral Classifier Cyclone and Hydroclone Soil Washing Solidification/Stabilization
Ground Water/ Surface Water	No Action Supply Well Restrictions Groundwater Monitoring Extraction Wells Extraction/Injection Wells Slurry Wall Clay Cut-off Wall Geomembrane Curtain Drainage Collection System Activated Carbon UV Peroxidation Conventional Precipitation Ion Exchange using Resin Sorption Filtration Neutralization Air Stripping Chemical Reduction Sulfide Precipitation Resin Sorption Permeable Treatment Pad Discharge to POTW Discharge to Surface Water Reinjection to Ground Water Deep Well Injection Off-Site Disposal at RCRA Facility

(including capacity), and the availability of necessary equipment and skilled workers to implement the technology.

Cost

Relative capital and O & M costs were estimated during this stage of the screening process. The cost estimates were made on the basis of published unit costs and vender estimates, and each process option is evaluated as to whether costs are high, medium or low relative to other process options of the same technology type.

Section 3

Section 3

3.0 DEVELOPMENT AND SCREENING OF ALTERNATIVES

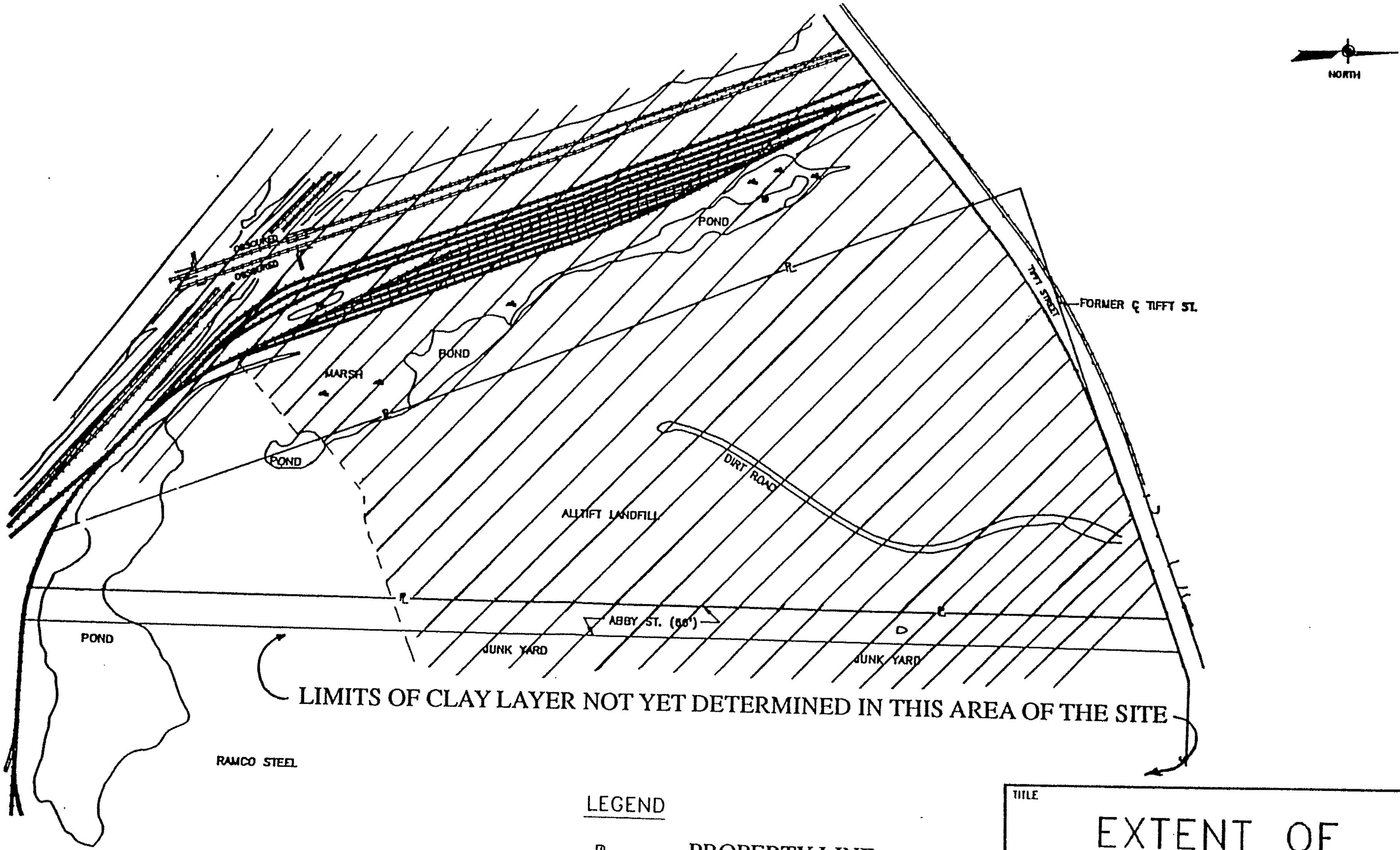
Screening of potentially applicable technologies was addressed in Section 2.0. Based on the technologies that have passed this initial screening process, Section 3.0 addresses the development and screening of media-specific alternatives (i.e., alternatives for soil, sediment, surface water and ground water) and the identification of the most feasible comprehensive remedial alternatives for subsequent detailed analysis (i.e., the Phase III Feasibility Study).

Located below a portion of the Site is a clay layer that limits the vertical migration of analytes from the landfill into the lower water bearing zone (Figure 3-1). Analytical data collected from the bedrock monitoring wells at the Site indicate that the existing clay layer is preventing the migration of analytes into the lower water bearing zone, even though this layer does not extend throughout the entire Site. The soil/sediment areas at the Site have been divided into the following three groups to take into consideration this natural confining layer:

1) Soil Over Clay Layer - this material includes the contaminated soil and fill in the landfill above the existing clay layer that extends over the majority of the Site.

2) Soil Over Bedrock and Sand - this material includes the contaminated soil and fill in the southern portion of the Site which is not underlain by the clay layer.

3) Pond Sediment - this material includes the contaminated sediment in the water bodies surrounding the south and west sides of the landfill.



LEGEND

PL PROPERTY LINE

(hatched box) APPROXIMATE AREA OF CLAY LAYER

NOTES:
1) DRAWING ADAPTED FROM METCALF & EDDY DRAWING.
2) LIMITS OF CLAY LAYER BASED ON BORING LOGS PREPARED BY OTHERS.

TITLE	EXTENT OF CLAY LAYER
PREPARED FOR	
ERM ERM–Northeast Environmental Resources Management	SCALE: / FIGURE: 3–1 / DATE:
DRAWN:	JOB NO.: / FILE NAME:

The technologies that apply to these three areas are summarized on Table 3-1. Due to its large volume and the limited vertical migration potential of the analytes within the material above the existing clay layer, the applicable technologies for this area include no action, limited action, on-Site landfilling (i.e., containment) and off-Site landfilling. The off-Site landfilling option would apply to only portions of this area exceeding specific cleanup levels.

The applicable technologies for addressing the contaminated soil, pond sediments and fill that does <u>not</u> have a confining clay layer below it include no action, limited action, solids excavation, on-Site landfilling, off-Site landfilling, solids physical treatment and solids chemical treatment technologies. The only difference between the applicable technologies for the soil and the pond sediment is the method of excavation (i.e., sediment removal includes mechanical/hydraulic dredging, cofferdams, curtain barriers and diversion/collection technologies; soil removal technologies include excavation equipment and watering/dust control).

The applicable technologies for ground water are summarized on Table 3-2. Groundwater technology categories include no action, limited action, extraction/control, on-Site treatment and disposal/discharge. Note that surface water is not addressed as a separate media of concern because it is anticipated that remediation of the pond sediments and contaminated surface soils at the Site will result in a reduction in the analyte levels in the on-Site surface waters.

Table 3-1
SOIL/FILL/SEDIMENT REMEDIAL TECHNOLOGY SUMMARY

REMEDIAL TECHNOLOGY CATEGORY	REMEDIAL TECHNOLOGY		
	SOIL/FILL OVER CLAY LAYER	SOIL/FILL OVER BEDROCK AND SAND	POND SEDIMENT
1. No Action	No Action	No Action	No Action
2. Limited Action	Fencing and Deed Restrictions	Fencing and Deed Restrictions	Fencing and Deed Restrictions
3. Solids Excavation	Not Feasible	Mechanical Equipment Watering/Dust Control	Mechanical Dredging Hydraulic Dredging Cofferdams Curtain Barriers Diversion/Collection
4. On-site Landfill	Composite Cap Grading Soil Erosion Control Revegetation/Restoration	Composite Cap Grading Soil Erosion Control Revegetation/Restoration	Composite Cap Grading Soil Erosion Control Revegetation/Restoration
5. Off-site Landfill	Off-site Sanitary Landfill Off-site Hazardous Waste Landfill	Off-site Sanitary Landfill Off-site Hazardous Waste Landfill	Off-site Sanitary Landfill Off-site Hazardous Waste Landfill
6. Solids Physical Treatment	Not Feasible	Centrifugation Gravity Thickening Screens and Sieves Settling Basin Spiral Classifier Cyclone and Hydroclone Filtration	Centrifugation Gravity Thickening Screens and Sieves Settling Basin Spiral Classifier Cyclone and Hydroclone Filtration
7. Solids Chemical Treatment	Not Feasible	Soil Washing Solidification/Stabilization	Soil Washing Solidification/Stabilization

Table 3-2
GROUND WATER REMEDIAL TECHNOLOGY SUMMARY

REMEDIAL TECHNOLOGY CATEGORY	REMEDIAL TECHNOLOGY
1. No Action	No Action
2. Limited Action	Supply Well Restrictions Ground Water Monitoring
3. Extraction/Control	Extraction Wells Extraction/Injection Wells Drainage Collection System Slurry /Clay/Geomembrane Wall
4. On-site Treatment	Activated Carbon Conventional Precipitation Ion Exchange Filtration Neutralization Air Stripping Chemical Reduction Sulfide Precipitation Resin Sorption UV-Peroxidation Permeable Treatment Beds
5. Disposal/Discharge	Sanitary Sewer to POTW Surface Water Ground Water Injection Off-site Treatment and Disposal

3.1 DEVELOPMENT OF ALTERNATIVES

The remedial alternatives presented in this section include alternatives that exceed, achieve, or do not achieve appropriate levels of remediation, as defined by the remedial action objectives (see Section 2.2). Note that these alternatives are not comprehensive (i.e., do not address all media) and the majority of them need to be supplemented with other alternatives to be effective.

Table 3-3 includes 11 separate remedial alternatives for soil/sediment. These alternatives are based on the applicable technologies presented on Table 3-1 and have been grouped for the purpose of evaluation into the following five categories (i.e., to identify the best media-specific alternatives in each group for subsequent development of comprehensive remedial alternatives):

1) No Action;
2) Limited Action;
3) Containment;
4) Off-Site Landfill; and
5) On-Site Treatment.

As shown on Table 3-3, to simplify the presentation of the containment alternatives, soil/sediment containment also includes vertical barrier technologies which were previously grouped with the ground water technologies.

Table 3-4 includes 17 separate remedial alternatives for ground water. These alternatives are based on the applicable technologies presented on Table 3-2, and have been grouped for the purpose of evaluation into the following six

Table 3-3

SOIL/SEDIMENT REMEDIAL ALTERNATIVE SUMMARY

REMEDIAL ALTERNATIVE	DESCRIPTION
1. No Action	No Action
2. Limited Action	Fencing and Deed Restrictions
3. Containment	
3A	Capping (1)
3B	Capping + Cut-off wall (1)
3C	Capping + Consolidation (1&2)
3D	Capping + Consolidation + Cut-off wall (1&2)
4. Off-site Landfill	
4A	All Contaminated Soil/Sediment to Off-site Landfill (2)
4B	Sediment and Soil Outside Clay Layer to Off-site Landfill (1&2)
5. On-site Treatment (3)	
5A	Soil Washing
5B	Solidification/Stabilization

Notes:
1) These technologies may include one or more of the following supplemental technologies:
Composite capping; Grading; Revegetation/Restoration; Slurry/Clay/Geomembrane Cut-off Wall and Soil Erosion Controls.
2) These technologies may include one or more of the following supplemental technologies:
Cofferdams; Curtain Barriers; Watering; Mechanical/Hydraulic Dredging; and Solids Excavation.
3) These technologies may include one or more of the following supplemental technologies:
Centrifuge; Gravitiy Thickening; Filtration; Sieves and Screens; Settling Basins; Spiral Classifiers; and Cyclone and Hydroclone.

Table 3-4

GROUNDWATER REMEDIAL ALTERNATIVE SUMMARY

REMEDIAL ALTERNATIVE	DESCRIPTION
1. No Action	No Action
2. Limited Action	Supply Well Restrictions Groundwater Monitoring
3. Extraction/Control	
3A	Extraction wells remove contaminated ground water
3B	Extraction/Injection Wells
3C	Interceptor Trenches (2)
4. On-site Treatment - Inorganics (1)	
4A	Conventional Precipitation
4B	Sulfide Precipitation
4C	Ion Exchange
4D	Activated Carbon
4E	Resin Sorption
5. On-site Treatment - Organics (1)	
5A	Activated Carbon
5B	Air Stripping
5C	UV-Peroxidation
6. Disposal/Discharge	
6A	Off-site Treatment and Disposal
6B	Sanitary Sewer to POTW
6C	Surface Water
6D	Groundwater Injection

Note:
1) These technologies may include one or more of the following supplemental technologies: Chemical Reduction; Nuetralization; and Filtration.
2) Interceptor trenches may be modified to provide treatment as permeable treatment beds.

categories (i.e., to identify the best media-specific alternatives in each group for subsequent development of comprehensive remedial alternatives):

1) No Action;
2) Limited Action;
3) Extraction/Control;
4) On-Site Treatment - Inorganics;
5) On-Site Treatment - Organics; and
6) Disposal/Discharge.

Each of the 28 alternatives (i.e., 11 soil/sediment and 17 groundwater) presented on Table 3-3 and 3-4 are described below.

3.1.1 Description of Soil/Sediment Alternatives

Alternative 1: No Action

The no action alternative for soil/sediment would involve leaving the Site in its present condition. Analytes in the soil and sediment would remain on-Site and could potentially migrate to ground water and surface water. The no action alternative is presented here as a baseline against which to evaluate other alternatives.

Alternative 2: Limited Action

The limited action alternative would limit public access to the Site and contact with contaminated areas identified during the RI. This alternative would include Site fencing and deed restrictions.

Alternative 3A: Capping

The capping alternative includes a composite cap over the entire contaminated area and improvement of Site drainage (e.g., grading, diversion/collection, soil erosion control, revegetation, etc.). Capping would reduce the movement of contamination via air, surface water and ground water (i.e., by reducing infiltration). Surface capping at the ALS would also limit direct contact with the contaminated soils by persons or animals entering the Site and would enhance other technologies (e.g., ground water collection) by mitigating the impacts of infiltration or isolating the source of contamination.

Alternative 3B: Capping + Cut-Off Wall

This alternative combines the capping alternative discussed above with a perimeter cut-off wall. The cut-off wall would be comprised of a soil/bentonite slurry wall or compacted clay (i.e., in areas of shallow depth to clay). This wall would limit the horizontal migration of ground water from the landfill.

Alternative 3C: Consolidation + Capping

The consolidation with capping alternative includes excavation of the contaminated soil and sediment in areas not underlain by clay and consolidation of this material with the soil and fill above the clay layer. The on-Site contaminated soil would be placed above a natural confining unit, thus limiting the potential for vertical migration of analytes. A cap would then be installed over the contaminated area.

Alternative 3D: Consolidation + Capping + Cut-off Wall

This alternative combines the benefits of consolidation, capping, and a perimeter cut-off wall. This alternative would essentially contain all contaminated soil and sediment on-Site (i.e., source isolation) and would limit potential vertical and horizontal leachate and ground water migration at the Site.

Alternative 4A: Off-Site Landfill Disposal - All Soil/Sediment Above Cleanup Levels

This alternative would involve excavation and removal of all soil and sediment above the cleanup levels. Excavation and off-Site disposal is a proven technology for remediation of waste Sites where waste quantities are not excessive and the excavated material can be accepted at an off-Site landfill. Watering and other dust control measures would be implemented during excavation. Soil excavation can be accomplished by a wide variety of conventional equipment ranging in size from a 22 cubic yard dragline down to the 1/4 cubic yard backhoe. These basic types of excavation machinery fall into the following general categories:

- Backhoes;
- Cranes and attachments (draglines and clamshells); and
- Dozers and loaders.

Excavation, dredging and transport equipment would have to be decontaminated prior to entry and before leaving the Site.

Sediment would be removed by constructing a cofferdam or silt curtain around the contaminated area of the on-Site ponds and dredging the sediments.

Dredged sediments could be dewatered and taken off-Site with the contaminated soil.

Based on waste characterization testing of the excavated material, the soil and sediment above the cleanup criteria would be taken to a sanitary landfill if below TCLP limits, or a hazardous waste landfill if above TCLP limits.

Alternative 4B: Off-Site Landfill Disposal - Soil/Sediment Outside Clay Layer

This alternative would involve excavation and disposal of the soil and sediment, above the cleanup levels, that is outside the area of the clay layer. This alternative is similar to Alternative 3C; however, instead of consolidating the soil and sediment on-Site, it would be taken to an off-Site landfill. Under this alternative, soil and sediment outside the area of the clay layer would be removed from the Site and would no longer be a potential on-Site source.

Alternative 5A: Soil Washing

Under this alternative, contaminated soil would be excavated and washed on-Site with a liquid medium for removal of contaminants. Sediment would be removed by constructing a cofferdam or silt curtain around the contaminated area of the on-Site ponds and the sediments would be dredged. Dredged sediments would be dewatered and washed on-Site together with the contaminated soil. Decontaminated soil/sediment would be backfilled while the washing solution would be reclaimed or treated for removal of the contaminants via the following treatment/disposal technologies:

- Reduction;
- Neutralization;

- Precipitation/Flocculation;
- Sedimentation;
- Filtration;
- Granular Activated Carbon Adsorption;
- pH Adjustment;
- Belt Filter Press (for sludge dewatering); and
- Off-Site Disposal of Dewatered Sludge.

Soil washing solutions with the greatest potential fall into the following classes:

- Acids-bases;
- Complexing and chelating agents; and
- Certain reducing/oxidizing agents.

Water alone can be used to leach water-soluble or water-mobile organics and inorganics. However, for most inorganics, including lead, chromium, barium, arsenic and copper, adjusting the pH with dilute solutions of acids or bases will enhance inorganic solubilization and removal. Desirable soil washing fluid characteristics are listed below:

- Favorable separation coefficient for extraction;
- Low volatility;
- Low toxicity;
- Safety and ease of handling;
- Recoverability; and
- Treatability of washing fluid.

Additionally, soil segregation methods (e.g., centrifugation, gravity thickening, screens and sieves, spiral classifier, cyclone, hydroclone, and settling basins) may be used to separate the soils into various particle sizes prior to the washing process. The treated effluent would be treated on-Site, taken to an off-Site treatment facility or discharged to the POTW, surface water or ground water. Prior to implementation of this alternative, treatability studies would be needed to evaluate the soil washing medium and the appropriate wash solution treatment process.

Alternative 5B: Solidification/Stabilization

Under this alternative, contaminated soil/sediment would be excavated/ dredged and solidified/stabilized on-Site. There are various types of solidification/stabilization processes such as cement solidification, silicate-based processes, sorbent materials processes, and thermoplastic techniques. The objectives of the solidification treatment process are to:

- Improve the handling and physical characteristics of the waste;
- Decrease the surface area across which transfer or loss of analytes can occur;
- Limit the solubility of metal contaminants in the waste; and
- Make the soil non-hazardous.

The success of this technology would depend primarily upon two factors: 1) the Site-specific waste characteristics; and 2) the chemicals/binding reagents to be applied to the soil. A cement-based solidification process appears feasible for the ALS because this technology has proven effectiveness in treating soils contaminated with heavy metals and low-level organics. However, bench-scale and pilot-scale studies are needed to evaluate the optimum solidification/stabilization process. Factors to be considered include leachability, compatibility with Site materials, volume increase, and strength of the solidified material. Solidification of the contaminated soil and sediment is expected to result in an increase in volume of approximately 40%. The actual increase in volume would be evaluated by bench- and pilot-scale studies.

3.1.2 *Description of Ground Water Alternatives*

Alternative 1: No Action

The no action alternative for ground water would involve leaving the Site in its present condition. Analytes in the shallow water bearing zone would not be addressed, and could potentially migrate off-Site. The no action alternative is presented here as a baseline against which to evaluate other ground water alternatives.

Alternative 2: Limited Action

This alternative includes monitoring and supply well use restrictions. The monitoring wells would be sampled and tested periodically. No treatment or disposal actions would be taken relative to ground water remediation. Restrictions on the use or installation of supply wells within the area of influence would be implemented by local government.

Alternative 3A: Extraction Wells

This alternative would involve installation of extraction wells around the perimeter of the landfill. These wells would be used primarily for long-term control of the ground water in the shallow water bearing zone and potential leachate within the landfill area. Other extraction wells (i.e., away from the perimeter of the landfill) may also be installed where ground water contamination has been identified. These wells would be active until the ground water conditions in these areas reached the cleanup level criteria.

This alternative would involve extraction of ground water through an on-Site pumping system. Pumping would be followed by on- or off-Site treatment or disposal to remove metal and organic contamination.

Alternative 3B: Extraction/Injection Wells

Alternative 3B is similar to 3A with the addition of injection wells to produce artificial recharge conditions in the upper water bearing zone which can improve the efficiency of the extraction system (i.e., the system's ability to remove contaminants from the saturated zone). This alternative is applicable at this Site due to the shallow natural clay layer which would limit vertical migration/movement of reinjected water and contaminants. A Site-specific pump test and/or modelling would be needed to evaluate and design a ground water extraction/injection system for this Site.

Alternative 3C: Interceptor Trenches

This alternative would involve installation of an intercepter trench around the perimeter of the landfill to collect ground water and leachate from the landfill. The intercepter trench would be keyed into the existing clay layer. Water intercepted by the trench would be collected in drainage pipes or pumped using extraction wells located at the base of the trench. This alternative is compatible with alternatives involving cut-off walls because it allows management of the ground water level inside the slurry wall containment area.

Alternative 4A: Conventional Chemical Precipitation

This alternative would involve design and construction of a conventional chemical precipitation system at the Site. Chemical precipitation (i.e., precipitation/flocculation/sedimentation) is the most common technique for the removal of heavy metals from waste waters (Figure 3-2). The chemicals most frequently used for precipitation of metals are lime, caustic soda, and sodium carbonate. Although most heavy metals are precipitated readily without pH adjustment, some inorganics (e.g., hexavalent chromium) are soluble and do not precipitate out of solution at any pH. Consequently, treatment for these inorganics usually consists of a two-stage process. First, the inorganics undergo chemical reduction. Second, the inorganics are precipitated out of solution and the water is neutralized prior to discharge.

Reducing agents most commonly employed are gaseous sulfur dioxide or a solution of sodium bisulfite. Since the reduction proceeds rapidly at low pH, an acid (e.g., sulfuric or hydrochloric) is usually added to keep the wastewater pH between 2 and 3. The waste stream is then treated in the neutralization/precipitation stage for removal of heavy metals.

Alternative 4B: Sulfide Precipitation

This alternative would involve the design and construction of a sulfide precipitation system at the Site (Figure 3-2). Since most metals form stable sulfides, removals can be attained by sulfide precipitation. Sulfide precipitation yields lower residual metal concentrations than hydroxide precipitation, and metal sulfides usually settle faster and can be dewatered more readily than hydroxide sludges.

Sulfide precipitation processes currently used for wastewater treatment fall into two broad categories: 1) the soluble sulfide process (SSP); and, 2) the insoluble sulfide process (ISP). In the SSP, the sulfide is added in the form of a water-soluble reagent, such as sodium sulfide. In the ISP process, developed by Permutt Co., a fresh prepared slurry (made by reacting ferrous sulfate and

NaHS) serves as the source of sulfide ions. Sulfide and ferrous ions reduce hexavalent chromium to the trivalent state, thereby eliminating the need to treat the chromium wastes separately.

Alternative 4C: Ion Exchange

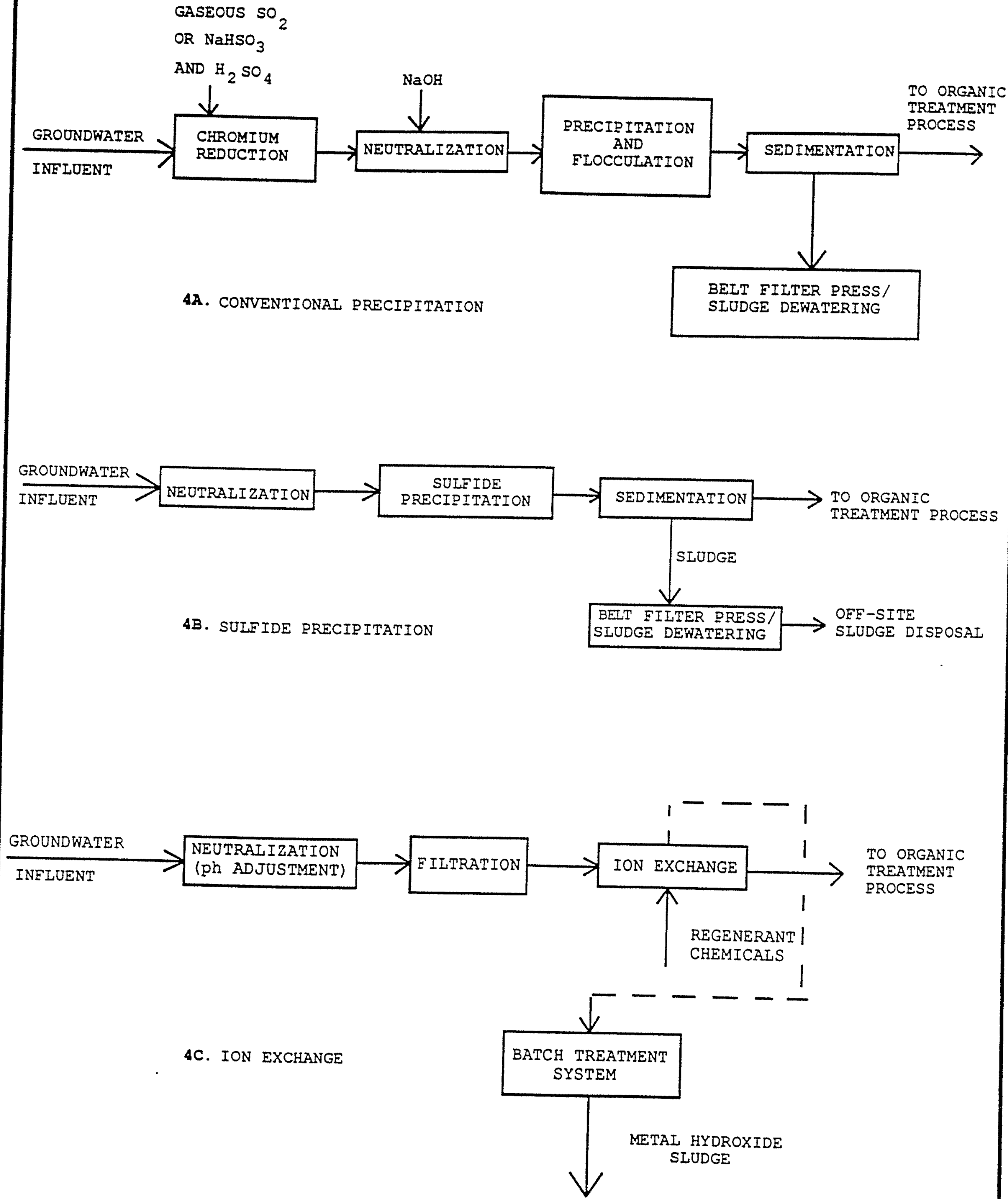
This alternative would involve installation of a pre-designed ion exchange unit (Figure 3-2). Ion exchange is a stoichiometric and reversible chemical reaction, wherein an ion from solution is exchanged for a similarly charged ion attached to an immobile solid particle. Although there are numerous inorganic materials possessing ion exchange capability, the synthetic organic sorptive resins are the predominant type used today because their characteristics can be tailored to specific applications.

Wastewater pretreatment requirements consist of pH adjustment to ensure that pH is within the operating range of the resin, and filtration to remove suspended solids that would foul the resin bed. A drawback of ion exchange is that the resin must be regenerated after it has exhausted its exchange capacity. This problem complicates the operation of the system.

Alternative 4D and 5A: Activated Carbon Adsorption

This alternative would involve design and installation of an activated carbon unit for the Site (Figure 3-3). Organics (e.g., benzene) and some metals (e.g., chromium) have been found to be readily adsorbed onto activated carbon, due to their high affinity towards activated carbon. Most applications involve the use of adsorption units which contain granular activated carbon (GAC) and operate in a downflow series mode. This method has been found to be cost-effective and produces the lowest effluent concentrations relative to other

FIGURE 3-2
METAL TREATMENT OPTIONS



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carbon absorber configurations (e.g., downflow in parallel, moving bed, and upflow-expanded).

Activated carbon can be implemented into more complex treatment systems. The process is well suited to mobile treatment systems as well as to on-Site construction. Space requirements are small, start-up and shut-down are rapid, and there are numerous contractors who are experienced in operating mobile units.

Alternative 5B: Air Stripping

This alternative would involve installation of an air stripping tower at the Site to treat volatile organics (Figure 3-3). Air stripping is a mass transfer process in which volatile contaminants in water are transferred to gas. Air stripping is used to remove volatile organics from aqueous waste streams. Generally, components with Henry's Law constants of greater than 0.003 can be removed by air stripping.

An important factor in the consideration of whether to utilize the air stripping technology for the removal of volatile contaminants, is the air pollution implications of air stripping. The gas stream generated during air stripping treatment may require collection and subsequent treatment or incineration.

Stripping of contamination by means of air has high removal efficiencies with chlorinated hydrocarbons. However, it is difficult to achieve the stringent NYS drinking water standards by air stripping alone. Air stripping followed by carbon adsorption (as a polishing unit) is considered as a viable option.

Alternative 5C: UV-Peroxidation

This alternative involves design and installation of a pre-designed UV-peroxidation unit (Figure 3-3). UV-Peroxidation consists of a combination of ultraviolet light and either hydrogen peroxide or ozone, which when combined, form hydroxyl radicals. These hydroxyl radicals destroy VOCs. A typical UV-peroxide system would include:

- pH control for optimum VOC destruction;
- Turbidity monitoring to maintain VOC destruction and recycling if necessary;
- Automatic warmup cycles; and
- Maintenance controls.

A treatability or pilot study would be required to evaluate the effectiveness of this technology on the Site's groundwater.

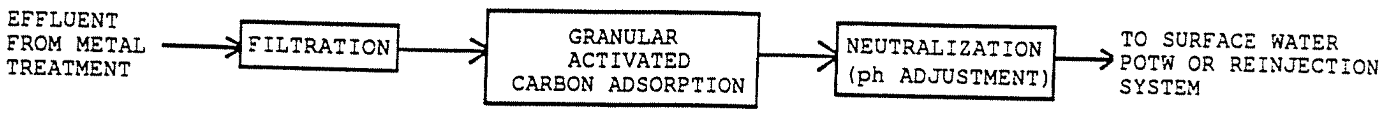
Alternative 6A: Off-Site Treatment and Disposal

This alternative involves containerizing the extracted ground water and transporting it to an off-Site wastewater treatment facility where it would be treated under that facility's RCRA permit. This alternative is applicable to this Site due to the availability of off-Site treatment facilities (e.g., CECOS) within the Western New York area. However, the volume of ground water being extracted may make this alternative cost-prohibitive.

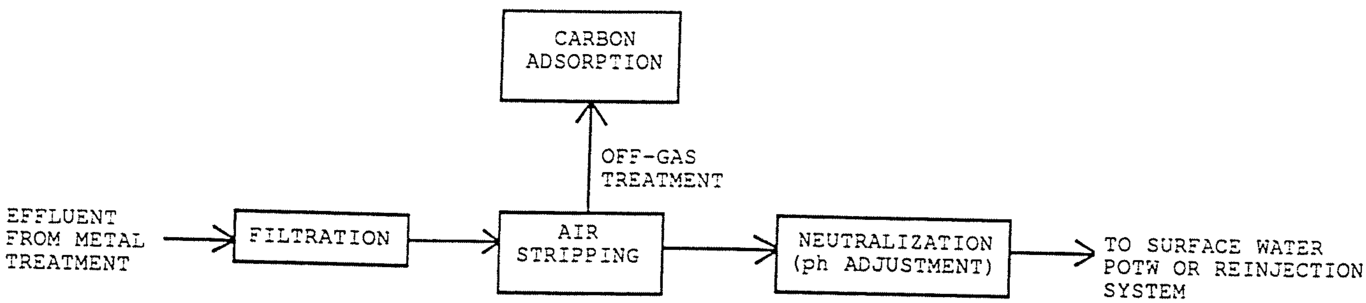
Alternative 6B: POTW

Under this alternative, ground water (pretreated, if necessary) would be discharged to the nearby sanitary sewer and eventually, the local Publicly

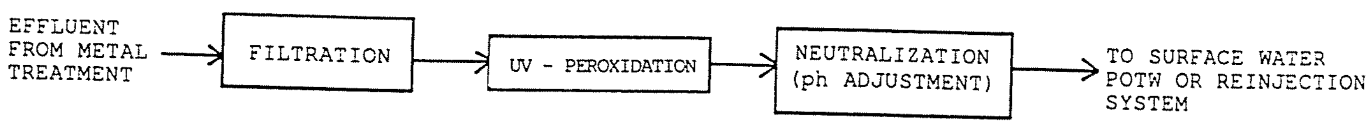
FIGURE 3-3
ORGANIC TREATMENT OPTIONS



4D & 5A. ACTIVATED CARBON ADSORPTION



5B. AIR STRIPPING



5C. UV - PEROXIDATION

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Owned Treatment Works (POTW). The POTW receiving discharge from the sanitary sewer system near the Site is operated by the Buffalo Sewer Authority (BSA). The influent limitations for the BSA are summarized on Table 3-5.

Alternative 6C: Surface Water Discharge

This alternative would include extraction of ground water, pretreatment, and discharge of the treated ground water to the on-Site ponds. Surface water discharge is feasible provided the volume of water does not produce localized flooding problems and the treatment system can meet appropriate effluent/surface water standards. The treatment system would be designed to attain appropriate surface water standards for these ponds. A State Pollutants Discharge Elimination System (SPDES) permit would be required under this alternative. It is anticipated such a permit would likely be granted.

Alternative 6D: Ground Water Injection

This alternative includes extraction, treatment and reinjection of the treated ground water. Under this alternative, an on-Site ground water treatment system would have to be installed to achieve NYSDEC Class GA water quality standards or background levels. The treatment and reinjection system would require substantial engineering and equipment.

3.2 SCREENING OF REMEDIAL ALTERNATIVES (PHASE II FS)

In this section, remedial alternatives discussed in Section 3.1 for soil/sediment and ground water are screened on the basis of effectiveness and implementability. The objective of the screening is to narrow the list of potential alternatives that will be combined into comprehensive alternatives for evaluation during the Phase III FS.

TABLE 3-5
BUFFALO SEWER AUTHORITY (BSA) DISCHARGE LIMITS

POLLUTANT	Maximum Allowable Instantaneous Discharge Limits (MAID)*	
Chloroform	8.5	mg/l
1,2, 4-trichlorobenzene	0.8	mg/l
Fluoranthene	0.1	mg/l
Pyrene	0.1	mg/l
Endosulfan	1.6	mg/l
4,4' - DDD	0.68	mg/l
BHC	1.9	mg/l
PCBs	0.002	mg/l
Phenol (Total)	20.0	mg/l
Selenium	2.4	mg/l
Silver	2.2	mg/l
Cadmium	40.0	mg/l
Chromium, Total	40.0	mg/l
Chromium, Hexavalent	9.2	mg/l
Copper	16.0	mg/l
Mercury	7.0	mg/l
Nickel	14.0	mg/l
Lead	65.0	mg/l
Zinc	25.0	mg/l
Cyanide, Total	66	mg/l
Cyanide, Amenable	6.2	mg/l

* Compliance determined on the basis of a grab sample.

Note: Table adapted from 1992 BSA Sewer Use Regulations.

Pursuant to the May, 1990 NYSDEC TAGM, cost was not used as an evaluation criteria. The evaluation forms for effectiveness and implementability from the above mentioned TAGM are included in Appendix A. A summary of the scoring results are presented in Tables 3-6 and 3-7. Alternatives were compared and screened-out based on a comparison of scores within alternative groupings (e.g., containment, treatment, etc). Note that the NYSDEC neither approves nor endorses the application of these scoring tables by PRPs or outside consultants; however, they have been included in this report to demonstrate how the various alternatives were screened.

3.2.1 Evaluation of Soil/Sediment Remediation Alternatives

Alternative 1: No Action

The no action alternative has been retained to provide a baseline condition against which other alternatives can be compared. As the title states, this alternative involves no remedial action and would leave the Site in its present condition. The no action alternative does not meet the remedial action objectives.

Effectiveness

No action is not considered effective, because environmental and public health risks (due to the contamination at the Site) would not be alleviated by this alternative. The magnitude of risks would remain the same and any reduction in risk would be due solely to natural attenuation. The contaminated soil/sediment would continue to be subjected to surface water percolation and run-off as well as lateral and vertical seepage, which could cause additional ground water and surface water contamination. There is also the potential for migration of contaminants via fugitive dust.

TABLE 3-6 SUMMARY OF NYSDEC SCREENING TABLES FOR SOIL/SEDIMENT REMEDIATION ALTERNATIVES (Appendix A)

Alternatives	Short Term/Long Term Effectiveness									Implementability				Total
	1	2	3	4	5	6	7	8	Sum	1	2	3	Sum	Score
1. No Action	4	4	0	0	0	0	2	0	**10**	9	2	3	**14**	**24**
2. Limited Action	4	4	0	0	0	0	2	1	**11**	9	1	3	**13**	**24**
3A. Capping	4	4	2	0	0	3	2	1	**16**	7	1	3	**11**	**27**
3B. Capping+Cut-off Wall	4	4	2	0	0	3	2	2	**17**	7	1	3	**11**	**28**
3C. Capping+Consolidation	4	4	2	0	0	3	2	1	**16**	7	1	3	**11**	**27**
3D. Capping+Consolidation+ Cut-off Wall	4	4	2	0	0	3	2	3	**18**	8	1	3	**12**	**30**
4A. Off-site Landfill (Above Cleanup Levels)	3	4	2	0	0	3	5	4	**21**	10	1	3	**14**	**35**
4B. Off-site Landfill (Outside Clay Layer)	3	4	2	0	0	3	2	2	**16**	8	1	3	**12**	**28**
5A. Soil Washing	4	4	2	3	3	0	3	2	**21**	6	1	3	**10**	**31**
5B. Solidification/ Stabilization	4	4	2	3	3	0	2	2	**20**	5	0	3	**8**	**28**

NOTE: SEE TABLE 3-3 FOR DESCRIPTION OF ALTERNATIVES.

[shaded box] - DENOTES AN ALTERNATIVE THAT IS ELIMINATED FROM FURTHER EVALUATION.

TABLE 3-7 SUMMARY OF NYSDEC SCREENING TABLES FOR GROUND WATER REMEDIATION ALTERNATIVES (Appendix B)

Alternatives	Short Term/Long Term Effectiveness									Implementability				Total Score
	1	2	3	4	5	6	7	8	Sum	1	2	3	Sum	
1. No Action	4	4	0	0	0	0	2	0	**10**	9	2	3	**14**	**24**
2. Limited Action	4	4	0	0	0	0	2	1	**11**	9	1	3	**13**	**24**
3A. Extraction	4	4	1	0	0	3	5	1	**18**	8	1	3	**12**	**30**
3B. Extraction/Injection	4	4	1	0	0	3	5	1	**18**	8	0	3	**11**	**29**
3C. Interceptor Trenches	4	4	1	0	0	2	5	2	**18**	9	2	3	**14**	**32**
4A. Conventional Precipitation	4	4	1	3	3	0	5	2	**22**	8	1	3	**12**	**34**
4B. Sulfide Precipitation	4	4	1	3	3	0	5	2	**22**	8	1	3	**12**	**34**
4C. Ion Exchange	4	4	1	3	3	0	5	2	**22**	9	2	3	**14**	**36**
4D. Resin Sorption	4	4	1	3	3	0	5	2	**22**	8	1	3	**12**	**34**
4E. Activated Carbon	4	4	1	3	3	0	5	2	**22**	9	2	3	**14**	**36**
5A. Activated Carbon	4	4	1	3	3	0	5	2	**22**	9	2	3	**14**	**36**
5B. Air Stripping	4	4	1	3	3	0	5	2	**22**	8	0	3	**11**	**33**
5C. UV-Peroxidation	4	4	1	3	3	0	5	2	**22**	8	2	3	**13**	**35**
6A. Off-site Treatment and Disposal	3	4	1	1	3	0	5	3	**20**	9	1	3	**13**	**33**
6B. POTW	4	4	1	1	3	0	5	2	**20**	9	1	3	**13**	**33**
6C. Surface Water	4	3	1	3	3	0	4	1	**19**	6	0	3	**9**	**28**
6D. Groundwater Injection	4	3	1	3	3	0	4	1	**19**	6	0	3	**9**	**28**

NOTE: SEE TABLE 3-4 FOR DESCRIPTION OF ALTERNATIVES.
[shaded box] DENOTES AN ALTERN. THAT IS ELIMINATED FROM FURTHER EVALUATION.

Implementability

There would be no technical difficulty associated with the implementation of this alternative.

Alternative 2: Limited Action

The limited action alternative would include fencing the Site and land use restrictions. This alternative would not address the contaminated media at the Site and does not meet the remedial action objectives.

Effectiveness

Limited action is not considered effective, because environmental and public health risks (due to the contamination at the Site) would not be alleviated by this alternative. The magnitude of risks would only be marginally reduced. The contaminated soil/sediment would continue to be subjected to surface water percolation and run-off as well as lateral and vertical seepage, which could cause additional ground water and surface water contamination. There is also the potential for migration of contaminants via fugitive dust.

Implementability

There would be no significant technical difficulty associated with the implementation of this alternative. Land use restrictions associated with this alternative would require minor coordination activities between NYSDEC and the local government.

Alternative 3A: Capping

This alternative involves capping the Site, or a portion of it, with a composite cap and grading the surrounding area. Capping of the soils would limit fugitive dust migration. It would also limit surface water infiltration thereby reducing the generation of contaminated leachate. However, waste would remain on-Site and contaminated ground water migration could occur, although at a lesser rate. Additionally, the contaminated soil in the southern portion of the landfill which does not have a clay layer below it, could potentially continue to impact ground water.

Effectiveness

A properly installed and maintained cap would be effective in limiting exposure and fugitive dust migration, since the contaminated soil would be physically isolated. This alternative would satisfy most of the remedial action objectives and would alleviate the short-term risks to human health once the cap is in place. However, potential for long-term risks would still exist, since the source of contamination would remain beneath the cap. Additionally, vertical and lateral migration of contaminated ground water and leachate from the landfill could occur, requiring extensive long term monitoring.

Implementability

Capping technology is reliable and well demonstrated. The materials, equipment, and labor to grade and cap the Site are readily available. The composite cap presents a fairly durable, weather resistant surface; however, the compacted clay portion is susceptible to cracking and settling if not properly maintained. Future remedial actions may be anticipated due to the potential migration of ground water and leachate from the landfill.

Capping the Site would require restricting its future use. The Site would need to be securely fenced to prevent damage to the cap. Capping and fencing the Site would preclude using the Site as a publicly accessible area. Additionally, long term landfill gas management may also impact future use of the Site.

Alternative 3B: Capping + Cut-off Wall

This alternative involves capping the Site with a composite cap and installing a perimeter cut-off wall to restrict horizontal movement of ground water and leachate from the landfill. Capping of the soils would limit fugitive dust migration and surface water infiltration. However, waste would remain on-Site and a portion of this material would not have a clay layer below it.

Effectiveness

A properly installed and maintained cap would be effective in limiting exposure and fugitive dust migration, since the contaminated soil would be physically isolated. This alternative would satisfy most of the remedial action objectives and would alleviate the short-term risks to human health once the cap is in place. However, potential for long-term risks would still exist, since the source of contamination would remain beneath the cap. Additionally, vertical migration of contaminated ground water and leachate from the portion of the landfill that is not underlain by clay layer could potentially occur, requiring monitoring.

To provide full effectiveness, this alternative would need to be combined with one of the ground water extraction alternatives (i.e., ground water alternatives 3A-3C). Control of the ground water level inside the containment area is important in maintaining its effectiveness.

Implementability

Capping and cut-off wall technologies are reliable and well demonstrated. The materials, equipment, and labor to grade and cap the Site and install the cut-off wall are readily available. The composite cap presents a fairly durable, weather resistant surface; however, it is susceptible to cracking and settling if not properly maintained.

Alternative 3C: Consolidation + Capping

This alternative involves excavating all contaminated soil in areas not underlain be clay, consolidating it areas underlain by clay, and capping the Site with a composite cap. Capping of the soils would limit fugitive dust migration. It would also limit surface water infiltration thereby limiting leachate generation. However, waste would remain on-Site and horizontal migration of contaminated ground water could continue to occur.

Effectiveness

In terms of effectiveness, this alternative scored similarly to Alternative 3A. Both alternatives allow horizontal migration of contaminated ground water to continue. Based on the data collected in the shallow and deep ground water bearing zones, horizontal migration of contaminated ground water from the landfill in the upper water bearing zone appears to be having a greater potential impact on overall ground water quality than migration of analytes into the deep water bearing zone.

Implementability

This alternative has the same implementability score as Alternatives 3A and 3B. Capping and excavation technologies are reliable and well demonstrated. However, future remedial actions may be anticipated due to the potential horizontal migration of ground water and leachate from the landfill.

Alternative 3D: Consolidation + Capping + Cut-off Wall

This alternative provides total containment of all contaminated soils at the Site. Under this alternative, exposure scenarios are addressed, sources to ground water are isolated and the remedial action objectives are satisfied. Although contained within a low permeability cell, waste would remain on-Site.

Effectiveness

In terms of effectiveness, this alternative scored higher than Alternatives 3A through 3C because it provides total containment. A minimal amount of long term monitoring and maintenance would be required under this alternative.

Implementability

This alternative also has a higher implementability score than Alternatives 3A through 3C because no future remedial actions are anticipated. Consolidation, capping and cut-off wall technologies are reliable and well demonstrated. Additionally, these technologies are compatible and readily available.

Alternative 4A: Off-Site Landfill Disposal - Above Cleanup Levels

This alternative includes excavation of contaminated soil, dredging of contaminated sediments, and disposal of all soil and sediment above the cleanup levels in an off-Site landfill.

Effectiveness

This alternative had a high effectiveness score and relies on established technologies for removal and disposal of contaminated soil/sediment. Additionally, remedial action objectives for the soil/sediment would be met and the potential for ground water or surface water contamination from the soil/sediment would be reduced. Short-term risks to the community during transport of the material and the possibility of worker exposure from on-Site inhalation could be addressed through environmental controls. Long term ground water monitoring would be limited under this alternative.

Implementability

This alternative is readily implemented. However, it will be necessary to identify a landfill with sufficient space to accept the contaminated soil and sediments. Implementation of this alternative may require treatment at the disposal facility, prior to landfilling, to meet landfill acceptance criteria.

Alternative 4B: Off-Site Landfill Disposal - Outside Clay Layer

Alternative 4B involves excavation and off-Site landfilling of all contaminated soil/sediment in areas not underlain by clay. This alternative eliminates the source of contamination outside the area of the clay layer. Although this alternative addresses vertical migration of contaminants, it leaves hazardous waste on-Site and does not address horizontal migration of ground water and leachate from the landfill.

Effectiveness

This alternative was evaluated based on the scenario that the contaminated soil/sediment remaining on Site, after the soil outside the clay layer is removed, would be contained under a composite cap. This alternative had a lower effectiveness score than Alternative 4A because it would leave waste at the Site. Additionally, moderate long term ground water monitoring would be required.

Implementability

This alternative is not as readily implemented as Alternative 4A because it would need to be combined with an on-Site containment system. Future remedial actions may be anticipated under Alternative 4B, due to the quantity of contaminated soil that would be left on-Site.

Alternative 5A: Soil Washing

This alternative involves excavation of the soil above the cleanup levels, followed by soil washing. The treated soil would then be backfilled and the washing solution would be treated or disposed of off-Site. This alternative satisfies the remedial action objectives.

Effectiveness

The effectiveness of soil washing is a function of the soil type, extracting agent, and other factors. Soil washing systems have experienced some problems related to soil/liquid separation. These documented problems were encountered subsequent to the washing phase, due to the high percentage of silt or clay in the soil material. In general, if the contaminated soil contains more than 50% clay material, soil washing is not an effective remedial technology. However, if the contaminated soil contains more than 50% sand and gravel materials, soil washing may provide an effective solution. Although the effectiveness score for soil washing based on the NYSDEC screening tables was relatively high, review of the characteristics of the fill and waste material at the ALS indicates that soil washing may not be effective at the Site.

<u>Implementability</u>

This alternative would not be as implementable as solidification/stabilization because a wash solution is generated by the process that would have to be treated and disposed of. This wash solution complicates the implementability of this alternative.

Alternative 5B: Solidification/Stabilization

Under this alternative, contaminated soil would be excavated and contaminated sediment would be dredged. The contaminated soil and sediment would be solidified/stabilized on-Site. The treated media would then be backfilled on-Site or disposed of off-Site in a landfill.

<u>Effectiveness</u>

Solidification/stabilization techniques have been effective in immobilizing inorganic contaminants in a solid monolith, thereby limiting their release to the environment and the possibility of direct contact with potential receptors.

Although some stabilization materials have been demonstrated to immobilize organic analytes, this technique has not been demonstrated to completely immobilize the organics over time. Thus, under this remedial alternative the remedial action objectives for the soil and sediment would not be fully satisfied.

Implementability

During implementation of this alternative, the treated material would be mixed with the solidification agent and backfilled on-Site. No byproducts are generated by this process. This alternative is implementable at the ALS due to the available open areas of the Site that could be used for construction of a solidification/stabilization system. However, the excavation of contaminated soil below the water table and the potentially large volume of soil that would require treatment need to be considered. Extensive environmental controls would be necessary to reduce the short term effects from airborne dust and waste particulates. Additionally, due to the subsurface debris within the landfill, mixing would be very difficult and/or ineffective.

3.2.2 *Screening of Ground Water Alternatives*

Alternative 1: No Action

The no action alternative has been retained to provide a baseline condition against which other alternatives can be compared. As the title states, this alternative involves no remedial action. This alternative would leave the Site in its present condition and does not meet the remedial action objectives. Under this alternative, no remedial actions would be taken to contain, treat or monitor the ground water.

Effectiveness

No action is not considered effective because the remedial action objectives would not be satisfied by this alternative. The magnitude of risks would remain the same, and any reduction in risk would be due solely to natural attenuation. The contaminated soil/sediment would continue to be subjected to surface water percolation and run-off as well as lateral and vertical seepage, which could cause additional leachate generation and subsequent ground water and surface water contamination.

Implementability

There would be no technical difficulty associated with the implementation of this alternative. However, the no action alternative may be strongly opposed by the public due to concern over environmental conditions at the Site.

Alternative 2: Limited Action

Limited action would include monitoring and supply well installation and use restrictions. This alternative would not address the contaminated media at the Site and does not meet remedial objectives.

Effectiveness

As was the case with the no action alternative for ground water, limited action is not considered effective because the remedial action objectives would not be satisfied. The magnitude of risks would only be marginally reduced. The contaminated soil/sediment would continue to be subjected to surface water percolation and run-off as well as lateral and vertical seepage, which could cause additional leachate generation and subsequent ground water and surface water contamination.

Implementability

There would be no significant technical difficulty associated with the implementation of this alternative. Supply well use restrictions associated with this alternative would require minor coordination activities between NYSDEC and the local government. Monitoring of the ground water monitoring wells at the Site on a periodic basis is readily implementable.

Alternatives 3A through 3C: Extraction

Alternatives 3A through 3C provide different methods of collecting contaminated ground water and bringing this water to the surface for treatment. All three alternatives could supplement a ground water remedial system that satisfies the ground water remedial action objectives. These three alternatives were screened for effectiveness and implementability to identify which one or ones provide a distinct advantage at the ALS.

Effectiveness

Alternatives 3A - 3C had the same effectiveness score. Alternatives 3A and 3B have somewhat greater lifetimes than intercepter trenches; however, intercepter trenches provide a more continuous barrier to contaminated ground water migration than wells. Additionally, intercepter trenches could be modified to serve as permeable treatment beds to provide in-situ treatment. Whether or not an extraction/injection system could expedite the ground water remediation program would need to be evaluated by a pumping test at the Site.

Implementability

Of these three alternatives, the extraction/injection well system would be the most difficult system to implement due to the piping and instrumentation systems that would need to be installed. Intercepter trenches would be readily implementable at this Site due to the shallow depth to the clay confining layer.

Alternatives 4A - 4E: Inorganics Treatment Methods

Alternatives 4A through 4E provide different inorganic treatment alternatives. These alternatives would supplement an on-Site ground water extraction system and an organic treatment system. All five alternatives have the capability to satisfy the ground water remedial action objectives. These five alternatives were screened for effectiveness and implementability to identify which ones provide a distinct advantage at the ALS.

Effectiveness

Alternatives 4A - 4E had the same effectiveness score and are capable of treating the inorganics detected in the ground water at the Site. In order to identify which alternatives would be more effective than others at the Site, it is necessary to conduct treatability or pilot studies using the on-Site ground water. These studies could be conducted during the pre-design phase.

Implementability

Alternatives 4A - 4E are implementable at this Site. There are no space constraints and there is the capability to discharge the treated effluent to the sanitary sewer, surface water, ground water or off-Site disposal. The alternatives that had the highest implementability scores were activated carbon and ion exchange because these systems can be purchased or rented from vendors as predesigned units.

Alternative 5A through 5C: Organics Treatment Methods

Alternatives 5A through 5C provide different organic treatment alternatives. These alternatives would supplement an on-Site ground water extraction system and an inorganic treatment system. All three alternatives have the capability to satisfy the ground water remedial action objectives. These three alternatives were screened for effectiveness and implementability to identify which ones provide a distinct advantage at the ALS.

<u>Effectiveness</u>

Alternatives 5A - 5C had the same effectiveness score and are capable of treating the organics detected in the ground water at the Site. In order to identify which alternatives would be the most effective at the Site, it is necessary to conduct treatability or pilot studies using the on-Site ground water. These studies could be conducted during the pre-design phase.

<u>Implementability</u>

Alternatives 5A - 5C are implementable at this Site. There are no space constraints and there is the capability to discharge the treated effluent to the sanitary sewer, surface water, ground water or off-Site disposal. All three alternatives can be purchased or rented from vendors as a predesigned units. Air stripping had the lowest implementability score due to permitting requirements and the need for subsequent activated carbon polishing of the effluent prior to discharge.

Alternative 6A: Off-Site Treatment and Disposal

This alternative would involve: collection of the ground water; temporary on-Site storage in vessels; and, transport to a nearby wastewater treatment facility for subsequent treatment and disposal. This alternative meets the remedial action objectives for ground water; however, is not feasible for treatment of high ground water extraction rates.

Effectiveness

This alternative would be effective in addressing the ground water contamination issue at the Site. It provides a high effectiveness score relative to the four discharge/disposal alternatives because it eliminates the possibility of reintroduction of contaminants into the environment.

Implementability

No significant barriers to implementation are expected for this alternative. However, there are transportation controls that would have to be instituted and as previously mentioned, the volume of ground water to be treated each day would need to be below a certain threshold volume that could be accepted by the off-Site facility.

Alternative 6B: POTW

This alternative would include extraction of ground water, pretreatment, if necessary to meet the BSA acceptance criteria, followed by discharge to the sanitary sewer. Pretreatment may involve the inorganic and organic treatment alternatives previously discussed. This alternative would satisfy the remedial action objectives for ground water.

Effectiveness

This alternative would be effective in addressing the ground water contamination issue at the Site. It provides a high effectiveness score relative to the four discharge/disposal alternatives because it limits the possibility of reintroduction of contaminants into the environment.

Implementability

To implement this alternative, a Sewer Use Ordinance permit would be needed. It is anticipated that this permit can be obtained with limited effort.

Alternative 6C: Surface Water

This alternative would include extraction of ground water and on-Site treatment, followed by discharge to the on-Site ponds. Treatment may involve the inorganic and organic treatment alternatives previously discussed. This alternative would satisfy the remedial action objectives for ground water.

Effectiveness

This alternative would be effective in addressing the ground water contamination issue at the Site. It did not provide as high of an effectiveness score as Alternatives 6A and 6B due to the possibility of reintroduction of contaminants into the environment.

Implementability

This alternative would be difficult to implement and would potentially require substantially more treatment than Alternatives 6A and 6B. Additionally, a

SPDES permit would be required. The remedial scheme would require land area to locate the treatment units and land use restrictions would be necessary at the location of the treatment units for the duration of remediation.

Alternative 6D: Ground Water Injection

This alternative would include extraction of ground water and on-Site treatment, followed by injection to ground water. Treatment may involve the inorganic and organic treatment alternatives previously discussed. This alternative would satisfy the remedial action objectives for ground water.

Effectiveness

This alternative would be effective in addressing the ground water contamination issue at the Site. It did not provide as high of an effectiveness score as Alternatives 6A and 6B due to the possibility of reintroduction of contaminants into the environment.

Implementability

This alternative may be difficult to implement due to the stringent ground water quality standards that would need to be met to discharge to the on-Site ground water bearing zone. This alternative would require substantially more treatment than Alternatives 6A and 6B. The remedial scheme would require land area to locate the treatment units and land use restrictions would be necessary at the location of the treatment units for the duration of remediation.

3.3 SUMMARY OF SCREENING

Seven soil/sediment and 14 ground water alternatives were retained for further evaluation based on the evaluation process discussed above. The rationale for screening-out soil/sediment alternatives 4B, 5A and 5B and ground water alternatives 5B, 6C and 6D is discussed below.

3.3.1 Soil/Sediment Remedial Alternatives

As indicated on Table 3-6, soil/sediment alternatives 3A and 3C did not score as high as the other containment alternatives (i.e., 3B and 3D). However, these alternatives were retained for further consideration because they could be combined with ground water controls to address horizontal migration of ground water and leachate from the landfill.

Alternative 4B scored considerably lower than Alternative 4A. Thus, 4B was not retained for further consideration.

Alternative 5A, soil washing, and Alternative 5B, solidification/stabilization, both had relatively high scores because the screening tables yield high scores for treatment alternatives. However, these alternatives were eliminated from further consideration because the nature of the fill/waste and the wide range of contaminants make the long-term effectiveness of these alternatives uncertain. Another negative factor that impacted the effectiveness and implementability scores for Alternative 5A was the wash solution generated by the soil washing process. The generation of this wash solution requires treatment and handling issues. Negative factors associated with Alternative 5B were the long term effectiveness of stabilization of organics and the short term concerns relating to air-borne dust and particulates.

3.3.2 *Ground Water Remedial Alternatives*

Ground water Alternatives 6C and 6D, which involved treatment followed by discharge to surface water and ground water, respectively, did not appear as effective or feasible as Alternatives 6A and 6B. As previously discussed, they involved treatment to more stringent water quality levels, which was not as implementable as off-Site disposal or discharging to the POTW.

3.3.3 *Comprehensive Remedial Alternatives*

The range of comprehensive remedial alternatives were developed by combining the alternatives for soil/sediment and ground water that passed the Phase II FS screening process. These ten (10) comprehensive remedial alternatives are summarized below and are further evaluated during the Detailed Analysis of Alternatives (Phase III FS).

ALTERNATIVE 1: NO ACTION

- No remedial action; leave Site in its present condition.

ALTERNATIVE 2: LIMITED ACTION

- Institutional Actions
    - Deed Restrictions
    - Groundwater Monitoring Activities
    - Site Restrictions (Fence, Gate, Signs)
    - Maintenance Activities (Mowing, Inspection)

ALTERNATIVE 3A: CONTAINMENT (CAP LANDFILL & SKYWAY)

- Obtain Access to Skyway
- Install Composite Cap
- Institutional Actions

ALTERNATIVE 3B: CONTAINMENT (CONSOLIDATE SOIL AND SEDIMENT OUTSIDE CLAY LAYER/CAP LANDFILL)

- Consolidate Soil/Sediments
- Install Composite Cap
- Install Downgradient Ground Water Extraction System
- Restoration
- Extraction & Treatment of Ground Water (Contingency)
- Institutional Actions

ALTERNATIVE 3C: CONTAINMENT (CONSOLIDATE SOIL AND SEDIMENT OUTSIDE CLAY LAYER/CAP LANDFILL AND SKYWAY)

- Obtain Access to Skyway
- Consolidate Soil/Sediments
- Install Composite Cap
- Install Downgradient Ground Water Extraction System
- Restoration
- Extraction & Pre-Treatment of Ground Water with Discharge to POTW (Contingency)
- Institutional Actions

ALTERNATIVE 3D: CONTAINMENT (CONSOLIDATE SOIL AND SEDIMENT OUTSIDE CLAY LAYER & SKYWAY SOIL/CAP LANDFILL)

- Temporary Relocation of Skyway
- Consolidate Soil/Sediments & Skyway Soil
- Install Composite Cap
- Install Downgradient Ground Water Extraction System
- Restoration

- Extraction & Treatment of Ground Water with Discharge to POTW (Contingency)
- Institutional Actions

ALTERNATIVE 3E: CONTAINMENT (CONSOLIDATE SOIL AND SEDIMENT OUTSIDE CLAY LAYER EXCLUSIVE OF SKYWAY/CAP LANDFILL/CUT-OFF WALL/GROUND WATER TREATMENT)

- Consolidate Soil/Sediments
- Install Composite Cap, Cut-off Wall and Ground Water Extraction System
- Restoration
- Ground Water Pre-Treatment/Discharge to POTW
- Institutional Actions

ALTERNATIVE 3F: CONTAINMENT (CONSOLIDATE SOIL AND SEDIMENT OUTSIDE CLAY LAYER/CAP LANDFILL AND SKYWAY/CUT-OFF WALL/GROUND WATER TREATMENT)

- Obtain Access to Skyway
- Consolidate Soil/Sediments
- Install Composite Cap, Cut-off Wall and Ground Water Extraction System
- Restoration
- Ground Water Pre-Treatment/Discharge to POTW
- Institutional Actions

ALTERNATIVE 3G: CONTAINMENT (CONSOLIDATE SOIL AND SEDIMENT OUTSIDE CLAY LAYER & SKYWAY SOIL/CAP LANDFILL/CUT-OFF WALL/GROUNDWATER TREATMENT)

- Temporary Relocation of Skyway

- Consolidate Soil/Sediments & Skyway Soil
- Install Composite Cap, Cut-off Wall and Ground Water Extraction System
- Restoration
- Ground Water Pre-Treatment/Discharge to POTW
- Institutional Actions

ALTERNATIVE 4: OFF-SITE DISPOSAL

- Temporary Relocation of Skyway
- Excavate & Transport Contaminated Soils/Sediments for off-Site Disposal
- Restoration
- Institutional Actions

3.3.4 Categories of Alternatives

EPA has designated five categories or levels of cleanup to consider when identifying remedial alternatives under CERCLA. These categories are related to the degree of remedial action, ranging from no action to total removal, and the degree of compliance with ARARs and SCGs. These categories are outlined below:

Category 1: The no-action alternative provides a baseline for evaluating other alternatives.

Category 2: Alternatives that will reduce the likelihood of present or future threat from the hazardous substances but do not attain applicable or relevant public health or environmental standards.

Category 3: Alternatives that attain applicable and relevant public health or environmental standards.

Category 4: Alternatives that exceed applicable and relevant public health or environmental standards.

Category 5: Alternatives for destruction, treatment, or disposal of the wastes at an off-site facility, approved by EPA, as appropriate.

Alternatives 1 and 2 are considered to be Category 1, since these alternatives involve little and no action and are provided as baseline standards for comparison purposes. Alternative 3A is a Category 2 level of clean-up because although the containment limits the release of further contamination from the soils, there is continued potential vertical migration of the analytes in ground water. Alternatives 3B through 3E would all be considered to be Category 3 levels of clean-up, where human health and the environment is protected overall for both soils and ground water. Alternatives 3F and 3G exceed applicable and relevant public health or environmental standards and are considered Category 4. Alternative 4 falls under Category 5 because it exceeds the human health requirements by removing all waste and soil above SCGs from the Site, with disposal at an off-Site location.

Section 4

Section 4

4.0 IDENTIFICATION AND SCREENING OF TECHNOLOGY TYPES AND PROCESS OPTIONS

Section 3.0 identified ten comprehensive remedial alternatives for the ALS. These alternatives are comprised of technologies which passed the Phase I and II FS screening process. Typically, upon completion of the Phase II FS, treatability studies are performed to contribute additional data to the alternative selection process. These studies were not performed for the ALS because the major components of the remedial alternatives include soil movement and containment structures. As discussed in Section 3.3, soil treatment technologies were not retained for further consideration due to the nonuniform subsurface conditions and the wide range of analytes at the Site.

4.1 INTRODUCTION

This step in the Feasibility Study process was conducted in general accordance with NCP and NYSDEC Guidance, to identify, based on current information, the most cost-effective and technically feasible technologies/process options (i.e., of those identified in section 3.3) for inclusion in the comprehensive remedial alternatives. This approach provides consistency in the evaluation of cost and performance criteria during the Detailed Analysis phase. The basis of the evaluation was:

1) Unit cost data from vendors and published cost references; and
2) Past performance under similar site conditions.

4.2 TECHNOLOGY TYPES AND PROCESS OPTIONS

Prior to proceeding with the Detailed Analysis phase, the following technology categories were evaluated to identify one technology/process option for each category:

- Capping;
- Ground Water Containment Cut-Off Wall (Barrier wall);
- Ground Water Extraction/Collection;
- Ground Water Treatment; and
- Ground Water Disposal.

The following sections discuss the specific technology/process options evaluated for each category followed by a qualitative evaluation identifying the most cost-effective technology/process option for each category.

4.2.1 Capping

Capping would limit the pathways of contaminant migration (i.e., ground water, surface water and leachate) by reducing the infiltration rate. Capping would also control gas emissions and limit human and wildlife contact with the contaminants. The following three cap types were evaluated:

- Synthetic Membrane Cap
- Low Permeability Soil Cap
- Multimedia Cap

Each of these cap types is discussed in the following paragraphs.

Synthetic Membrane Cap

The synthetic membrane cap (or commonly known as flexible membrane liner, FML) is designed to limit infiltration of precipitation by means of a synthetic barrier between the surface and the waste material. An FML cap consists of a geotextile fabric overlain by a geomembrane and vegetated cover soil. An optional gas venting layer can be added to this configuration.

Installation of the FML cap follows regrading of the Site. Sheets of geotextile and geomembrane are unrolled across the exposed surface of the area to be capped. The seams between the sheets are sealed using chemical or heat methods. The FML would then be covered with soil and vegetated to hold the membrane in place and to reduce weathering of the liner. Advantages of this technology include availability of FML in different thicknesses, ease of installation and the very low permeability of the material (typically 1×10^{-12} cm per sec).

Low Permeable Soil Cap

Soil of low to moderate permeability can be utilized as cap material. Single layer cover (e.g., eighteen inches to two feet thick of low permeability soil with a permeability of 1×10^{-7} cm per sec) can be placed and compacted over the regraded landfill surface and can be overlain by vegetated soil to control erosion and dust. Advantages of this technology include the availability of clay material in Western New York, ease of construction and maintenance, slope stability and relatively low cost.

A disadvantage of this cap type is that the infiltration reduction is not as great as that for synthetic membrane and multimedia caps because soil caps are subjected to desiccation cracking, freeze/thaw damage and root penetration. In addition, soil cap placement methods do not ensure the capping layer is free from voids, channels or other areas of higher permeability. Lastly, the permeabilities of soil caps are typically higher than synthetic membrane or multi-media caps.

Multimedia Cap

A multimedia cap combines a number of layers: 1) a compacted clay layer; 2) a geomembrane; 3) sand drainage layer; 4) barrier protection layer, and 5) topsoil/vegetation. Typically, what distinguishes a multi-media cap from other cap types is that there are at least two low permeability layers.

Advantages of this technology include cap stability, relatively low infiltration and reduction in the amount of leachate being discharged to ground water. The low permeability layers have the advantage of being relatively thick and somewhat plastic; therefore, they can flex and conform to the slowly decomposing wastes. This plastic action reduces the chance of a sudden failure. Multi-media caps have been used in numerous waste capping and liner applications and are also specified by EPA in the Part 265 regulations under RCRA and New York State Part 360 closure requirements.

Disadvantages of this technology include high costs and the extended time required for construction.

Evaluation

The performance of the three cap types were evaluated using the Hydrologic Evaluation of Landfill Performance (HELP) model. The synthetic membrane and the multi-media caps reduced leachate generation more effectively than the soil cap. The cost of the synthetic membrane cap was also lower than the soil cap (including transportation of clay from an off-site source) and the multi-media cap. Thus, the synthetic membrane cap was retained for inclusion in the Detailed Analysis phase.

4.2.2 *Ground Water Containment Cut-Off Wall (Barrier Wall)*

Subsurface cut-off walls are used for waste containment and ground water control. Cut-off walls contain the waste and limit the flow of ground water into and out of a source area thereby reducing the migration of contaminants.

To contain ground water, subsurface cut-off walls are normally keyed into the bedrock or a confining layer. The depth to a clay confining layer at the ALS is approximately 15 to 30 feet.

Cut-off wall construction costs increase rapidly with depth. Additionally, it becomes extremely difficult to monitor the wall construction and to monitor the integrity of the wall at greater depths. If not properly constructed, contaminants may migrate through the cut-off wall.

The following four cut-off walls were evaluated:

- Soil-Bentonite
- Clay
- Interlocking Sheet Piling
- Gundwall Polyethylene Vertical Wall

Each of these technologies is summarized in the following paragraphs.

Soil-Bentonite

This technology involves installing an approximate 2 foot thick soil-bentonite cut-off wall around the perimeter of the landfill. Soil-Bentonite cut-off walls are constructed by excavating a trench and keying into a geologic unit of low permeability. The trench is kept open during excavation with a slurry of bentonite and water and, as excavation proceeds, the trench is backfilled with a soil-bentonite mixture, prepared on-Site. Soil-bentonite walls are considered reliable containment technology which can be used to provide long-term waste containment, ground water containment and dewatering.

Advantages of this technology include relatively low cost, reliability and workability. Soil-bentonite walls can be installed below the water table in miscellaneous fill materials that may contain obstructions. Limitations of soil-bentonite cut-off walls are that they require a large area to prepare the mixture and require a relatively flat installation surface.

Clay

A clay cut-off wall is constructed by excavating a trench and compacting clay in the open excavation trench. The local availability of clay makes this technology economically feasible; however, the depth of the cut-off wall in some areas of the ALS and the shallow ground water table would make installation of a clay wall difficult.

Interlocking Sheet Piling

This technology involves driving interlocking sheets (e.g., steel) from the surface to within the underlying low permeability layer. The advantages of this technology are that it requires no excavation, can be installed in areas with limited work area and can be driven through miscellaneous fill materials that may contain obstructions.

This technology is reliable for short-term waste containment and water diversion, but is considered a low performance option for long-term ground water containment. Also, sheetpiles do not form an impermeable barrier to ground water flow and are not as resistant to chemical attack as other cut-off walls described herein. Additionally, sheet piling is relatively more expensive when compared with other vertical containment alternatives.

Gundwall Polyethylene Vertical Barrier

This technology involves installing Gundwall™ around the perimeter of the landfill to provide ground water containment. Gundwall consists of Gundline High Density Polyethylene sheets welded to a patented locking profile. The panels are installed with a vibratory hammer and insertion plate, interlocked with each preceding panel. Ranging in thickness from 80 to 120 mils, Gundwall can be installed using a vibrating method to reach a depth of up to 40 feet.

The advantage of this technology is that it requires no excavation and can be installed in restricted work areas. The flexible nature of Gundwall is such that even substantial soil deformation will not compromise the vertical barrier. Gundwall retains its integrity and provides chemical resistance. This can be used in place of or in conjunction with traditional slurry walls. The disadvantage of Gundwall is the uncertainties associated with installing this material through the non-uniform subsurface materials at the ALS and its relatively high cost.

Evaluation

Based on the costs, the implementability concerns at the ALS and past performance of the various cut-off wall types, a soil-bentonite cut-off wall was identified as being the most cost-effective option for the Site. This cut-off wall type was retained for inclusion in the Detailed Analysis phase.

4.2.3 Ground Water Extraction/Collection

A ground water collection system serves two purposes:

1) it limits contaminant migration in ground water by creating zones of influence which extend across the downgradient side of the contaminant source; and
2) it adjusts the ground water levels to limit the formation of a plume so that contaminants can be collected and treated.

The following ground water extraction/collection systems were evaluated:

- Well-Point
- Extraction Wells
- Subsurface Drains

Well-Point

Well-Point extraction systems typically include a series of closely spaced wells which are networked together and tied to a common pump. The wells are driven into the subsurface soils and are pumped by suction lift. The effectiveness of this type of system is limited by the height that water can be lifted by this technology which is typically around 15 feet.

Extraction Wells

An extraction well is typically a fully penetrating well which can be used to precisely control ground water levels. The wells are typically installed in a collection trench containing coarse drainage material. Ground water extraction is completed by strategically installing a series of wells to control the contaminated plume. Each well can be independently controlled, with the discharge going to the on-site treatment system. The monitoring of ground water quality in the on-site monitoring well network as well as the water quality of the extracted ground water is used to assess the progress of the extraction system. Although extraction wells provide more flexibility in controlling contaminant migration, capital costs of the wells are higher than well points.

Subsurface Drains

Subsurface drains or interceptor trenches would be constructed by excavation of a trench to the top of clay, placement of a perforated drainage pipe in the base of the trench, and backfilling the trench with a coarse material. A subsurface drain at the ALS would be effective in controlling ground water; however, this system would not allow isolated ground water control at specific locations (i.e., all water is typically pumped from one end of the trench).

Evaluation

Based on the site conditions, it is anticipated that isolated ground water control at depths greater than 15 feet (in some areas) will be needed to limit ground water treatment costs. An extraction well system satisfies these requirements, and although these systems have somewhat higher capital costs, the benefits in reduction of ground water treatment costs are significant.

4.2.4 Ground Water Treatment

Since both inorganic (i.e., heavy metals) and organic (i.e., VOCs and semi-VOCs) contaminants are of concern at the ALS, the following treatment process options were evaluated:

- Chemical Precipitation
- Air Stripping
- Activated Carbon Adsorption

Although other technologies passed the Phase II FS screening process, these three are the most reliable for the analytes of concern at the ALS. Additionally, a significant amount of performance data was available on these three proven options in the USEPA Treatability Study Data Base.

Chemical Precipitation

Chemical precipitation is effective in the overall treatment scheme for removing suspended solids and metals. However, it has been proven inefficient in the removal of soluble organic matter from contaminated ground water. Based on a review of the USEPA Treatability Study Data Base and the nature of the ground water contamination at the Site, chemical precipitation would be cost-effective for treatment of metals; however, not for VOCs and semi-VOCs.

Air Stripping

VOCs can be removed from ground water with a high degree of efficiency by air stripping. Packed tower air strippers, the most commonly used air stripping process option by virtue of cost, optimize air to liquid contact by dispersing the ground water into fine droplets, and subjecting the droplets to a counter-current air flow. This technology is typically used to remove the majority of VOCs in the treatment stream, followed by activated carbon for final polishing.

Activated Carbon Adsorption

Activated carbon is well-established process for the removal of organic contaminants from ground water. Based on a review of the USEPA Treatability Study Data Base, this process has been successfully used to remove a large number of volatile and other organic contaminants. Activated carbon can be used for pre-treatment, complete treatment, or effluent polishing, provided that pre-treatment for the removal of suspended solids and oil and grease is included in the system.

Evaluation

If ground water extraction is required at the Site, a ground water treatment system will need to be designed. Treatability studies may be needed during pre-design activities to specify the components of this system. For the purposes of the Detailed Analysis of Alternatives, a ground water treatment system combining chemical precipitation air stripping and activated carbon is recommended. This system was identified through a comparison of the analytes at the Site with the USEPA Treatability Study Data Base. The need for such a pre-treatment system prior to POTW discharge (i.e., the extracted ground water may satisfy POTW influent standards without pre-treatment) and its exact configuration will be completed during the design phase.

4.2.5 Ground Water Disposal

The ground water (treated or untreated) must be discharged after it is extracted. The following ground water disposal options were evaluated:

- Local POTW Disposal
- Off-Site TSDF

Local POTW Disposal

Disposal of ground water to the Buffalo Sewer Authority (BSA) is a feasible option for the ALS. The extraction/pre-treatment system would be connected to the sanitary sewer system near the Site. A discharge permit with BSA would also need to be negotiated including a cost schedule. This option is very cost-effective due to the anticipated flow volumes and the proximity of the sanitary sewer to the Site.

Off-site TSDF

Small amounts of untreated ground water (thousands of gallons per day) could be transported and disposed of at an off-site Treatment, Storage and Disposal Facility (TSDF). A vacuum pump tanker and storage tank for the on-site collection of ground water would suffice for collection/storage of untreated ground water. This option is only cost-effective for very small volumes.

Evaluation

Discharge to the POTW appears to be the most cost-effective ground water disposal option for the ALS. It requires limited pre-treatment, if any, and the volumes of extracted ground water anticipated for this Site make this option attractive from a cost and implementability stand point.

Section 5

5.0 DETAILED ANALYSIS OF ALTERNATIVES

The ten comprehensive remedial alternatives developed for the ALS, are summarized in Section 3.3. Consistent with the NCP and NYSDEC guidance documents, these remedial alternatives undergo a more detailed evaluation in this section. The detailed evaluation of alternatives (Phase III FS) includes an individual analysis of the alternatives relative to criteria described in USEPA 540/6-89/004.

5.1 CRITERIA FOR ANALYSIS OF ALTERNATIVES

The ten remedial alternatives represent a range of distinct waste management strategies which, to a varying degree, address human health and environmental concerns associated with the site. Although the selected alternative will be further refined as necessary during the design phase, these alternatives reflect the fundamental components of the various alternative hazardous waste management approaches being considered for the Site. These alternatives are evaluated with respect to seven (7) of the nine (9) criteria recommended in USEPA 540/G-89/004. The seven (7) criteria are summarized in the following paragraphs. State acceptance and community acceptance, the remaining two criteria, are not dealt with herein but will be addressed in the Record of Decision (ROD), once comments have been received on the RI and FS reports.

1) Overall Protection of Human Health and the Environment - The evaluation of each alternative with respect to the overall protection of human health and the environment provides a summary of how the alternative reduces the risk from potential exposure pathways through treatment, engineering or institutional controls. This criteria also evaluates whether alternatives pose unacceptable short-term or cross-media impacts. NYSDEC agreed to permit a qualitative rather than a quantitative evaluation of risk for each alternative.

2) Compliance with SCGs - The applicable or relevant and appropriate SCGs are applied to each alternative. The ability of each alternative to meet the SCGs or the need to justify a waiver is noted for each.

3) Long-Term Effectiveness and Permanence - Long-term effectiveness and permanence are evaluated with respect to the magnitude of residual risk and the adequacy and reliability of controls used to manage remaining waste (i.e., untreated waste and treatment residuals) over the long-term. Alternatives that have the highest degree of long-term effectiveness and permanence are those that leave little or no waste remaining at the Site, such that long-term maintenance and monitoring are unnecessary and reliance on institutional controls is limited.

4) Reduction of Toxicity, Mobility, or Volume Through Treatment - Evaluation of reduction of toxicity, mobility, or volume through treatment addresses the anticipated performance of the treatment technologies. This evaluation relates to the statutory preference for selecting a remedial action that uses treatment to reduce the toxicity, mobility, or volume of hazardous substances. Aspects of this criteria include: 1) the amount of waste treated or destroyed; 2) the reduction of toxicity, mobility, or volume; 3) the irreversibility of the treatment process; and 4) the type and quantity of residuals resulting from any treatment process.

5) Short-Term Effectiveness - Evaluation of alternatives with respect to short-term effectiveness takes into account: 1) protection of workers and the community during the remedial action; 2) environmental impacts from implementing the action; and 3) the time required to achieve the cleanup goals.

6) Implementability - Implementability deals with the administrative and technical feasibility of implementing the alternatives as well as the availability of necessary goods and services. This evaluation includes such items as: 1) the ability to obtain services, capacities, and equipment; 2) the ability to construct and operate components of the alternative; 3) the ability to monitor the performance and the effectiveness of the technologies; and 4) the ability to obtain the necessary approvals and permits from other agencies.

7) Costs - Costs are divided into capital and operation and maintenance (O&M) costs. Capital costs include those expenditures required to implement a remedial action (i.e., both direct and indirect costs are considered). Direct capital costs include construction costs or expenditures for equipment, labor, and materials required to implement a remedial action. Indirect capital costs include those associated with engineering, permitting, construction management, and other services necessary to carry-out a remedial action.

Annual O&M costs include labor, maintenance materials, energy, and purchased services. The O&M costs include costs incurred even after the initial remedial activity is complete. The 1994 present worth costs are estimated using a 5 percent discount per year for the time period associated with implementation of the specific alternative, not to exceed 30 years. Table 5-1 summarizes the costs expected to be encountered for each alternative. Detailed cost analyses summary tables for each alternative are provided in Appendix B. Tables summarizing the basis for each cost are included in Appendix C.

The cost estimates presented herein are order-of-magnitude estimates; these costs are based on vendor information, conventional cost estimating guides, generic unit costs and prior experience. The FS cost estimates have been prepared for guidance in project evaluation from the information available at the time of the estimate. The real costs of the project at the time of implementation will depend on real labor and material costs, site conditions, competitive market conditions, final project scope, the implementation schedule, and other variable factors both anticipated and unforeseen. An uncertainty that would affect the cost is actual

TABLE 5-1

COST COMPARISON

FEASIBILITY STUDY, PHASE 3

ALLTIFT LANDFILL SITE

BUFFALO, NEW YORK

ALTERNATIVE	CAPITAL COST	YEARLY O&M	TOTAL COST(a)
ALTERNATIVE 1	$0	$0	$0
ALTERNATIVE 2	$175,160	$15,550	$385,288
ALTERNATIVE 3A	$11,723,819	$27,550	$12,096,103
ALTERNATIVE 3B	$7,532,287	$154,230	$9,616,403
ALTERNATIVE 3C	$10,400,208	$156,270	$12,511,890
ALTERNATIVE 3D	$11,375,237	$155,230	$13,472,866
ALTERNATIVE 3E	$9,502,837	$44,630	$10,105,924
ALTERNATIVE 3F	$12,762,754	$56,670	$13,528,538
ALTERNATIVE 3G	$13,345,787	$45,630	$13,962,387
ALTERNATIVE 4	$87,692,693	$29,630	$88,093,084

(a) Total Cost includes capital costs plus present worth O&M costs for 30 years.

volumes of contaminated soil, sediment and groundwater. The accuracy of these "study estimate" costs are expected to be in the range of +50 percent to -30 percent based on anticipated Site conditions and other variables as mentioned above.

Sensitivity analyses were not conducted on the individual costs. This analysis was considered to be of limited value for this Site since the primary parameters that have a large degree of uncertainty associated with them (e.g., contaminated soil and groundwater volumes) have a similar impact on the costs of Alternatives 3 (A to G) and 4. The costs of Alternatives 1 and 2 are substantially lower than Alternatives 3 (A to G) through 4. Thus, a sensitivity analyses will not change the relative ranking of the alternatives with respect to cost. However, Section 6.0 includes a sensitivity analysis that was conducted on the recommended alternative to evaluate the need for contingency or reserve funds.

5.2 SITE MEDIA TO BE REMEDIATED

The media at the Site which are to be addressed by the remedial action prescribed in each alternative were generally discussed in Section 2.3. These are as follows:

(1) subsurface soil/waste;
(2) groundwater; and
(3) sediment.

These media are described below, including where applicable, the quantity of each to be remediated.

5.2.1 Subsurface Soil/Waste

The subsurface soil and waste has been divided into three classifications for the review of remedial actions: (1) the soil/waste within the landfill above the clay liner; (2) the soil/waste within the landfill outside of the clay lined area; and (3) the soil/waste underneath the skyway. Each of these classifications are detailed further below.

Soil/Waste Within the Landfill Above the Clay Liner. The northern two thirds of the Site are underlain by a silty clay layer, as determined from the remedial investigations conducted previously at the Site. This clay layer ranges in thickness up to 48 feet. Landfill-related waste material lie directly on the silty clay over most of the Site, except in the southern end of the Site and along the east and west margins of the landfill. The landfill related waste reaches a maximum thickness over this clay layer of about 35 feet in the central portion of the Site and gradually thins at the Site margins. Laboratory tests conducted of the silty clay during earlier investigations (RECRA and Weheran, 1978) showed a hydraulic conductivity of approximately 10^{-8} cm/sec. The extent of the soil/waste in the landfill which exceeds SCGs and is underlain by the clay layer is approximately 97,000 cubic yards. This estimate is based on a review of the Site topography and the geologic cross sections across the landfill developed in the RI report.

Soil/Waste Within the Landfill Outside the Clay Lined Area. As discussed above, the southern portion of the Site does not have the naturally occurring clay layer. Instead landfill-related waste materials in this section overlie silt and fine sand materials. The silt and sand deposits are up to 25 feet thick. The quantity of soil/waste in this area was estimated to be approximately 14,500 cubic yards (cy).

Soil/Waste Under Skyway. A review of historical information during the RI indicated that the property east of the Site, currently Skyway Auto Parts (Skyway), was apparently utilized for disposal of wastes. Specifically, it appears that a large drainage swale, which extends easterly through the center of the skyway property to the eastern property boundary, was filled in with waste materials. Test pits were installed along the area to delineate the extent of waste materials underlying the skyway. Visual observations from these test pits show that approximately four feet of clean fill overlies the waste in these areas. The depth of waste materials extends from approximately 4 to 10 feet below ground surface. The quantity of soil/waste deposited at the skyway is estimated to be approximately 73,000 cubic yards. This volume is based upon geologic cross sections and subsurface information from the RI. This volume does not include the top four feet of soil which does not contain landfill waste material.

5.2.2 Groundwater

Two water bearing zones, upper and lower, have been identified at the Site. The uppermost zone was encountered at depths between 4 and 28 feet. This zone is generally a perched unit located on the silty clay layer in the northern end of the Site. In the southern portion of the Site, this zone is hydraulically connected with the surface water and, potentially where the clay layer is missing, the lower zone.

The lower zone, found at 22 to 90 feet (depending upon surface elevation), is confined by the clay layer in the northern section of the Site and may be connected with the upper zone and the Ramco Pond. This zone is typically confined to the till and upper fractured portion of the bedrock. Although there is communication between the upper and lower zones, the deeper zone has been determined by the RI not to be of concern. Thus, the remedial alternatives address only the shallow zone.

Groundwater flow conditions in the shallow zone were evaluated in the RI based on a study of shallow piezometers. There is a slight mounding of three to four feet which occurs in the immediate vicinity of the landfill, with radial flow outwards in all directions. Water flowing to the north, west and south ultimately discharges to the ponds along the western and southern margins of the landfill. Water flowing to the east is intercepted by the westerly flowing regional water bearing zone. These two flows appear to merge and flow south towards the Ramco Pond.

The actual quantity of water to be extracted and treated in the post-closure condition was estimated using empirical models. The HELP model was used to estimate infiltration and Darcy's Law was used to estimate lateral flow in the upper zone. Input parameters for the model were derived from RI hydraulic conductivity data and groundwater level measurements. The amount of groundwater to be treated for each alternative varies, depending on whether a collection trench or a collection trench/cut-off wall system is proposed, as detailed in each alternative.

5.2.3 Sediment

Information has been collected on two areas of sediment: 1) the western pond system, comprised of two ponds located along the western side of the landfill; and, 2) the Ramco Pond, located south of the Site. The quantity of sediment in the western pond system was estimated from the cross-sectional area of each pond and associated wetland multiplied by the field observed depths of sediment in each pond, as provided in the RI. The estimated sediment volume in this system is approximately 5,700 cubic yards.

The Ramco Pond is being investigated by Dames & Moore under a separate RI/FS. However, this material will be remediated as part of the ALS remedial program. Dames & Moore estimated the average depth of the sediment in the Ramco Pond at 18 to 24 inches, with a total removal volume of 9,800 cubic yards.

5.3 *COMMON COMPONENTS*

5.3.1 *Alternatives 2 - 4*

Alternatives 2 - 4 have one common component, institutional actions. A description of this component is presented below and its evaluation is included with the assessment of Alternative 2.

Institutional actions. Institutional actions to be completed for the ALS encompass four activities: deed restrictions, groundwater monitoring, site control; and maintenance. These items are discussed below:

- Deed Restrictions - The Site and the adjoining skyway would have deed restrictions to prevent below ground surface use of the property. The deed restrictions would not allow the property to be used for residential, recreational or agricultural purposes. This would limit future exposure to materials containing the analytes of concern. In Alternatives 3A through 3G, this deed restriction would prevent disturbance of the cap, once completed.

- Supply Well Restrictions - The local government or agencies will be requested to oversee well installation and use in the area that is in the vicinity of the Site. This oversight may include a local regulation requiring a review/permit for all proposed groundwater well installation and use plans. This regulation would prohibit installing or using wells in the vicinity of the Site so that the analytes that are currently beneath the landfill do not migrate as a result of off-Site pumping.

- Groundwater Monitoring - Groundwater monitoring is a method of evaluating the performance of the selected remedial alternative by reviewing the contaminant concentrations within the groundwater over time. Groundwater monitoring of indicator parameters within the existing monitoring wells would be done periodically, until the parameter levels satisfy the established performance criteria. This periodic monitoring program would continue beyond the cessation of remediation (for a limited time) to verify that none of the analytes are migrating.

- Site Control - Site control will be performed by repair or replacement of the existing fence along the east side of the ALS property. New fencing would be installed along the remaining perimeter of the property. Access to the Site will be through a series of gates which will be maintained and locked unless in use. Signs will be posted on the fence at uniform locations.

- Maintenance Activities - The current Site conditions and the Site control structures will be maintained through periodic inspections of the ALS property. Routine activities such as lawn mowing and fence/gate repair will also be conducted.

5.3.2 Alternatives 3B-3G

Alternatives 3B - 3G have the following three common components, as well as those described above: 1) the excavation and consolidation of soil outside the clay layer and excavation and consolidation of sediment; 2) the restoration of the areas which were excavated; and 3) the treatment of groundwater (as a Contingency for Alternatives 3B through 3D). These components are described below.

Excavation

In Alternatives 3B - 3G, excavation of soil/waste and sediment is used to varying degrees. However, there are associated activities that would take place as part of the excavation process that would be completed regardless of the extent of the excavations. These operations include decontamination, dust control and restoration/revegetation.

Decontamination would be done at the designated decontamination area. This area would include a decontamination pad to be used for decontaminating equipment. The pad would be bermed and sloped to a sump to collect the water used to decontaminate the equipment. This water would then be pre-treated and discharged to the POTW.

On-site dust control would take place during construction and excavation operations. This technology would involve wetting down the soil to limit dust emissions. The quantity of water would be limited and would not cause leachate production and contaminant migration vertically into the soil or laterally off-site.

Restoration

Following excavation and backfilling, the disturbed areas will be graded to limit surface flow on the land surface during storm events. The graded areas will then be seeded with perennial grass seed to limit erosion and fugitive dust emissions from the site. This procedure will also improve aesthetic conditions. The wetlands will be replanted with vegetation similar to the current species.

Groundwater Treatment

Groundwater treatment for the Site involves three processes: 1) chemical precipitation; 2) air stripping; and 3) carbon adsorption followed by discharge to the POTW.

Once the groundwater reaches the POTW it will undergo treatment including mechanical screens, influent pumps and aerated grit chambers, primary clarifiers, aeration tanks, secondary clarifiers, and a chlorine contact tank. A discharge permit and approval from the BSA will be necessary. If selected, this alternative will require further study to evaluate potential POTW upgrading requirements (currently anticipated to be unnecessary for 6 gallons per minute) and possible modeling of the wastewater treatment train using the USEPA Fate and Treatability Estimator (FATE) Model.

5.4 ALTERNATIVE 1 - NO ACTION

5.4.1 Description

The no action alternative is included in this FS to measure the potential problems posed by the Site if no remedial actions were to be implemented. All waste material in the landfill would remain on-Site, with the cover material currently in place. There would be no removal of sediment, nor would there be any work performed relative to the waste materials underlying the skyway.

5.4.2 Assessment

1) Overall Protection of Human Health and the Environment - Since no remedial actions would be conducted as part of this alternative, the risk to human health and the environment from potential pathways would not be reduced, except through natural degradation of the analytes.

2) *Compliance with SCGs* - This alternative would not meet the applicable SCGs since no steps were taken to manage the current status of the contaminants.

3) *Long-Term Effectiveness and Permanence* - The selection of this alternative would not result in a long-term, or permanent solution since the analytes would remain in place.

4) *Reduction of Toxicity, Mobility, or Volume Through Treatment* - Since there are no activities to be performed during this alternative, the only reduction in toxicity, mobility or volume of the contamination is the naturally occurring degradation of the analytes.

5) *Short-Term Effectiveness* - The lack of any activities conducted under this alternative has also eliminated the short-term risks encountered by workers on-Site.

6) *Implementability* - Since there are no activities which will be performed under this alternative, this alternative is considered to be the most implementable.

7) *Costs* - The present worth cost and capital cost of the individual technologies/process options as well as the comprehensive alternatives are included on Table 5-1. The cost estimate and cost basis forms are included in Appendix B and Appendix C, respectively.

5.5 ALTERNATIVE 2 - LIMITED ACTION

5.5.1 Description

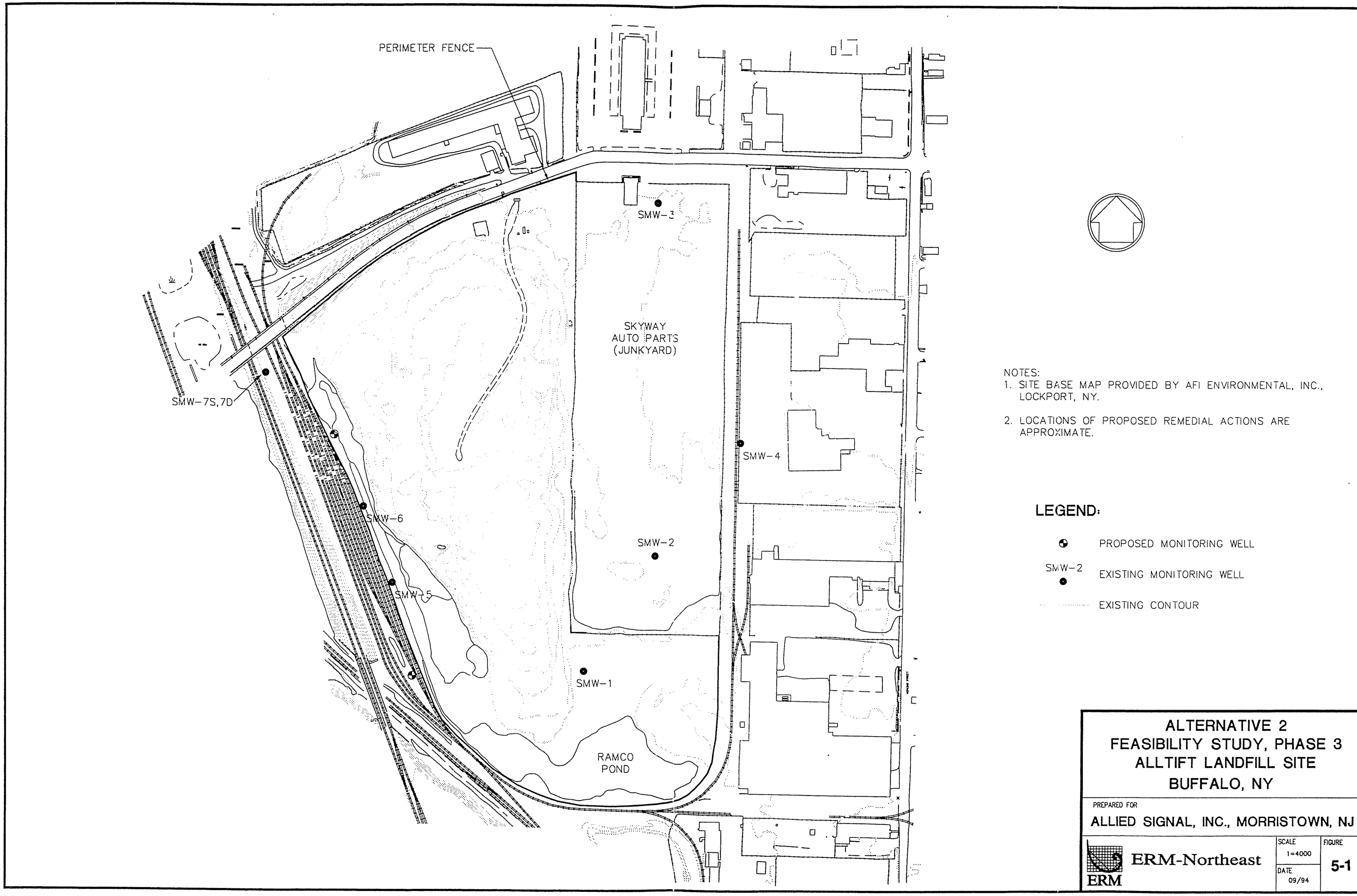
Actions under this alternative would include land use restrictions, supply well installation and usage restrictions, fencing, and periodic monitoring of the level of contaminants in monitoring wells. These activities are described previously under the description of institutional actions in Section 5.3, Common Components.

A total of 2 groundwater monitoring wells would be installed under this alternative. Seven perimeter monitoring wells which are currently on-Site would also be part of the monitoring network. The location of these wells are shown on Figure 5-1. The wells would be sampled on a quarterly basis for the first two years and semi-annually thereafter.

5.5.2 Assessment

1) Overall Protection of Human Health and the Environment - Because no remedial actions would be implemented to correct or contain the contamination with the limited action alternative, long-term human health and environmental risks for the Site would essentially be the same as those identified in the RI. However, the risk associated with future ingestion of groundwater and contact with contaminated soil would be reduced as a result of the supply well restrictions and Site controls, respectively.

2) Compliance with SCGs - Alternative 2 provides no control of exposure via fugitive dust emissions, only a slight reduction in future risk to human health posed by groundwater, and no decrease in impact on benthic life from the sediment. It also allows for the possible migration of contaminants and further


PERIMETER FENCE
SMW-3
SKYWAY
AUTO PARTS
(JUNKYARD)
SMW-7S,7D
SMW-4
SMW-6
SMW-2
SMW-5
SMW-1
RAMCO
POND
NOTES:
1. SITE BASE MAP PROVIDED BY AFI ENVIRONMENTAL, INC., LOCKPORT, NY.
2. LOCATIONS OF PROPOSED REMEDIAL ACTIONS ARE APPROXIMATE.
LEGEND:
PROPOSED MONITORING WELL
SMW-2
EXISTING MONITORING WELL
EXISTING CONTOUR
ALTERNATIVE 2
FEASIBILITY STUDY, PHASE 3
ALLTIFT LANDFILL SITE
BUFFALO, NY
PREPARED FOR
ALLIED SIGNAL, INC., MORRISTOWN, NJ
ERM-Northeast
ERM
SCALE
1=4000
DATE
09/94
FIGURE
5-1

degradation of the groundwater. Since no action is being taken to reduce or contain the contamination, it would not meet SCGs for a number of analytes.

3) Long-Term Effectiveness and Permanence - This alternative includes no controls for exposure and no long-term management measures. Current and potential future risks would remain under this alternative.

4) Reduction of Toxicity, Mobility, or Volume Through Treatment - This alternative provides no reduction in toxicity, mobility or volume of the contaminated soil or groundwater through treatment.

5) Short-Term Effectiveness - There would be no additional risks posed to the community, the workers, or the environment as a result of this alternative being implemented.

6) Implementability - The only implementation concern is that of the addition of land and supply well use restrictions to the deeds of the effected properties.

7) Costs - The present worth cost and capital cost of the individual technologies/process options as well as the comprehensive alternatives are summarized on Table 5-1. The cost estimate and basis forms are included in Appendix B and Appendix C, respectively.

5.6 ALTERNATIVE 3A - CONTAINMENT (CAP LANDFILL AND SKYWAY)

5.6.1 Description

This alternative consists of the following components:

1) Obtain access to Skyway;

2) Regrade and cap the entire Site, including Skyway, with a synthetic membrane composite cap; and

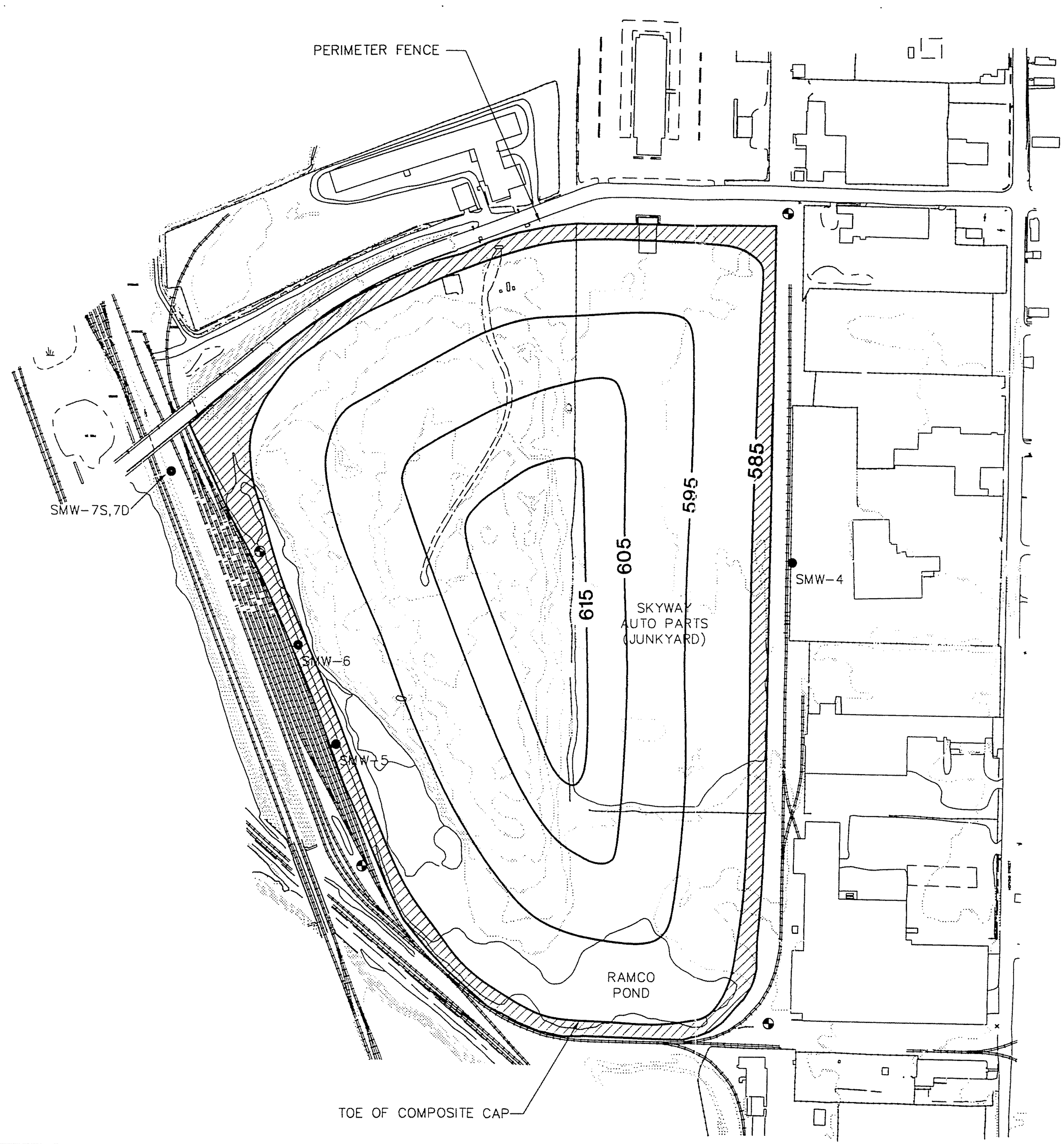
3) Institutional controls.

A Site map showing the key elements of this alternative is presented as Figure 5-2. The specific actions and the sequence of work required to implement this alternative are described below.

Obtain access to Skyway. Access to Skyway would be obtained from the current owner. The cars and car parts currently on the land will be removed and managed at another location.

Installation of the Composite Cap. A synthetic membrane composite cap would then be constructed on the Site as shown on Figure 5-3. The area to be capped for this alternative is approximately 58 acres, encompassing the entire landfill property and the adjoining Skyway. The first step of the cap installation consists of regrading the Site. A six-inch layer of subbase would then be placed over the landfill wastes and covered with a geotextile fabric. This fabric would separate the fines in the subbase from the overlying, more porous, 12-inch thick gas venting layer. A 60-mil HDPE geomembrane would be placed on top of the gas venting layer in accordance with 6NYCRR Part 360-2.13(s). This geomembrane would be covered with a 2-foot layer of soil fill which would then be covered with a 6-inch layer of topsoil. The permeability of the completed cap will be approximately 1×10^{-12} cm/sec.

This cap will be sloped to a drainage system that would collect and transport surface water away from the cap. The drainage system would be designed to meet the peak runoff for a 25 year storm event.



NOTES:
1. SITE BASE MAP PROVIDED BY AFI ENVIRONMENTAL, INC., LOCKPORT, NY.
2. LOCATIONS OF PROPOSED REMEDIAL ACTIONS ARE APPROXIMATE.
3. FINAL TOPOGRAPHY OF LANDFILL CAP MAY VARY.

LEGEND:

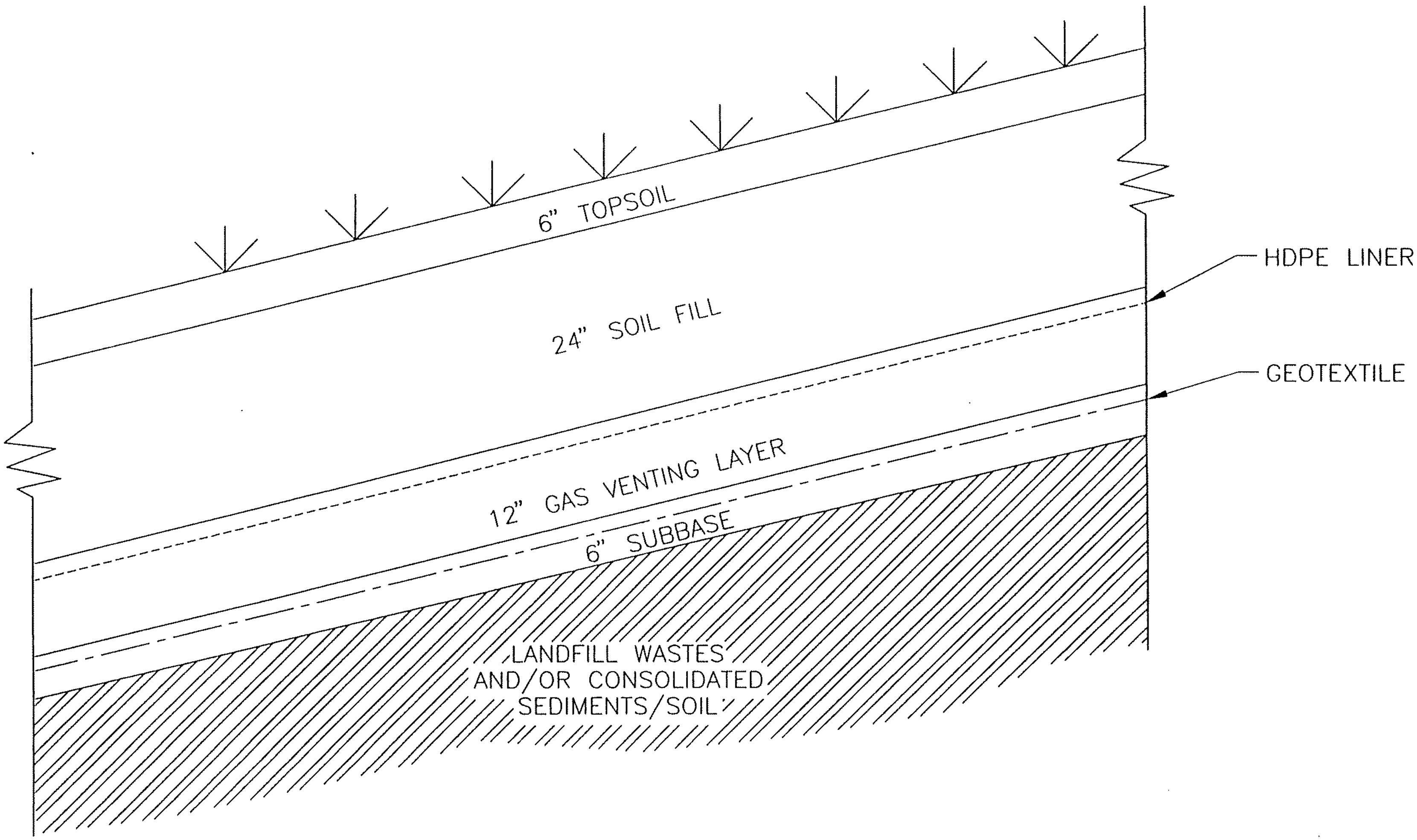
- PROPOSED MONITORING WELL
- SMW-2 EXISTING MONITORING WELL
- EXISTING CONTOUR
- PROPOSED FINAL CONTOUR
- AREA FOR ACCESS ROAD, SURFACE WATER COLLECTION CHANNEL(S), AND MISCELLANEOUS STRUCTURES

ALTERNATIVE 3A
FEASIBILITY STUDY, PHASE 3
ALLTIFT LANDFILL SITE
BUFFALO, NY

PREPARED FOR
ALLIED SIGNAL, INC., MORRISTOWN, NJ

ERM ERM-Northeast

SCALE	FIGURE
1=4000	5-2
DATE 09/94	



TITLE

COMPOSITE CAP
ALLTIFT LANDFILL SITE

PREPARED FOR

ALLIED SIGNAL, INC., MORRISTOWN, NJ

ERM ERM–Northeast Environmental Resources Management

DRAWN:	JOB NO.:	FILE NAME:	SCALE	DATE	FIGURE
E.M.F.	409.005.3	CAPC	NONE	9/7/94	5-3

New Source Performance Standards of the Clean Air Act Amendments of 1990 (40 CFR Part 60 Subpart Ea) will not apply to the landfill because: 1) based on the nature of the waste, it is anticipated that only a small quantity of landfill gas will be generated, which will be vented to atmosphere through individual landfill vents; and 2) the collection and combustion of this landfill gas is not anticipated.

The cap will reduce the leaching of metals and other analytes of concern to the groundwater. The monitoring wells would be used to evaluate the natural attenuation of the contaminants. Also included in this alternative are deed restrictions that would restrict on-Site excavation and installation and use of supply wells within the Site vicinity.

This alternative also includes control and monitoring of the Site under institutional actions, previously described in Section 5.3. Four new monitoring wells will be installed for Alternative 3A. An additional 8 groundwater monitoring wells currently in place will also be sampled under the institutional controls. The proposed well spacing is based upon the 6NYCRR Part 360 spacing requirements of a minimum of 500 feet apart downgradient and a minimum of 1,500 feet apart upgradient.

5.6.2 Assessment

1) Overall Protection of Human Health and the Environment - Alternative 3A is protective of the human health in that exposure to contamination is controlled. Exposure to contaminated soil/sediment and fugitive dust is reduced by the cap. Further release of contaminants to the surface water is limited. Leachate contributions of contaminants to the groundwater are also reduced. This alternative, however, allows for the potential migration of the existing contaminated groundwater. Additionally, analytes in the southern portion of the landfill may migrate vertically into the lower water bearing zone.

2) *Compliance with SCGs* - Alternative 3A would reduce the risks associated with the contaminated soil/sediment by containing these materials. The cap will also reduce fugitive dust emissions. Groundwater exposure in this alternative would only be limited by restrictions placed on supply well usage and installation.

3) *Long-Term Effectiveness and Permanence* - In order to remain effective over the long-term, careful maintenance of the cap and restricting water well usage is required. Damage to the cap could potentially allow groundwater contamination and fugitive dust emissions. Alternative 3A includes an extensive cap, extending over the entire landfill and the adjoining Skyway; therefore, the level of effort in maintaining the cap and the long term effectiveness of the remedial alternative is expected to be the most extensive of all of the containment alternatives.

Long term monitoring, maintenance, and control would be required under this alternative because contaminated soil would remain on-Site and because the groundwater may remain contaminated above NYSDEC water quality levels.

The institutional controls (i.e., well restrictions) are expected to be effective over the short term but may not be effective over the long term due to the degree of difficulty in enforcing any possible regulation or restriction with new residents or industries not familiar with the local conditions. A review would be conducted every five (5) years to provide adequate protection of human health and the environment in accordance with CERCLA 121(c) as this alternative would leave wastes on-Site.

4) *Reduction of Toxicity, Mobility, or Volume Through Treatment* - This alternative provides a reduction in the mobility of the contamination in the soil by limiting the quantity of water which comes into contact with the analytes of concern. However, the alternative does not eliminate potential contact with the groundwater nor does it reduce the toxicity or the volume of waste through

treatment.

5) Short-Term Effectiveness - The potential for particulate emissions during construction would be limited through the use of dust control technologies (i.e., watering). Since no soil or waste is being excavated, the potential for creation of air borne particulates is minimal. The installed cap limits further fugitive dust emissions. This cap could be constructed within a one-year period.

6) Implementability - The only implementation concerns are: 1) the purchase of Skyway; and 2) water supply well restrictions. These are concerns because of the dependency on the other involved parties to agree to these steps. The other materials and equipment to be used under this alternative are readily available and easy to procure.

7) Costs - The present worth cost of Alternative 3A is presented on Table 5-1. The annual O&M costs are mainly for cap maintenance and monitoring well sampling and analysis. These costs are detailed in Appendix B and Appendix C.

5.7 ALTERNATIVE 3B - CONSOLIDATE SOIL AND SEDIMENT/CAP LANDFILL

5.7.1 Description

This alternative consists of the following technologies:

1) Excavation of the soil/subsurface landfill materials which are not currently underlain by the clay layer. Consolidation of this material into the landfill.

2) Excavation and dewatering of the sediment from the ponds. Consolidation of this material into the landfill.

3) Capping of the landfill with a synthetic membrane composite cap.

4) Installation of a groundwater extraction system utilizing a collection trench with extraction wells.

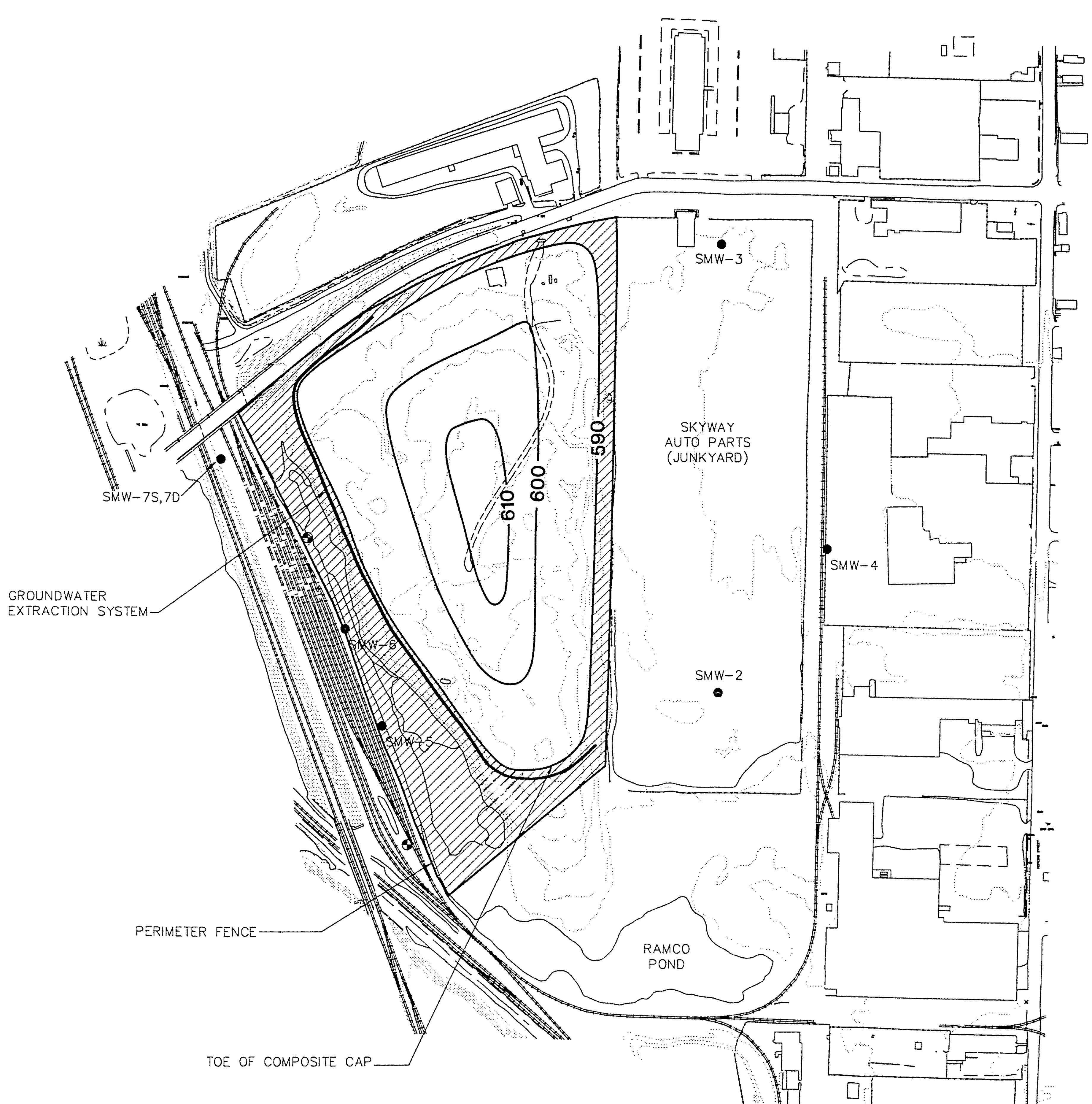
5) Operation, if necessary, of a groundwater treatment system with discharge of treated groundwater to the local POTW.

6) Institutional Controls.

The Common Components are described in Section 5.3. A Site map showing the components of this alternative is presented as Figure 5-4. The specific actions and the sequence of work required to implement this alternative is described below.

Excavation of the Soil/Waste Outside Clay Layer. The soil and waste from the southern portion of the facility would be excavated using backhoes, front-end loaders, and other excavation equipment. The material would be loaded into dump trucks for transportation to the landfill area where it would be placed in a manner to allow proper grading for the cap. Following excavation, the disturbed area would be backfilled with clean fill, regraded to improve drainage, and revegetated.

Excavation of Sediments and Consolidation into Landfill. Prior to removal of the sediments from the ponds, all surface water discharge points to the ponds will be temporarily bermed or rerouted to eliminate flow through the ponds. These actions will limit the suspended sediment from being discharged downstream.



STATE OF NEW YORK
JEFFREY A. WITTLINGER
No. 064031
LICENSED PROFESSIONAL ENGINEER

NOTES:
1. SITE EASE MAP PROVIDED BY AFI ENVIRONMENTAL, INC., LOCKPORT, NY.
2. LOCATIONS OF PROPOSED REMEDIAL ACTIONS ARE APPROXIMATE.
3. FINAL TOPOGRAPHY OF LANDFILL CAP MAY VARY.

LEGEND:

- PROPOSED MONITORING WELL
- SMW-2 — EXISTING MONITORING WELL
- EXISTING CONTOUR
- PROPOSED FINAL CONTOUR
- AREA FOR ACCESS ROAD, SURFACE WATER COLLECTION CHANNEL(S), AND MISCELLANEOUS STRUCTURES

ALTERNATIVE 3B
FEASIBILITY STUDY, PHASE 3
ALLTIFT LANDFILL SITE
BUFFALO, NY

PREPARED FOR
ALLIED SIGNAL, INC., MORRISTOWN, NJ

ERM ERM-Northeast

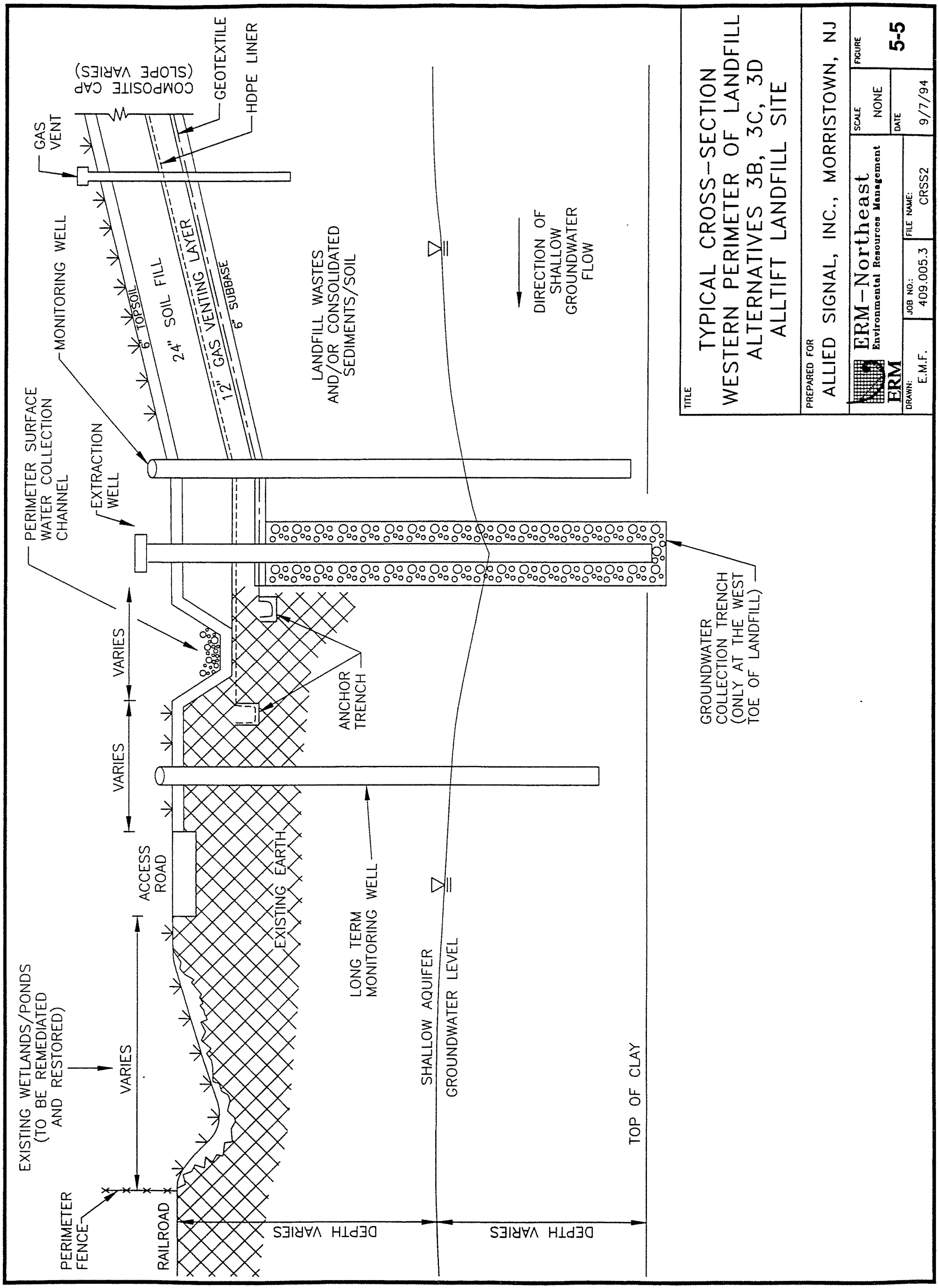
SCALE	FIGURE
1=4000	5-4
DATE 09/94	

The sediments from both the Western Pond system and the Ramco Pond will then be removed from the ponds using a backhoe or similar excavation equipment. These materials will be temporarily staged on-Site for dewatering. If additional dewatering is needed on the sediments to remove free liquids prior to landfilling, the sediments will be mixed with soils removed from other areas to obtain a more uniform material to consolidate into the landfill.

Water generated during control of the surface water and dewatering activities will be contained on-Site. This water will be managed in one of two ways, depending on the quantity generated and the characteristics of the water. The water will be tested to determine if it meets BSA discharge requirements. If it meets these requirements it will be discharged under a temporary arrangement with the BSA. The water may also be pretreated on-Site using a portable system, prior to discharge to the BSA.

Sediment removal will consist of removal of all sediments within the ponds and the associated nearby wetland areas. The limits of this removal will be based upon the RI data and pre-design studies. The disturbed areas will be backfilled to the original grade with clean fill material. The ponds and surrounding disturbed wetlands areas will be revegetated to restore the wetlands. The temporary surface water control structures will then be removed.

Installation of the Composite Cap. A synthetic membrane composite cap would be constructed on the Site, as shown on Figure 5-4. The area to be capped for this alternative is approximately 34 acres, encompassing the existing landfill, exclusive of Skyway. The installation of the cap will follow the methodology previously discussed in Section 5.6. Figure 5-5 provides a cross-section showing the placement of the cap and the monitoring well system.



TITLE
TYPICAL CROSS-SECTION
WESTERN PERIMETER OF LANDFILL
ALTERNATIVES 3B, 3C, 3D
ALLTIFT LANDFILL SITE
PREPARED FOR
ALLIED SIGNAL, INC., MORRISTOWN, NJ
ERM-Northeast
Environmental Resources Management
DRAWN: E.M.F.
JOB NO.: 409.005.3
FILE NAME: CRSS2
SCALE NONE
DATE 9/7/94
FIGURE 5-5
GAS VENT
COMPOSITE CAP (SLOPE VARIES)
GEOTEXTILE
HDPE LINER
MONITORING WELL
6" TOPSOIL
24" SOIL FILL
12" GAS VENTING LAYER
6" SUBBASE
LANDFILL WASTES AND/OR CONSOLIDATED SEDIMENTS/SOIL
DIRECTION OF SHALLOW GROUNDWATER FLOW
PERIMETER SURFACE WATER COLLECTION CHANNEL
EXTRACTION WELL
VARIES
VARIES
ANCHOR TRENCH
GROUNDWATER COLLECTION TRENCH (ONLY AT THE WEST TOE OF LANDFILL)
ACCESS ROAD
EXISTING EARTH
LONG TERM MONITORING WELL
EXISTING WETLANDS/PONDS (TO BE REMEDIATED AND RESTORED)
VARIES
SHALLOW AQUIFER
GROUNDWATER LEVEL
TOP OF CLAY
PERIMETER FENCE
RAILROAD
DEPTH VARIES
DEPTH VARIES

Installation of Groundwater Extraction System.

Figure 5-4 shows the proposed locations of the groundwater collection system, consisting of an interceptor trench placed along the western and southern toe of the capped landfill. The location of this system is in the presumed downgradient location of groundwater flow in the post-closure condition. The post-closure groundwater flow direction was based on the top of clay contour map and regional groundwater flow. The collection trench will also extend around the southern toe of the landfill (see Figure 5-4) to intercept potential groundwater flow towards the Ramco pond, potentially emanating from the landfill or from Skyway. This trench will be equipped with groundwater extraction wells to discharge the groundwater into the treatment system. The current well placement is based upon knowledge of the clay layer of the Site. The trench will be installed along the base of the clay layer with approximately three wells located in the three lowest points of the top surface of the clay layer. It is believed that this system will best capture the groundwater identified by the shallow monitoring well network. Further modifications of this extraction system may result from the pre-design groundwater pumping test and modelling of post-closure conditions. The combined 3-well pumping rate will be approximately 6 gallons per minute (gpm).

Operation of a Groundwater Treatment System. If concentrations of analytes in the interior wells (see Figure 5-5) exceed performance criteria specified in the ROD Consent Order, a groundwater treatment system will be installed and activated to manage the water extracted from the western and southern portion of the Site. The preliminary design of this system includes three unit operations: 1) primary treatment in the form of chemical precipitation and settling; 2) secondary treatment with air stripping, and 3) a final polishing step of carbon adsorption.

The chemical precipitation and settling unit will consist of a series of chemical addition tanks or static mixers flowing into a settling chamber, equipped with bottom valves for sludge removal. This unit will remove particulates, specifically metals, from the groundwater. The coagulation and settling unit also serves as a preliminary iron removal step to reduce the potential for formation of chelating bacteria in the following units.

The air stripper would most likely be a packed tower to maximize the contact of the water with air and enhance removal. It is expected that air stripping will significantly reduce most of the volatile organics in the groundwater. The actual size of the tower, the packing material and the flow rate of the air through the unit will be determined based upon the characteristics of the groundwater encountered in the groundwater pumping tests.

Carbon adsorption units will be placed in series behind the air stripper to provide a final polishing step and to remove the non-volatile organics contained in the groundwater. Due to the estimated low flow rate of groundwater to be extracted and the lower concentrations of semi-volatile organics found in the groundwater, it is expected that a replaceable canister (55-gallon drum) system can be used. Upon completion of treatment in the above described system, the groundwater will be discharged to the BSA.

<u>Institutional Controls.</u> The monitoring well network proposed for Alternative 3B consists of installation of 2 new wells. A total of 10 wells will be sampled quarterly for the first two years and semi-annually for the years following.

5.7.2 Assessment

1) Overall Protection of Human Health and the Environment - Protection of human health and the environment in Alternative 3B is accomplished by isolating and containing the soil contaminants and the suspected source of the groundwater contamination from direct exposure to the environment through capping.

Exposure to contaminated fugitive dust is also eliminated through capping of the soil and waste. The consolidation of the sediment from the pond areas into the landfill removes this material from contact with the surface water and potential contact with the groundwater.

Also, further spread of the contaminants and further environmental degradation are reduced because the groundwater will be monitored for the constituents of concern and, if necessary, a groundwater extraction and treatment system will be activated.

Alternative 3B is a control and isolation technology that would not be considered permanent as defined in HWR-90-4030. However, on-site containment is a very reliable technology and will achieve the remedial action objectives in a relatively short time frame (i.e., less than 3 years). The risks to human health and the environment are limited to the implementation phase when soils and sediments will be excavated and moved. During this phase the risks will be controlled through monitoring and engineering controls (e.g., dust suppression, personal protective equipment).

2) Compliance with SCGs - The following SCGs are considered applicable to the Site and Alternative 3B:

- Applicable portions of Air Guide 1, TAGM HWR-89-4031 and 6NYCRR Parts 200, 201, 211, 212 and 257 that pertain to potential fugitive dust issues during construction and landfill gas emissions.

- Applicable portions of ECL Article 24 and 71-Title 23, 33 CFR Parts 320-330 and 6NYCRR Parts 608, 662, 663, 664 and 665 that pertain to disturbance and restoration of wetlands.

- Applicable portions of 6NYCRR Parts 364, 370, 371, 372, 374, 376, 373-1, 373-2, 373-3 that pertain to on-site treatment of groundwater and the handling and off-site disposal of the residuals from the treatment process. Note that if there is no groundwater extraction and treatment these regulations will not be considered SCGs for this site.

- Applicable portions of TAGM HWR-94-4046 that pertain to cleanup levels for the soil at the Site.

- Applicable portions of TAGM HWR-90-4030 and 6NYCRR Part 375 that pertain to evaluation of remedial alternatives.

- Applicable portions of 33 USC 466 Section 404 and 6NYCRR Part 700-705 that pertain to groundwater and surface water quality at the Site.

- Applicable portions of 6NYCRR Part 360 that pertain to the landfill cap.

Alternative 3B satisfies HWR-94-4046 by isolating and containing all soil and sediment above SCGs with the exception of the subsurface soil at Skyway Auto Parts. A waiver under Part 375-1.10(c)(1)(i) is appropriate for Skyway subsurface soil due to the engineering impracticability of remediating the buried layer of soil/waste that contains concentrations of analytes above soil cleanup objectives in TAGM HWR-94-4046. Remediation of Skyway subsurface soil is impracticable for two reasons: 1) the 4 to 10 feet of non-landfill-related material that lies above the relatively small amount of landfill waste, and 2) the highly transmissive Skyway soil combined with the shallow groundwater table (i.e., approximately 4 feet below grade) present an enormous feasibility issue of dealing with the large quantity of groundwater that will need to be pumped and possibly treated and discharged to allow excavation of the buried layer of soil/waste material.

6 NYCRR Part 700-705 Water Quality Standards apply to aquifers that could be potentially used for water supply. Supply well restrictions and the nature of the Site dictate that groundwater at the Site will not be used for drinking or any other foreseeable use; thus, the standards are not applicable to the Site. However, the standards do apply to the groundwater migrating away from the Site. The concentrations at and beyond the perimeter of the Site currently do not exceed 6 NYCRR Part 700-705 Water Quality Standards in the shallow groundwater zone. This water quality will be maintained through the contingency groundwater extraction and treatment system, proposed in Alternative 3B. This system will prevent off-Site migration of analytes above these standards, and will ensure that water quality is maintained through long- term monitoring.

The sediments in the wetland areas are addressed under Alternative 3B by excavating, consolidating and containing the sediments that exceed the sediment cleanup criteria developed in the RI. During remedial activities in these wetlands, applicable wetland SCGs relating to disturbance and restoration of wetlands will also be satisfied (i.e., Part 662-665). These SCGs will be satisfied through obtaining appropriate wetlands permits and implementing restoration in accordance with these regulations.

3) Long-Term Effectiveness and Permanence - As with the previous alternative, the long-term effectiveness of Alternative 3B is dependent upon maintenance of the cap and the institutional controls. Since the cap contains material which has been excavated from other areas and consolidated into one place, the actual size of the cap is significantly reduced from Alternative 3A. The cap proposed in Alternative 3B is expected to be easier to maintain due to the reduced surficial area.

The contingency groundwater control system will address infiltration which occurs through the cap. However, if the cap loses integrity, an increase in leachate generation and fugitive dust emissions could result.

Long term monitoring, maintenance, and control would be required under this alternative because contaminated soil would remain on-Site and because the groundwater may remain contaminated above NYSDEC water quality levels. A review would be conducted every five (5) years to provide adequate protection of human health and the environment in accordance with CERCLA 21(c) as this alternative would leave waste on-Site.

Alternative 3B is a control and isolation technology that would not be considered permanent as defined in HWR-90-4030. Alternative 3B would eliminate the potential trespasser dermal, inhalation and ingestion pathways by isolating and containing the soil and sediment exceeding SCGs. The exposure pathways relative to plants and animals are also eliminated through the consolidation of the contaminated soils and sediments under the cap. The potential groundwater exposure pathway is eliminated through groundwater controls which prevent the off-site migration of contaminants.

4) Reduction of Toxicity, Mobility, or Volume Through Treatment - Long-term reduction of mobility will be dependent upon regular maintenance, repair and monitoring of the containment system. Given appropriate maintenance, the containment system proposed under Alternative 3B is a proven technology that will reduce the mobility of the contaminants of concern. If groundwater pretreatment is necessary, the residuals from the treatment system will be taken for off-Site disposal in a RCRA hazardous waste landfill or will be incinerated at an off-Site TSDF.

5) Short-Term Effectiveness - The major short-term concern for the steps being performed under Alternative 3B is the temporary increase of potential risks to worker and community health and safety during soil/waste excavation. This work would be accomplished over a short duration.

Potential on-Site exposure to this medium would be mitigated by protective clothing and respirators, if needed. Air monitoring will be conducted to ensure that adequate personnel protective equipment is being used and that effective dust control measures are being implemented.

There may be releases of VOCs to the atmosphere during excavation and consolidation of the soils and sediments. These releases will be controlled through the preparation and implementation of the Remedial Design Work Plans which will outline air quality monitoring requirements for the remediation phase. Certain action levels will trigger temporary engineering controls which may include wetting, temporary cessation of work or other VOC suppression methods.

Alternative 3B will satisfy RAOs and applicable SCGs once the closure is complete. This closure should be completed in less than 3 years.

Alternative 3B does not include excavation of Skyway, which lessens the short-term exposure risks for the on-Site workers and the surrounding community. The excavation and consolidation of the sediment from the ponds carries a low short-term risk since the material will be wet during excavation and management.

6) Implementability - There will be implementability concerns relative to obtaining the proper permits for wetland excavation and restoration. These permitting activities involve federal agencies that may cause a delay in implementation of certain phases of the remediation under Alternative 3B. Once all permits are in place, construction difficulties may arise involving the excavation of sediments below the water table. Appropriate sedimentation controls and/or possible dewatering may be necessary.

The access of construction equipment on the west, east and south sides of the Site is a concern due to the surface water bodies and marshland and/or private property access issues. Special access agreements and equipment may he required.

Since Skyway is not required to be purchased or moved as part of this alternative, dependency on third party negotiation is reduced. The institutional controls will still require that the deed for Skyway not allow subsurface excavations or residential use.

7) Costs - The present worth cost of Alternative 3B is presented on Table 5-1. Initially, the annual O&M costs are mainly for fence and cap maintenance, along with monitoring well sampling and analysis. If groundwater monitoring results show that the extraction and treatment of the groundwater is necessary, the yearly O&M costs increase substantially based upon operation of the system and POTW discharge costs.

5.8 ALTERNATIVE 3C - CONSOLIDATE SOIL AND SEDIMENT/CAP LANDFILL AND SKYWAY

5.8.1 Description

This alternative consists of the following components:

1) Excavation of the soil/subsurface materials which are not currently underlain by the clay layer. Consolidation of this material into the landfill.

2) Excavation and dewatering of the sediment from the ponds. Consolidation of this material into the landfill.

3) Obtain access to Skyway.

4) Capping of the landfill and Skyway with a synthetic membrane composite cap.

5) Installation of a groundwater extraction system utilizing a collection trench with extraction wells.

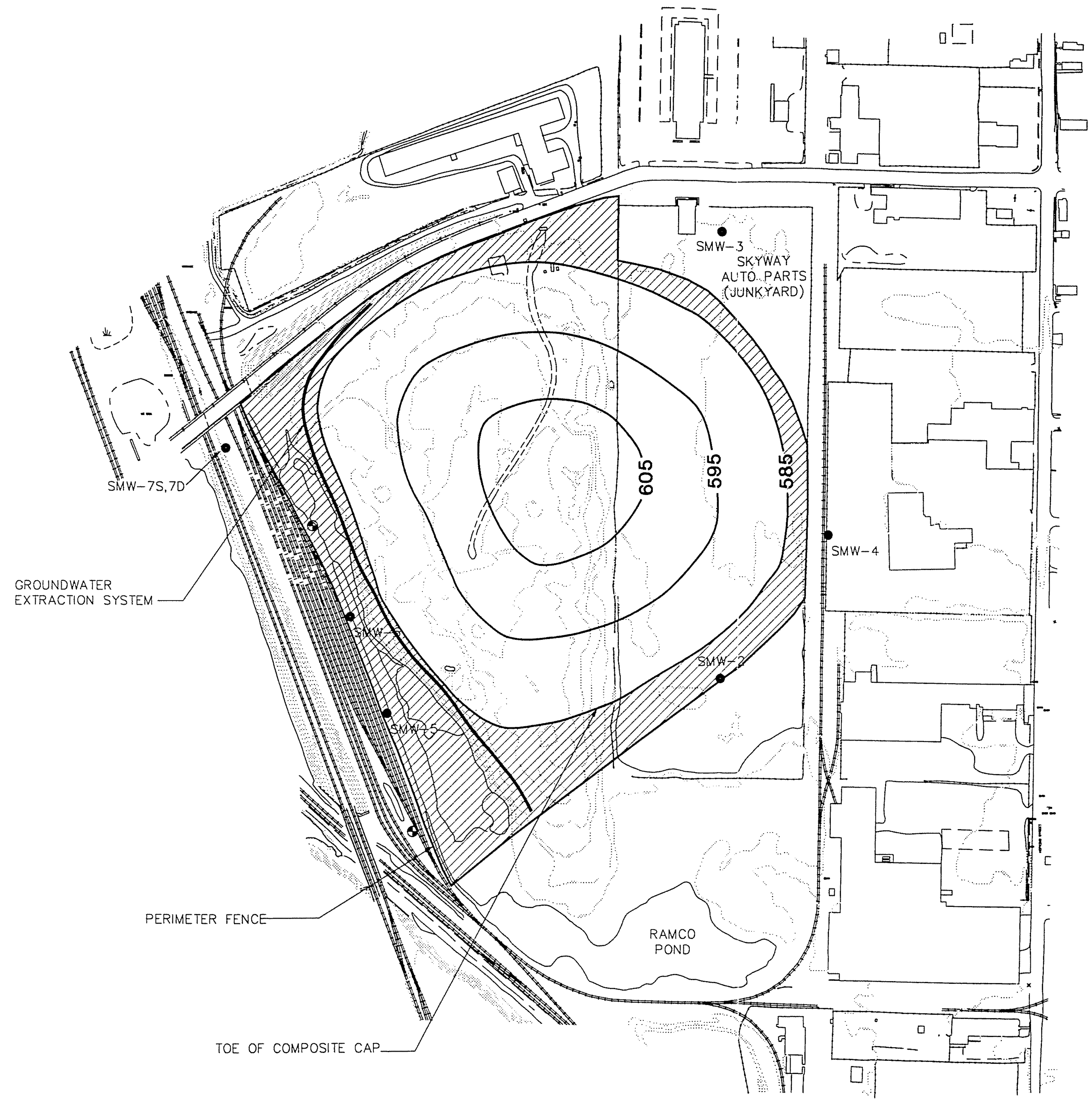
6) Operation, if necessary, of a groundwater treatment system with discharge of treated groundwater to the local POTW.

7) Institutional controls

The Common Components are described in Section 5.3. A Site map showing the remedial components is presented as Figure 5-6. The specific actions and the sequence of work required to implement this alternative are described below.

Excavation of the Soil/Waste Outside Clay Layer. The soil and waste from the southern portion of the facility would be excavated using backhoes, front-end loaders, and other excavation equipment, as described previously in Section 5.7. The excavated material would be consolidated onto the landfill and graded prior to placement of the cap. Following excavation the area would be backfilled with clean fill, regraded to improve drainage, and revegetated.

Excavation of Sediments and Consolidation into Landfill. Removal of the sediments from the ponds would also follow the methods described in Section 5.7. The sediments from both the Western Pond system and the Ramco Pond will be



NOTES:
1. SITE BASE MAP PROVIDED BY AFI ENVIRONMENTAL, INC., LOCKPORT, NY.
2. LOCATIONS OF PROPOSED REMEDIAL ACTIONS ARE APPROXIMATE.
3. FINAL TOPOGRAPHY OF LANDFILL CAP MAY VARY.

LEGEND:

● (proposed well symbol)	PROPOSED MONITORING WELL
SMW-2 ●	EXISTING MONITORING WELL
(dotted line)	EXISTING CONTOUR
(solid line)	PROPOSED FINAL CONTOUR
(hatched area)	AREA FOR ACCESS ROAD, SURFACE WATER COLLECTION CHANNEL(S), AND MISCELLANEOUS STRUCTURES

ALTERNATIVE 3C
FEASIBILITY STUDY, PHASE 3
ALLTIFT LANDFILL SITE
BUFFALO, NY

PREPARED FOR
ALLIED SIGNAL, INC., MORRISTOWN, NJ

ERM-Northeast
ERM

SCALE	FIGURE
1=4000	5-6
DATE 09/94	

removed and dewatered. Additional mixing of this material with on-Site soils removed from other areas may be performed to obtain a more uniform material for ease of consolidation and grading into the landfill.

Installation of the Composite Cap. A synthetic membrane composite cap would be constructed on the Site, as shown on Figure 5-6. The area to be capped for this alternative is approximately 34 acres, encompassing the landfill property underlain by clay and Skyway where soil concentrations exceeded SCGs.

The installation of the cap will follow the methodology previously discussed in Section 5.6.

Installation of Groundwater Extraction System. Groundwater extraction would consist of installing a collection trench containing extraction wells. Upon determination of the need for groundwater control, the wells would be pumped, using submersible extraction pumps, as described in Section 5.7.

Figure 5-6 shows the proposed location of the groundwater extraction system in the estimated downgradient location for the post-closure condition. The system would consist of a trench with strategically placed withdrawal wells, as discussed previously in Section 5.7. Further modifications of this extraction system may result from the pre-design groundwater pumping test and modelling of post-closure conditions.

Operation of a Groundwater Treatment System. Groundwater generated during the implementation of Alternative 3C is not expected to differ greatly from the groundwater generated in Alternative 3B in quantity or characteristics. The groundwater from this alternative would be treated using the same three step treatment system as was described in Section 3.7.

5.8.2 *Assessment*

1) Overall Protection of Human Health and the Environment - This alternative will eliminate or reduce to acceptable limits the risks posed by the on-Site soils outside the clay layer and the sediments by incorporating these materials into the landfill prior to capping. The extension of the cap over Skyway will reduce the risk posed by the waste remaining on this property. The groundwater analytes of concern will be addressed by the groundwater treatment system, if operation of the system is deemed necessary.

2) Compliance with SCGs - Alternative 3C would satisfy SCGs for soil and sediment by providing containment of these media. If groundwater monitoring indicates that post-closure levels of the analytes exceed the performance criteria, the groundwater treatment system will be operated to maintain compliance with these levels.

3) Long-Term Effectiveness and Permanence - The long-term effectiveness for this alternative is directly related to the maintenance of the cap and the access control mechanisms because the analytes of concern remain on-Site. Since the cap for Alternative 3C is extended over Skyway area (i.e., a total of 34 acres of cap compared to the 23 acre cap for Alternative 3B) an additional level of effort will be necessary to maintain the cap, upon which the long-term effectiveness of this remedial action is dependent.

4) Reduction of Toxicity, Mobility, or Volume Through Treatment - There is no reduction in the volume of contamination in the soils and sediments on-Site. The consolidation of the soils from outside the clay layer, the sediments from the pond into the landfill, and the capping of the landfill and Skyway reduces the mobility of the contaminants contained in these media. If groundwater treatment is deemed necessary, based upon groundwater monitoring results, the toxicity, mobility and volume of the analytes in groundwater from the ALS will be further reduced.

5) *Short-Term Effectiveness* - As with the previous alternatives involving excavation and movement of previously landfilled waste, there are short-term health risks posed to the on-Site workers and the surrounding community. The risks will be reduced by use of proper personnel protective equipment and through dust control measures.

Since Skyway waste is not being excavated, the short term risks encountered by workers during the implementation of the remedial action is less than that of Alternative 3D, where Skyway waste will be excavated. Due to the reduced quantity of soil/waste being managed in this alternative, the cap installation should take less than one year, which also reduces the short term risk.

6) *Implementability* - No special technology, materials or labor would be required to complete the work proposed under this alternative. The purchase of Skyway will require negotiation with a third party.

7) *Costs* - The present worth cost of Alternative 3C is presented on Table 5-1. The annual O&M costs for this alternative are also mainly for fence and cap maintenance, monitoring well sampling and analysis. If groundwater monitoring results show that the extraction and treatment of the groundwater is necessary, the yearly O&M costs increase substantially based upon operation of the system and POTW discharge costs.

5.9 ALTERNATIVE 3D - CONSOLIDATE SOIL AND SEDIMENT AND SKYWAY SOIL/CAP LANDFILL

5.9.1 Description

This alternative consists of the following components:

1) Excavation of the soil/waste materials which are not currently underlain by the clay layer. Consolidation of this material into the landfill.

2) Excavation and dewatering of the sediment from the ponds. Consolidation of this material into the landfill.

3) Temporary relocation of Skyway.

4) Excavation of the soil/waste beneath Skyway that can be attributed to former Alltift Landfill activities. Consolidation of this material into the landfill.

5) Capping of the landfill with a synthetic membrane composite cap.

6) Installation of a groundwater extraction system utilizing a collection trench with extraction wells.

7) Operation, if necessary, of a groundwater treatment system with discharge of treated groundwater to the local POTW.

8) Institutional controls.

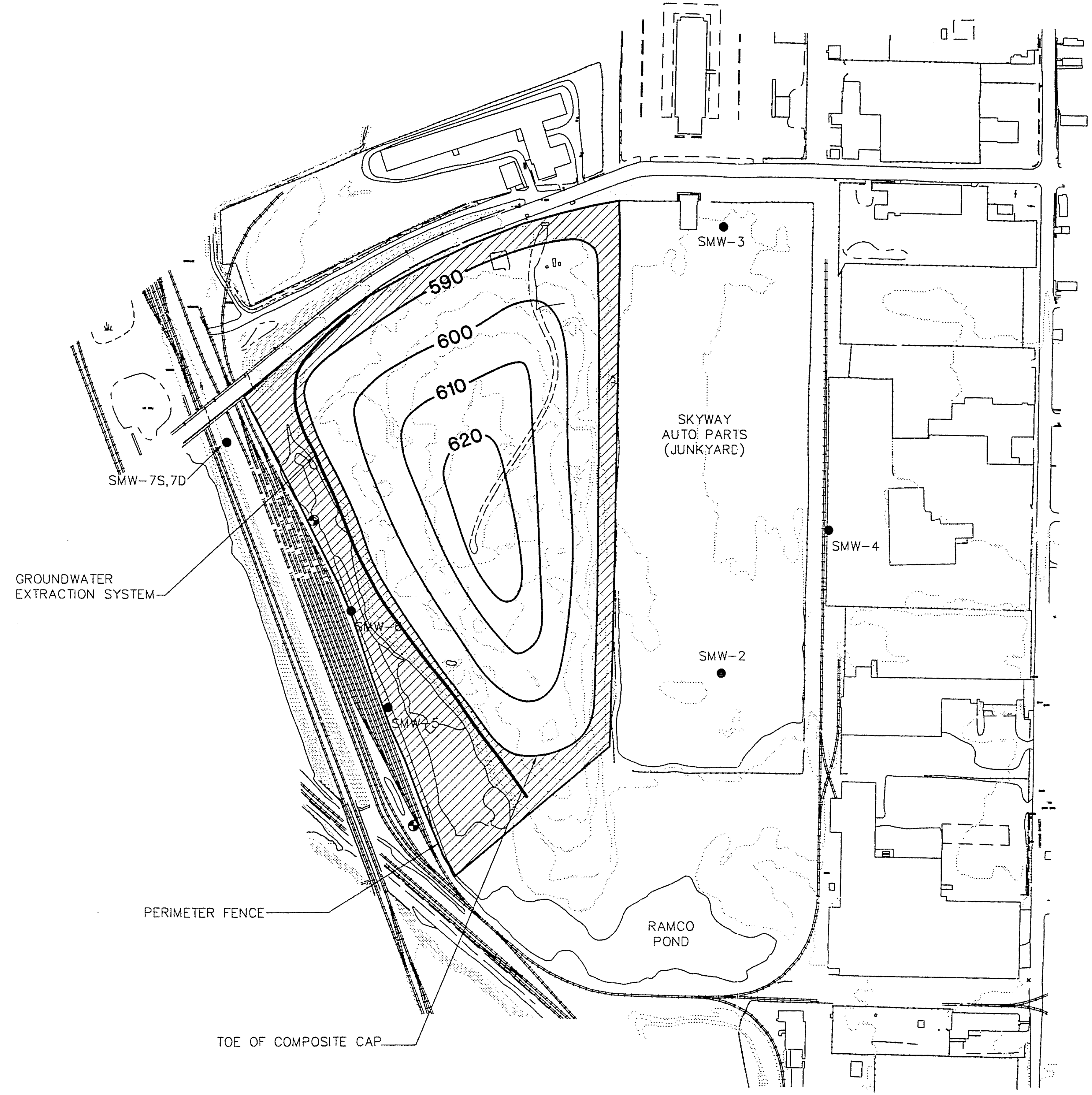
The Common Components are described in Section 5.3. A Site map showing the remedial components is presented as Figure 5-7. The specific actions and the sequence of work required to implement this alternative are described below.

Excavation of the Soil/Waste Outside Clay Layer. The soil and waste from the southern portion of the Site would be excavated using backhoes, front-end loaders, and other excavation equipment, as described previously in Section 5.7. The excavated material would be consolidated onto the landfill and graded prior to placement of the cap. Following excavation, the disturbed area would be backfilled with clean fill, regraded to improve drainage, and revegetated.

Excavation of Sediments and Consolidation into Landfill. Removal of the sediments from the ponds would also follow the methods described in Section 5.7. The sediments from both the Western Pond system and the Ramco Pond will be removed using a backhoe or similar excavation equipment. The sediments will be dewatered and mixed with soils removed from other areas to obtain a more uniform material to consolidate into the landfill.

Temporary Relocation of Skyway. An arrangement would be made with the owner of Skyway to temporarily relocate the business. This relocation would involve movement of the vehicles in the central portion of Skyway to a temporary off-Site location or to a staging area on-Site.

Excavation of Soil in Skyway. The cover soil from approximately surface level to 4 feet below grade will be excavated and staged as clean fill on-Site. The soil/waste from approximately 4 to 10 feet would be excavated, dewatered and placed on the landfill. The limits of the excavation both vertically and laterally were delineated during the RI by a test pitting program and comparison of the analyte concentrations with SCGs. Prior to backfilling, the open excavation will



NOTES:
1. SITE BASE MAP PROVIDED BY AFI ENVIRONMENTAL, INC., LOCKPORT, NY.
2. LOCATIONS OF PROPOSED REMEDIAL ACTIONS ARE APPROXIMATE.
3. FINAL TOPOGRAPHY OF LANDFILL CAP MAY VARY.

LEGEND:

- PROPOSED MONITORING WELL
- SMW-2 — EXISTING MONITORING WELL
- EXISTING CONTOUR
- PROPOSED FINAL CONTOUR
- AREA FOR ACCESS ROAD, SURFACE WATER COLLECTION CHANNEL(S), AND MISCELLANEOUS STRUCTURES

ALTERNATIVE 3D
FEASIBILITY STUDY, PHASE 3
ALLTIFT LANDFILL SITE
BUFFALO, NY

PREPARED FOR
ALLIED SIGNAL, INC., MORRISTOWN, NJ

ERM-Northeast

SCALE	FIGURE
1=4000	5-7
DATE 09/94	

be sampled and tested to confirm that all soil/waste above SCGs that are a direct result of former Alltift Landfill disposal activities is removed.

Installation of the Composite Cap. A synthetic membrane composite cap would be constructed on the Site, as shown on Figure 5-7. The area to be capped for this alternative is approximately 23 acres, encompassing the landfill property underlain by clay and incorporating the additional volume of soil removed from the southern portion of the landfill, the ponds and Skyway. The installation of the cap will follow the methodology previously discussed in Section 5.6.

Installation of Groundwater Extraction System. Groundwater extraction would consist of installing a collection trench containing extraction wells . Upon determination of the need for groundwater treatment, the wells would be activated as described in Section 5.7.

Figure 5-7 shows the proposed location of the groundwater extraction system. The rationale for the well and trench placement is discussed in Section 5.7. Further modifications of this extraction system may result from the pre-design groundwater pumping test and model.

5.9.2 *Assessment*

1) Overall Protection of Human Health and the Environment - This alternative satisfies protection of human health and the environment through total containment of all media exceeding SCGs.

2) Compliance with SCGs - The SCGs are all met for this alternative by the consolidation of external media of concern into the landfill and the placement of a composite cap over the landfill.

3) Long-Term Effectiveness and Permanence - Long term effectiveness and permanence is measured by the magnitude of the residual risk and the reliability of controls. Implementation of this alternative would eliminate the potential unacceptable risks for exposure to soil, waste materials and sediments. Site related chemicals would remain on-Site after this alternative is implemented, although the risks of migration of the soil or sediment would be significantly reduced by the installation of the cap. The ability of this alternative to continue to protect against these risks is dependent on the effectiveness of the cover maintenance. Since all of the waste materials of concern have been consolidated into one area prior to capping, the level of effort for this alternative will be reduced compared to the larger caps.

4) Reduction of Toxicity, Mobility, or Volume Through Treatment - This alternative has reduced the mobility of the on-Site contamination through containment. If activated, the groundwater treatment system reduces the toxicity, mobility and volume of the analytes in groundwater.

5) Short-Term Effectiveness - This alternative requires the excavation and consolidation of three areas: the soil/waste outside the clay layer, the sediments from the ponds and Skyway soil/waste. As a result, outside of Alternative 4 where all soils exceeding the SCGs are excavated, this alternative contains the highest short term risks to worker health and the surrounding community. As discussed previously, these risks will be controlled by the use of proper protective equipment and monitoring equipment.

6) Implementability - No special technology, materials or labor would be required to complete the work proposed under this alternative. The temporary relocation of Skyway would require third party cooperation.

7) Costs - The present worth cost of Alternative 3D is presented on Table 5-1. The annual O&M costs for this alternative are mainly for fence and cap maintenance and monitoring well sampling and analysis. If groundwater monitoring results show that extraction and treatment of groundwater is necessary, the yearly O&M costs increase substantially based upon operation of the system and POTW discharge costs.

5.10 ALTERNATIVE 3E - CONSOLIDATE SOIL AND SEDIMENT/CAP LANDFILL/INSTALL CUT-OFF WALL

5.10.1 Description

Alternative 3E is very similar to Alternative 3B, with the addition of a cut-off wall surrounding the capped landfill. This alternative consists of the following components:

1) Excavation of the soil/subsurface materials which are not currently underlain by the clay layer. Consolidation of this material into the landfill.

2) Excavation and dewatering of the sediment from the ponds. Consolidation of this material into the landfill.

3) Installation of a cut-off wall and groundwater collection trench completely surrounding the landfill.

4) Capping of the landfill with a synthetic membrane composite cap.

5) Treatment of the groundwater collected in the trench.

6) Institutional controls

The Common Components are described in Section 5.3. A Site map showing the remedial components is presented as Figure 5-8. The specific actions and the sequence of work required to implement this alternative are described below.

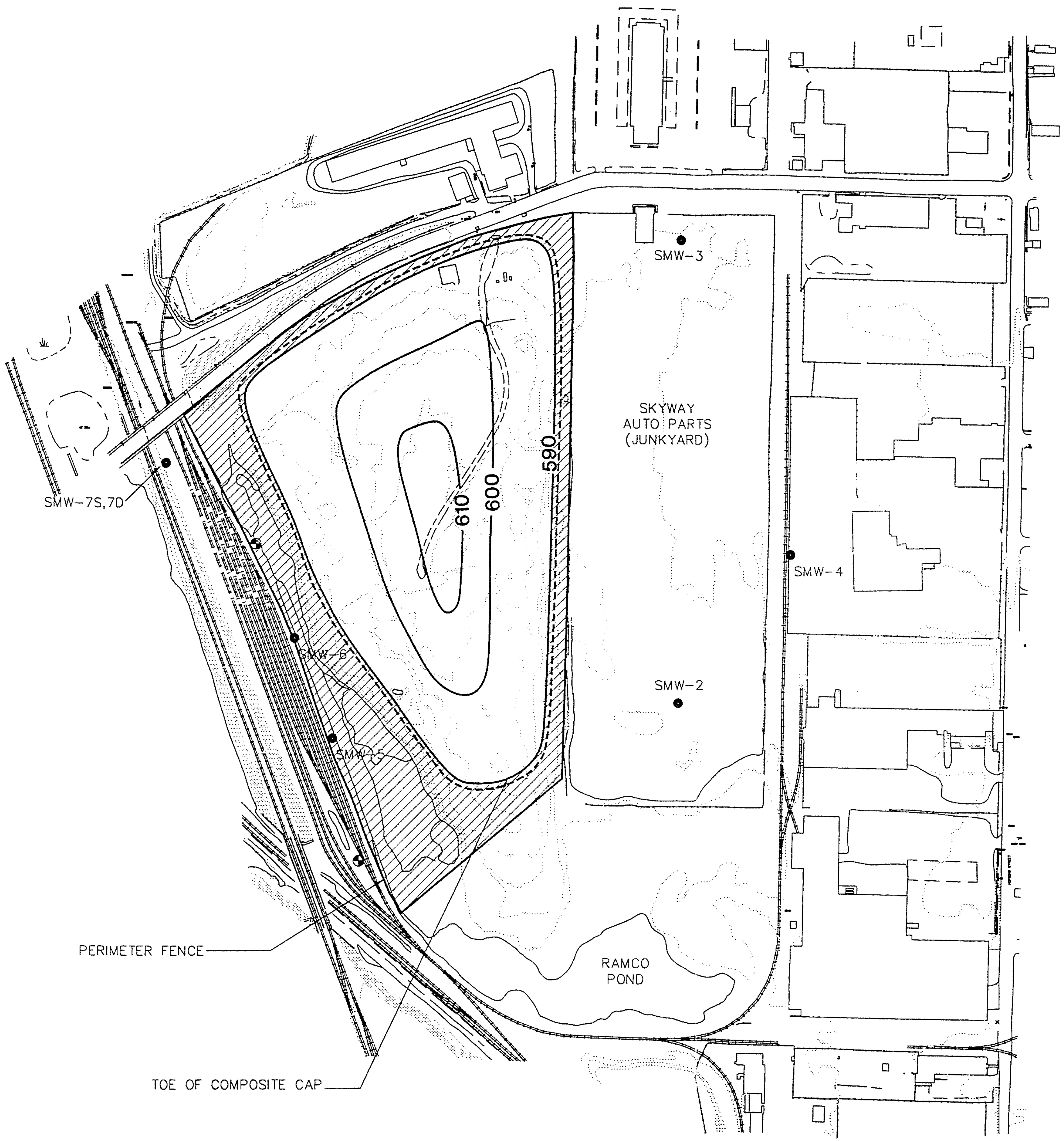
The initial steps of waste excavation and consolidation will follow Alternative 3B. The only variations from this alternative are as follows:

Installation of a Cut-Off Wall and Groundwater Collection Trench. Upon completion of the grading of the landfill, a soil-bentonite cut-off wall will be installed surrounding the toe of the landfill. Immediately adjacent to this cut-off wall, on the interior side, a groundwater collection trench will be installed, consisting of coarse stone placed inside a geotextile lined trench. This trench will be equipped with groundwater extraction wells which will be activated as necessary to maintain an inward hydraulic gradient on all sides of the landfill cell.

The flexible membrane liner will be placed over both the groundwater collection trench and the cut-off wall, as shown in Figure 5-9. This will reduce infiltration of surface water into the groundwater collection system.

5.10.2 Assessment

1) Overall Protection of Human Health and the Environment - Alternative 3E satisfies the requirements of being protective of human health and the environment. The placement of a cap over the consolidated soil/waste limits the access to this material and reduces potential contaminant migration. The placement of a cut-off wall with a groundwater collection system surrounding the capped landfill greatly restricts the potential migration of the contaminated groundwater to outside the landfill.



NOTES:
1. SITE BASE MAP PROVIDED BY AFI ENVIRONMENTAL, INC., LOCKPORT, NY.
2. LOCATIONS OF PROPOSED REMEDIAL ACTIONS ARE APPROXIMATE.
3. FINAL TOPOGRAPHY OF LANDFILL CAP MAY VARY.

LEGEND:

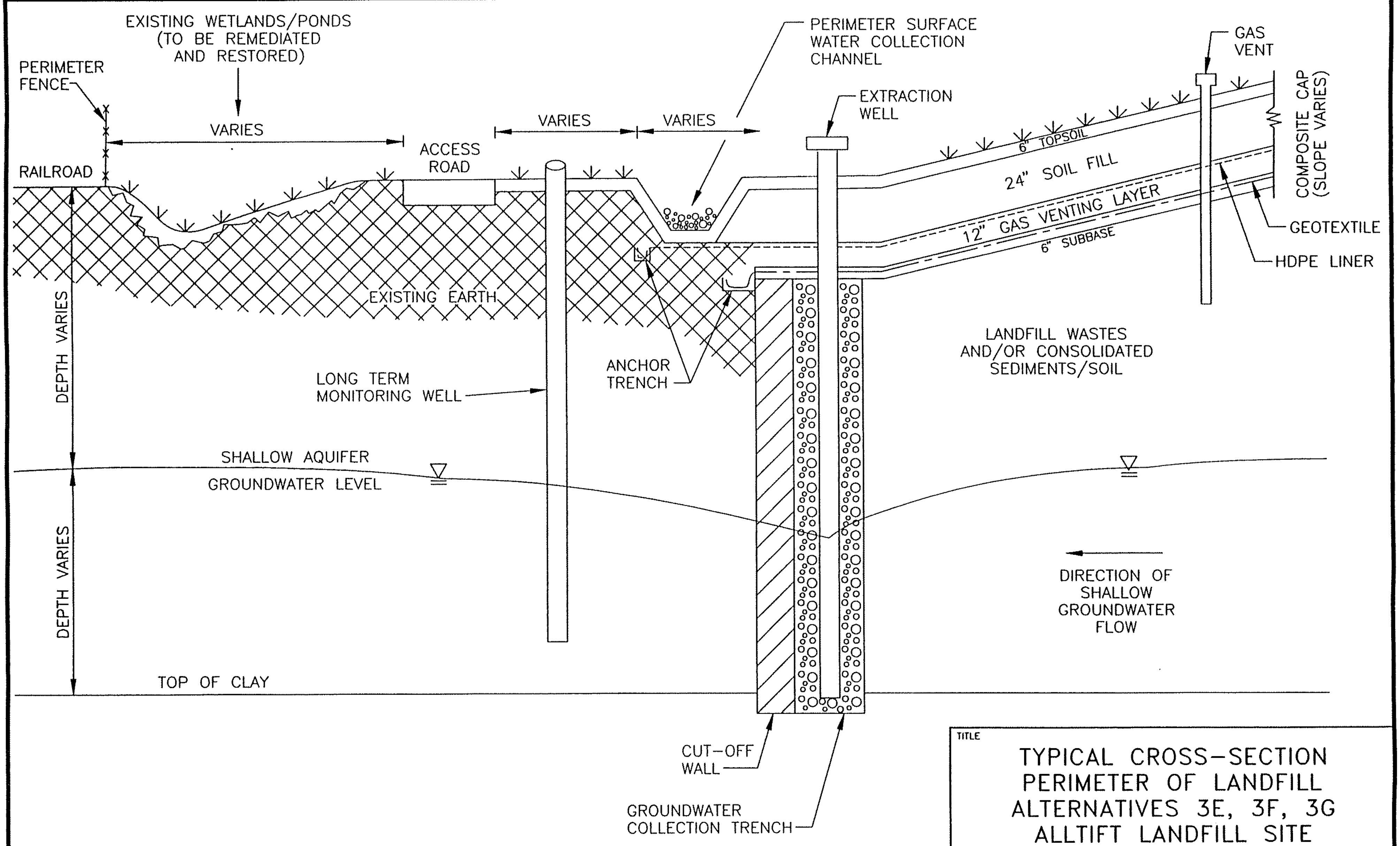
- PROPOSED MONITORING WELL
- SMW-2 EXISTING MONITORING WELL
- EXISTING CONTOUR
- PROPOSED FINAL CONTOUR
- CUT-OFF WALL AND GROUND WATER COLLECTION TRENCH
- AREA FOR ACCESS ROAD, SURFACE WATER COLLECTION CHANNEL(S), AND MISCELLANEOUS STRUCTURES

ALTERNATIVE 3E
FEASIBILITY STUDY, PHASE 3
ALLTIFT LANDFILL SITE
BUFFALO, NY

PREPARED FOR
ALLIED SIGNAL, INC., MORRISTOWN, NJ

ERM-Northeast
ERM

SCALE	FIGURE
1=4000	5-8
DATE 09/94	



TITLE

TYPICAL CROSS-SECTION
PERIMETER OF LANDFILL
ALTERNATIVES 3E, 3F, 3G
ALLTIFT LANDFILL SITE

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ERM ERM-Northeast
Environmental Resources Management

SCALE	FIGURE
NONE	5-9

DRAWN:	JOB NO.:	FILE NAME:	DATE
E.M.F.	409.005.3	CRSS-SEC	9/7/94

2) Compliance with SCGs - This alternative satisfies almost all of the SCGs by containing the soil from outside the clay layer and the sediments from the ponds. Although Skyway soils will not be capped, these soils are currently under four feet of clean fill material. Groundwater coming into contact with on-Site waste will be collected and treated. The only component of groundwater not being collected and treated will be the groundwater which comes into contact with Skyway soils. This condition is not expected to cause exceedances of groundwater SCGs.

3) Long-Term Effectiveness and Permanence - The long-term effectiveness of this alternative will be dependent on the maintenance of the cap and cut-off wall system. Since the areal extent of the cap is reduced, the level of effort in maintaining the cap will be less than in Alternative 3F. The long-term maintenance of the cut-off wall is also dependent on proper operation of the groundwater extraction system. If the groundwater levels interior and exterior of the cut-off wall are not maintained at a slightly inward gradient, uneven fores will be exerted on the wall, causing potential failure of the wall.

4) Reduction of Toxicity, Mobility, or Volume Through Treatment - Alternative 3E reduces the mobility of soil from outside the clay layer and from the sediments, by consolidating this material into the landfill and then capping the landfill. The installation of a cut-off wall around the capped landfill will then allow collection of groundwater which comes into contact with the consolidated soil/waste. Groundwater treatment will reduce the toxicity, mobility and volume of the analytes in groundwater.

5) Short-Term Effectiveness - The short term effects of this alternative are limited since the soil/waste from Skyway is not being uncovered and excavated for consolidation into the landfill.

6) Implementability - No special technology, materials or labor would be required to complete the work proposed under this alternative.

7) Costs - The present worth cost of Alternative 3E is presented on Table 5-1. The annual O&M costs for this alternative include the institutional costs and operational costs for the extraction and treatment of the groundwater. Groundwater treatment costs are lower under Alternatives 3E through 3G because the cut-off wall limits groundwater flow within the landfill cell.

5.11 ALTERNATIVE 3F - CONSOLIDATE SOIL AND SEDIMENT/CAP LANDFILL AND SKYWAY/INSTALL CUT-OFF WALL

5.11.1 Description

The remedial activities conducted under Alternative 3F are similar to those conducted under Alternative 3C, with the addition of a cut-off wall and interior groundwater collection trench surrounding the landfill. This alternative consists of the following components:

1) Excavation of the soil/subsurface materials which are not currently underlain by the clay layer. Consolidation of this material into the landfill.

2) Excavation and dewatering of the sediment from the ponds. Consolidation of this material into the landfill.

3) Installation of a cut-off wall and groundwater extraction system completely surrounding the landfill.

4) Capping of the landfill and the adjacent Skyway with a synthetic membrane composite cap.

5) Treatment of the groundwater collected in the trench.

6) Institutional controls

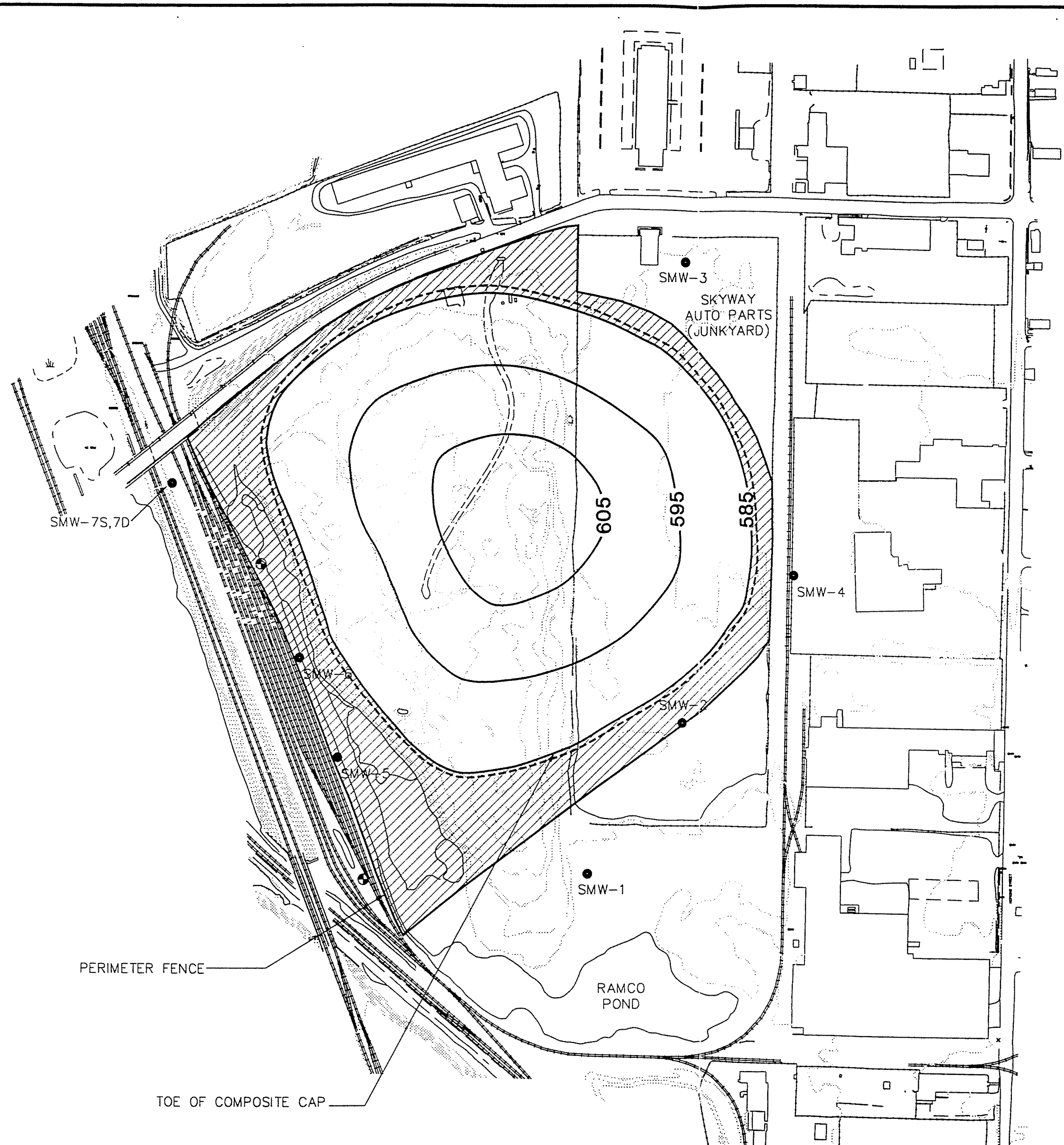
The Common Components are described in Section 5.3. A Site map showing the remedial components is presented as Figure 5-10. The specific actions and the sequence of work required to implement this alternative are described below.

The details of implementation of Alternative 5F would follow the implementation of 5C, as discussed in Section 5.8. The only alteration to this implementation is as follows:

<u>Installation of a Cut-Off Wall and Groundwater Collection Trench.</u> The soils from the southern portion of the ALS and the sediment from the pond will be graded into the landfill over Skyway to create a sufficient cap surface gradient. Upon completion of final grading, a soil-bentonite cut-off wall will be installed surrounding the toe of the landfill and extending around Skyway portion of the landfill. This system will also include installation of the groundwater extraction system, as discussed previously in Section 5.10.

5.11.2 Assessment

1) Overall Protection of Human Health and the Environment - Alternative 3F exceeds the requirements for protection of human health and the environment because it almost eliminates all potential expensive pathways. The perimeter groundwater control system minimizes potential off-Site groundwater impacts because all sources are contained and controlled.



NOTES:

1. SITE BASE MAP PROVIDED BY AFI ENVIRONMENTAL, INC., LOCKPORT, NY.
2. LOCATIONS OF PROPOSED REMEDIAL ACTIONS ARE APPROXIMATE.
3. FINAL TOPOGRAPHY OF LANDFILL CAP MAY VARY.

LEGEND:

- PROPOSED MONITORING WELL
- SMW-2 EXISTING MONITORING WELL
- EXISTING CONTOUR
- PROPOSED FINAL CONTOUR
- CUT-OFF WALL
- AREA FOR ACCESS ROAD, SURFACE WATER COLLECTION CHANNEL(S), AND MISCELLANEOUS STRUCTURES

ALTERNATIVE 3F
FEASIBILITY STUDY, PHASE 3
ALLTIFT LANDFILL SITE
BUFFALO, NY

PREPARED FOR

ALLIED SIGNAL, INC., MORRISTOWN, NJ

ERM-Northeast

SCALE 1=4000 | DATE 09/94 | FIGURE 5-10

2) *Compliance with SCGs* - This alternative meets all of the SCGs by containing all soil, sediment and groundwater with analyte concentrations in excess of the SCGs.

3) *Long-Term Effectiveness and Permanence* - The long-term effectiveness of this alternative is dependent upon proper maintenance of the cap, which extends over 34 acres. The surrounding cut-off wall is also more extensive in Alternative 3F because of the large size of the capped area capped. The entire system consists of 88,500 square feet of cut-off wall compared to the 76,000 square feet of cut-off wall for Alternative 3E.

4) *Reduction of Toxicity, Mobility, or Volume Through Treatment* - Alternatives 3F and 3G provide a greater reduction in the toxicity and the mobility of the contamination at the ALS by containing potentially contaminated groundwater within the landfill cell.

5) *Short-Term Effectiveness* - Alternative 3F requires excavation of the same quantity of soil/waste as Alternatives 3B, 3C, and 3E. The main short term concern is the exposure which occurs during the excavation and movement of this material.

6) *Implementability* - This alternative includes obtaining longterm access to Skyway, requiring negotiation with a third party, and deed restrictions. Other than these previously discussed concerns, there are no specific implementability problems for Alternative 3F.

7) *Costs* - The present worth cost of Alternative 3F is presented on Table 5-1. The annual O&M costs for this alternative include the operational costs for the extraction and treatment of the groundwater.

5.12 *ALTERNATIVE 3G - CONSOLIDATE SOIL AND SEDIMENT AND SKYWAY SOIL/CAP LANDFILL/INSTALL CUT-OFF WALL*

5.12.1 *Description*

The remedial activities included under Alternative 3G are similar to those under Alternative 3D, with the addition of a cut-off wall and interior groundwater collection trench surrounding the landfill. This alternative consists of the following components:

1) Excavation of the soil/subsurface materials which are not currently underlain by the clay layer. Consolidation of this material into the landfill.

2) Excavation and dewatering of the pond sediment. Consolidation of this material into the landfill.

3) Temporary relocation of Skyway.

4) Excavation of the soil/waste in Skyway. Consolidation of this material into the landfill.

5) Installation of a cut-off wall and groundwater extraction system completely surrounding the landfill.

6) Capping of the landfill with a flexible membrane composite cap.

7) Treatment of the groundwater collected in the trench.

8) Institutional controls

The Common Components are described in Section 5.3. A Site map showing the remedial components is presented as Figure 5-11. The specific actions and the sequence of work required to implement this alternative are described below.

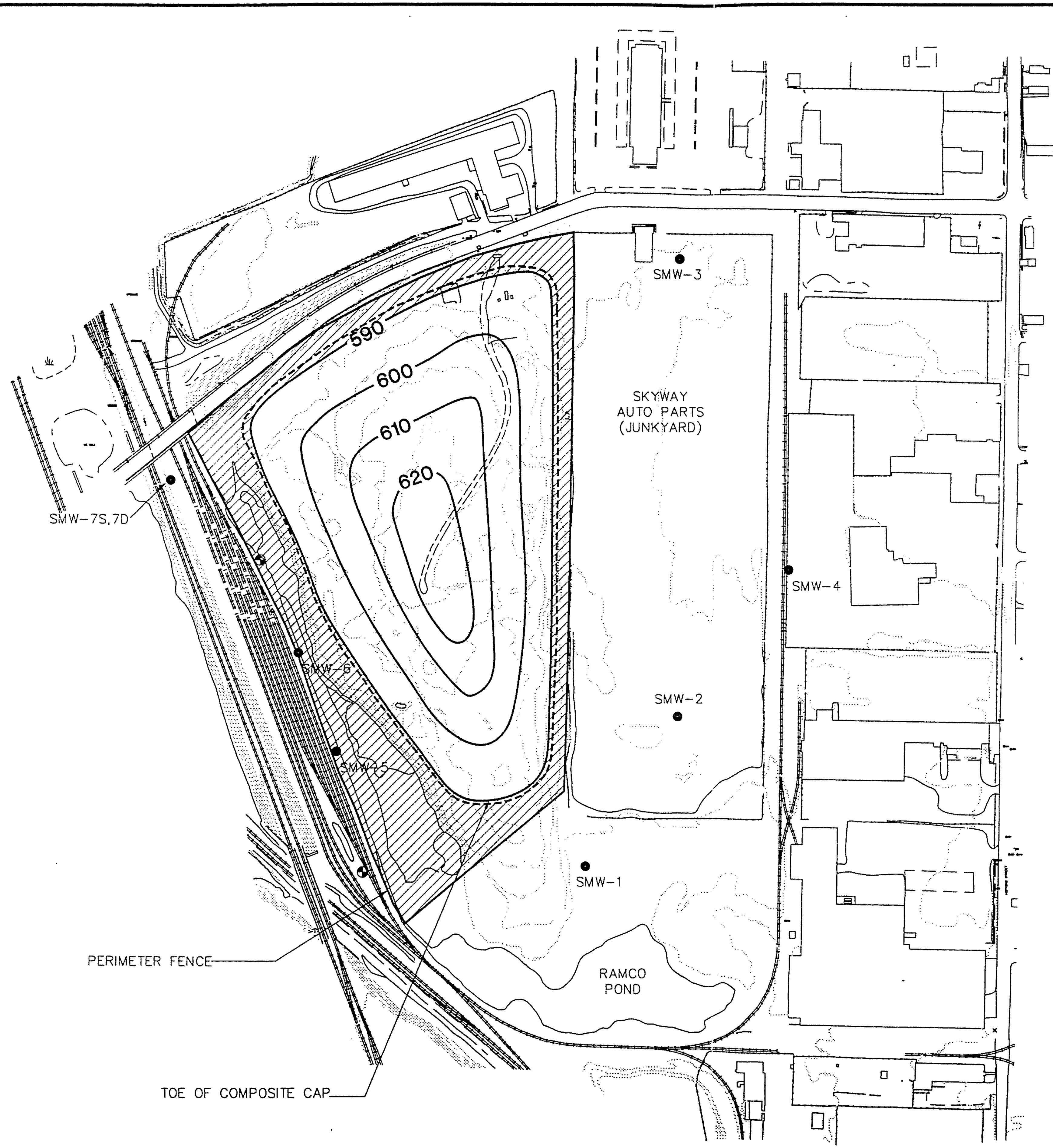
5.12.2 Assessment

1) Overall Protection of Human Health and the Environment - Alternative 3G exceeds the requirements of being protective of human health and the environment by consolidating all of the soil/waste and sediments onto the landfill and capping the landfill. This landfill will then be completely surrounded by a cut-off wall which will contain the groundwater.

2) Compliance with SCGs - All of the SCGs are satisfied by this alternative. Contaminated soil/waste, sediment and groundwater are contained.

3) Long-Term Effectiveness and Permanence - The landfill established as a result of Alternative 3G is 23 acres, surrounded by a cut-off wall estimated to be 76,000 square-feet. The relatively small area of the containment cell makes this alternative easier to maintain than Alternative 3F. As discussed previously, proper maintenance of the containment system is essential for the continued effectiveness of a containment alternative.

4) Reduction of Toxicity, Mobility, or Volume Through Treatment - Alternative 3G reduces the mobility of contaminants in the soil, sediment and groundwater through capping and cut-off wall containment. The toxicity mobility and volume of the groundwater would be reduced by the treatment of the collected water in the on-Site system.



NOTES:
1. SITE BASE MAP PROVIDED BY AFI ENVIRONMENTAL, INC., LOCKPORT, NY.
2. LOCATIONS OF PROPOSED REMEDIAL ACTIONS ARE APPROXIMATE.
3. FINAL TOPOGRAPHY OF LANDFILL CAP MAY VARY.

LEGEND:

- PROPOSED MONITORING WELL
- SMW-2 EXISTING MONITORING WELL
- EXISTING CONTOUR
- PROPOSED FINAL CONTOUR
- CUT-OFF WALL
- AREA FOR ACCESS ROAD, SURFACE WATER COLLECTION CHANNEL(S), AND MISCELLANEOUS STRUCTURES

ALTERNATIVE 3G
FEASIBILITY STUDY, PHASE 3
ALLTIFT LANDFILL SITE
BUFFALO, NY

PREPARED FOR
ALLIED SIGNAL, INC., MORRISTOWN, NJ

ERM-Northeast
ERM

SCALE	FIGURE
1=4000	5-11
DATE 09/94	

5) Short-Term Effectiveness - The short-term problems encountered in the implementation of Alternative 3G result from the large quantity of soil/waste which would need to be excavated and consolidated into the landfill. This larger quantity of soil increases the time during which soil and waste are exposed to the elements and increases the potential for materials to become airborne or to affect worker health and safety. Proper techniques will be used to limit these effects.

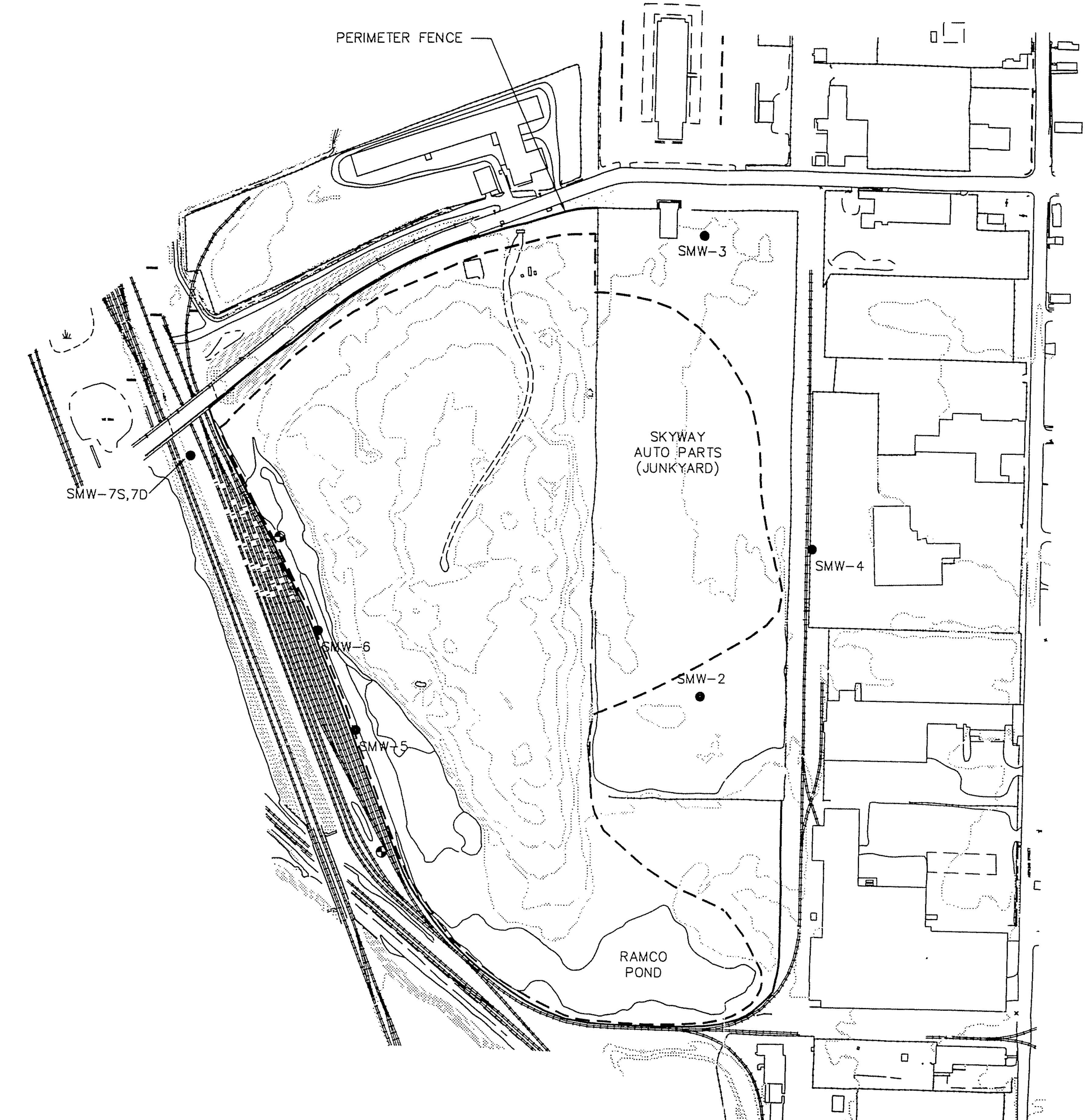
6) Implementability - The implementability of this alternative is dependent upon negotiations necessary for the temporary relocation of Skyway. However, once this relocation and the excavation of the material has been completed, Skyway does not need to be included in the deed restrictions. There are no new technologies or excessive unknown factors involved in the implementation of this alternative.

7) Costs - The present worth cost of Alternative 3G is presented on Table 5-1. These costs are detailed further in Appendix B and Appendix C.

5.13 ALTERNATIVE 4 - OFF-SITE DISPOSAL

5.13.1 Description

This alternative consists of excavation of all materials which exceed the soil SCGs established in the RI and transportation of this material to an off-Site disposal facility. The Common Components are described in Section 5.3. A Site map showing the remedial components is presented as Figure 5-12. The specifications and the sequence of work required to implement this alternative is described below.



NOTES:
1. SITE BASE MAP PROVIDED BY AFI ENVIRONMENTAL, INC., LOCKPORT, NY.
2. LOCATIONS OF PROPOSED REMEDIAL ACTIONS ARE APPROXIMATE.

LEGEND:

(half-filled circle)	PROPOSED MONITORING WELL
SMW-2 ●	EXISTING MONITORING WELL
....	EXISTING CONTOUR
— — — —	APPROXIMATE EXTENT OF CONTAMINATED SOIL/SEDIMENT FOR OFF-SITE DISPOSAL

ALTERNATIVE 4
FEASIBILITY STUDY, PHASE 3
ALLTIFT LANDFILL SITE
BUFFALO, NY

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SCALE 1"=4000 | FIGURE 5-12 | DATE 09/94

Excavation and Transportation Off-Site for Disposal. All soils and waste materials which exceed the SCGs would be removed using backhoes and similar earth moving equipment. This material includes the following approximate quantities:

Soil/Waste Outside the Clay Layer	14,500 cubic yards
Soil/Waste Over the Clay Layer	97,000 cubic yards
Sediment from On-Site Ponds	15,500 cubic yards
Soil/Waste from Skyway	73,000 cubic yards
QUANTITY OF SOIL TO BE EXCAVATED	200,000 cubic yards

This soil would be loaded into roll-offs or dump trucks and transported to a local industrial landfill (i.e., no soil exceeding TCLP levels is anticipated at the Site). Additional waste characterization testing and landfill approvals would be needed prior to disposal. The excavated areas would be backfilled and restored.

5.13.2 Assessment

1) Overall Protection of Human Health and the Environment - This alternative would protect human health and the environment by removing all of the soil/waste and sediment exceeding the SCGs from the Site. Since the source of the contamination is removed and since only the shallow groundwater has been found to be of concern, no groundwater remediation would be needed.

2) Compliance with SCGs - The elimination of contamination from the site and from contact with the groundwater results in meeting all of the SCGs on a long-term basis.

3) *Long-Term Effectiveness and Permanence* - This alternative is the most permanent since all soil/waste and sediment will be removed from the Site and replaced with clean fill material.

4) *Reduction of Toxicity, Mobility, or Volume Through Treatment* - Since the soil/waste and sediment will be removed from the Site, the toxicity, mobility and volume of the material on the Site will be eliminated.

5) *Short-Term Effectiveness* - Alternative 4 still contains activities which have short-term concerns for worker exposure and the surrounding community. This alternative has the lowest short-term effectiveness because this is the only alternative where all of the soil on-Site is being excavated and moved.

6) *Implementability* - Although this alternative is implementable, the obtaining of landfill space and the scheduling of transportation vehicles add difficulties to the coordination of this alternative.

7) *Costs* - The present worth cost of Alternative 3G is presented on Table 5-1. These costs are detailed further in Appendix B and Appendix C.

5.14 IDENTIFICATION OF THE RECOMMENDED ALTERNATIVE

Based upon the above evaluation of the seven performance criteria focused upon for each of the ten comprehensive remedial alternatives, Alternative 3B (Consolidation of Soil and Sediment/Cap Landfill) is recommended for this Site for the following reasons:

1) This alternative satisfies the requirements for protection of human health and the environment, as well as satisfying almost all the SCGs for soil, sediment and groundwater. Based upon the RI, Skyway soil/waste in

excess of SCGs is not significantly impacting groundwater and is isolated from potential exposure pathways.

2) The quantity of soil and sediment being disrupted as a result of the remedial actions is minimal, thereby limiting the effects of the remediation upon worker health and the surrounding community.

3) Alternative 3B greatly reduces scheduling delays associated with obtaining longterm access to Skyway. Alternatives 3C, 3D, 3F and 3G all include some Skyway activities and negotiations with a third party. These negotiations could significantly delay implementation of remedial actions.

4) The area to be capped was minimized by the consolidation of the soil and waste materials into the landfill above the clay layer. The smaller cap decreases the level of long-term maintenance required to preserve the integrity of the remedial system.

5) The costs of implementing Alternatives 3C through 3G were greater than the costs for implementing Alternative 3B. However, the added benefit of Alternatives 3C through 3G is marginal and does not justify the additional costs.

In summary, Alternative 3B satisfies all of the remedial action objectives in a very cost-effective manner in comparison with the other alternatives evaluated in the Detailed Analysis Phase. All media requiring remediation that were identified in the RI are addressed. All exposure and migration pathways are eliminated or controlled. The subsequent section discusses the details and sequence of remediation for Alternative 3B.

Section 6

Section 6

6.0 CONCEPTUAL DESIGN OF RECOMMENDED REMEDIAL ACTION

6.1 INTRODUCTION

This section provides a discussion of the recommended remedial action that was identified through the Detailed Analysis of Alternatives (Section 5.0). Although some details regarding the proposed action are provided, further sampling and studies (i.e., Pre-Design Investigation) will be necessary prior to the final engineering design and preparation of construction drawings. Additionally, the selected alternative will undergo further modifications and refinement as more data are collected.

Section 6.2 describes the various tasks included in the recommended alternative. These tasks are presented in the approximate chronological order in which they will be implemented. Section 6.3 includes a sensitivity analysis for the recommended remedial alternative.

6.2 DESCRIPTION OF RECOMMENDED ACTION

Task 1: Pre-Design Investigation

The initial task of the implementation of the recommended alternative will be a Pre-Design Investigation (PDI). The PDI may include the following components:

Pump Test - A pump test is needed to evaluate additional hydrogeologic parameters and the concentration of the analytes from the groundwater extraction system, if necessary.

Groundwater Model - The pump test information will be used to simulate projected groundwater flow conditions for the post-closure condition. Additionally, the model will be used to identify the optimum groundwater collection system relative to its position, configuration (i.e., collection trench or slurry wall/collection trench combination) and extraction volume. The pump test and groundwater model will also be used to evaluate the wetland hydrology in the post-closure condition. Although it appears that, if activated, the pumping rate of the groundwater extraction system will not impact the wetlands hydrology, this assumption will be confirmed through the groundwater model.

Perimeter Borings - Additional perimeter borings along the west and north sides of the landfill may be needed to identify the depth to clay in some areas and the location of valleys in the top of clay that may be ideal locations for groundwater extraction wells.

Sediment Delineation - The lateral extent of sediment with concentrations of analytes above the cleanup criteria may require further evaluation in the marshy areas near the ponds west of the landfill, and a determination of the source of any such contaminants (i.e., railroad).

Data needs, in addition to those discussed above, may be identified during the initial remedial design phase.

Task 2: Pilot Studies

To limit the response time for design and installation of the contingency on-Site groundwater pre-treatment system, on-Site Pilot Studies may be conducted to refine the projected groundwater flow volumes and treatment processes. Additionally, the capacity and efficiency of the POTW will be assessed and the afore-mentioned FATE model will be used to evaluate the fate of the on-site contaminants if discharged to the POTW.

Task 3: Remedial Design

The information collected during Tasks 1 and 2 will be used in the preparation of the remedial design documents. These documents will include the work plans, detailed construction drawings, specifications and schedules that will guide the remedial process. Additionally, bids will be received from qualified contractors for the various phases of the project to refine budget estimates and identify the remedial contractors that will perform the work.

Based on the results of the pump test and groundwater model, the groundwater control system design may be expanded to include perimeter groundwater containment and extraction, similar to Alternative 3E. The basis for expansion of the groundwater control system will be whether the groundwater control system proposed under Alternative 3B can adequately control potential longterm migration of the analytes of concern. If pump test and model data indicate that there will be radial flow components away from the cap in the post-closure condition, then it may be more cost-effective to provide a perimeter cut-off wall and groundwater extraction system.

Task 4: Site Preparation

Site preparation will be required prior to initiation of the remediation. Initially, a field trailer will be set-up on-site to provide a communications center where personnel and contractors can maintain contact with their home office, where copies of daily documents can be made and filed and where workers can shower/change prior to leaving the project site. It is currently anticipated that the northern end of the site (i.e., near Tift Street) will be designated for construction of temporary structures. These structures will include a decontamination pad and equipment storage shelter.

Site preparation activities will also include obtaining the necessary permits to implement the remedial action. For example, a wetlands permit will be needed for dredging the ponds.

Task 5: Clearing/Grubbing and Regrading

The landfill and its perimeter areas will be cleared and grubbed as necessary to facilitate remedial action activities. The landfill will then be regraded and prepared for consolidation of soil and sediments.

Task 6: Sediment Dredging and Consolidation

The lateral limits of the sediment with analytes above the cleanup criteria will be staked in the field based on the PDI. Sediment dredging will be conducted using temporary silt curtains/fencing to limit sediment transport during dredging. The contaminated sediment will be dredged, staged (for dewatering) and deposited on the landfill. The excavated areas will then be backfilled with clean soil.

Task 7: Excavation and Consolidation of Soils

The southern limit of the natural clay layer will be staked in the field based on previous test boring/monitoring well data. The soil in the southern portion of the landfill, not underlain by the natural clay layer, will be excavated. This material will be consolidated on the landfill. Special excavation techniques may be used to address soil below the groundwater table, if necessary (e.g., sheet piling, dewatering, etc.).

The soil will be excavated using backhoes and other earth moving equipment. The areas of excavation will be watered to limit dust generation during remediation. The southern limit of the excavation will be based on visual observation of the topography of the landfill and waste material observed in the open excavation. The excavated areas will then be backfilled with clean soil.

Task 8: Installation of Groundwater Extraction System

The groundwater collection trench and extraction wells will be installed to control down gradient groundwater flow in the post-closure condition. The specific location, configuration and capacity of the groundwater extraction system will be identified based on the PDI. This system may be a combined slurry wall/collection trench configuration (i.e.,"gate system") which directs groundwater to one location for collection, thereby reducing the size of the collection trench and the number of extraction wells. It is currently anticipated that the extraction system will include a submersible pump within each extraction well and appropriate piping and contingency systems.

Task 9: Regrading, Wetlands Restoration and Closure

Once the soil and sediment is consolidated on the landfill, it will undergo final grading in accordance with the design plans. Additionally, during this task the western and northern toe of the landfill may need to be moved to the east to provide sufficient area for the remedial components proposed for these areas (e.g., groundwater collection trench, access road, anchor trench, restored wetlands, etc.).

A composite cap will be installed over the landfill and a perimeter drainage channel will be constructed to control sheet flow from off of the site. This collection system will discharge to the restored western ponds which will serve as surface water retention areas. Surface water control structures will also be installed to control surface water flow and limit erosion. The site will be seeded with perennial grass seed and trees and shrubs will be planted for aesthetic value. The ponds will also be reseeded and restored with appropriate wetland vegetation.

Task 10: Contingency Activation of Groundwater Treatment System

Monitoring wells will be installed inside the groundwater extraction system and along the perimeter of the site. The interior monitoring wells will serve to identify potential lateral migration of analytes from beneath the landfill cap. The perimeter monitoring wells serve to evaluate long-term groundwater quality at the site's perimeter.

If analytes are detected in the interior monitoring wells at concentrations above the performance criteria to be established in the Consent Order, then the groundwater extraction system will be activated and a groundwater pre-treatment system will be installed at the Site. The design of groundwater treatment system will be based on the PDI; however, it is currently anticipated that the treatment system will include chemical precipitation followed by air stripping and activated carbon treatment. The system will have a capacity of approximately 6 gallons per minute.

Note that based on the PDI pump test, it may be determined that the groundwater extracted from the site requires no pre-treatment prior to discharge to the POTW. In this case, the groundwater extraction system will discharge directly to the sanitary sewer system.

Based on the relatively low VOC concentrations in the groundwater beneath the landfill, it is not currently anticipated that air stripping will be required.

However, if air stripping is included in the treatment system, then the need for air discharge controls will be evaluated as part of the treatment system design.

Task 11: Monitoring

The locations of the long-term groundwater monitoring wells will be determined during the Remedial Design phase. Water quality monitoring for the contaminants of concern will be initiated following closure of the landfill. Initially, this monitoring may be conducted on a quarterly basis in selected monitoring wells until a seasonal data base has been developed. This monitoring will then be scaled-back to bi-annually (spring and fall). Water levels will also be measured in the monitoring wells concurrent with groundwater sampling. Monitoring and repair, if necessary, will include periodic observations of the cover system and full-time on-site maintenance and monitoring of the groundwater extraction/treatment system, if activated.

Task 12: Deed Restrictions

Deed restrictions must be negotiated for the Skyway property to prevent the potential future excavation of the material beneath this property. These deed restrictions will regulate excavation, drilling or earth movement on the relevant portions of the Skyway property by the present and future owners of the property or any other person.

6.3 SENSITIVITY ANALYSIS

A Sensitivity Analysis was conducted for the recommended remedial alternative to identify worst-case scenarios and to evaluate the need for contingency or reserve funds. The following factors were considered during the Sensitivity Analysis because these factors were considered to have the greatest influence on the total costs of the recommended alternative:

1) The O&M Duration Period;
2) The Volume of Contaminated Soil and Groundwater; and
3) The Discount Rate.

A summary of the results from the sensitivity analysis is presented below.

Factor	% Change	Total Cost(x1000$)	% Cost Change
O&M Duration	+ 5	9,682	+0.7
Volume	+ 5	9,761	+1.7
Disc. Rate	- 40	10,346	+7.6
Disc. Rate	+ 100	8,789	-8.6
Disc. Rate	- 5	9,761	+1.5

Extending the O&M duration period by 5 percent (i.e., 30 to 32 years) impacted present worth costs of institutional actions and groundwater extraction and treatment. This cost increase was less than 1 percent of the total present worth remediation costs.

The volume of contaminated soil and groundwater was increased 5 percent. This volume increase resulted in a 1.5 percent increase in the total present worth remediation costs.

An increase in the discount rate from 5 to 10 percent resulted in a decrease in the total present worth costs of 8.6 percent. A decrease in the discount rate from 5 to 3 percent resulted in an increase in the total present worth costs of 7.6 percent. A decrease in the discount rate from 5 to 4.75 percent (i.e., a relative 5 percent decrease) resulted in an increase in the total present worth costs of approximately 1.5 percent.

Based on the Sensitivity Analysis presented above, the factors of total soil and groundwater volume and the discount rate have the greatest impact on the estimated total remediation costs. The O&M duration period appears to have a relatively small impact. Of those factors evaluated, the ones most likely to vary during remediation are the volume of contaminated soil and groundwater.

Section 7

Section 7

7.0 *LIMITATIONS AND USE OF REPORT*

This Feasibility Study report was prepared in accordance with generally accepted practices of other consultants preparing similar reports, and we observed that degree of care and skill generally exercised by other consultants under similar circumstances and conditions. The analyses and conclusions submitted in this report are based upon data and information provided by others, and are contingent upon their validity. Cost and volume estimates included herein should considered approximate.

This report was prepared exclusively for Allied-Signal, Inc. for specific application to the Alltift Landfill Site in accordance with generally accepted engineering practice. No other warranty, expressed or implied, is made.

Section 8

Section 8

8.0 REFERENCES

The following references were used to develop this FS report for Allied Signal Inc.:

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Appendices

Appendices

APPENDIX A

SCREENING TABLES FOR SOIL/SEDIMENT AND GROUND WATER ALTERNATIVES

Table 4.1

Soil/Sediment Remediation
1) No Action

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___0 No _X_4
	o Can the Short-term risk be easily controlled?	Yes ___1 No ___0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___0 No ___2
Subtotal (maximum = 4)		4
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___0 No _X_4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___3 No ___0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr___1 ≥2yr_X_0
	o Required duration of the mitigative effort to control short-term risk.	<2yr___1 >2yr_X_0
Subtotal (maximum = 2)		0
4. On-site or off-site treatment or land disposal	o On-site treatment*	___3
	o Off-site treatment*	___1
	o On-site or off-site land disposal	_X_ 0
Subtotal (maximum = 3)		0
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	Yes ___3 No _X_0
Subtotal (maximum = 3)		0

Table 4.1 (cont'd)

Soil/Sediment Remediation
1) No Action

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr ___ 3 20-25yr ___ 2 15-20yr ___ 1 <15yr _X_ 0
Subtotal (Maximum = 3)		0
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None ___ 3 <25% ___ 2 25-50% ___ 1 ≥50% _X_ 0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 8.)**	Yes ___ 0 No _X_ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		2
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr ___ 1 >5yr _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no, go to "IV")**	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident ___ 1 Somewhat to not confident _X_ 0
	iv) Relative degree of long-term monitoring required **(compare with other remedial alternatives)**	Minimum ___ 2 Moderate ___ 1 Extensive _X_ 0
Subtotal (maximum = 4)		0
TOTAL (maximum = 25)		10

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Soil/Sediment Remediation
1) No Action

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	X 3
	ii) Somewhat difficult to construct. No uncertainities in construction.	___2
	iii) Very difficult to construct and/or significant uncertainities in construction.	___1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	___2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		9
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	X 2
	ii) Required coordination is normal.	___1
	iii) Extensive Coordination is required.	___0
Subtotal (maximum = 2)		2
3. Availability of Services and Materials	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___0
a. Availability of prospective technologies.	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		14

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Soil/Sediment Remediation
2) Limited Action

Table 4.1

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___0 No _X_4
	o Can the Short-term risk be easily controlled?	Yes ___1 No ___0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___0 No ___2
Subtotal (maximum = 4)		4
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___0 No _X_4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___3 No ___0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr___1 ≥2yr_X_0
	o Required duration of the mitigative effort to control short-term risk.	<2yr___1 >2yr_X_0
Subtotal (maximum = 2)		0
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	___3 ___1 _X_0
Subtotal (maximum = 3)		0
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	Yes ___3 No _X_0
Subtotal (maximum = 3)		0

Table 4.1 (cont'd)

Soil/Sediment Remediation
2) Limited Action

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr___ 3 20-25yr___ 2 15-20yr___ 1 <15yr _X_ 0
Subtotal (Maximum = 3)		0
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None____ 3 <25%____ 2 25-50%___ 1 ≥50% _X_ 0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 8.)**	Yes ___ 0 No _X_ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		2
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr___ 1 >5yr _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no, go to "IV")**	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident _X_ 1 Somewhat to not confident ___0
	iv) Relative degree of long-term monitoring required **(compare with other remedial alternatives)**	Minimum ___2 Moderate ___1 Extensive_X_0
Subtotal (maximum = 4)		1
TOTAL (maximum = 25)		**11**

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	X 3
	ii) Somewhat difficult to construct. No uncertainities in construction.	__2
	iii) Very difficult to construct and/or significant uncertainities in construction.	__1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	__2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	__1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	__2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		9
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	__ 2
	ii) Required coordination is normal.	X 1
	iii) Extensive Coordination is required.	__0
Subtotal (maximum = 2)		1
3. Availability of Services and Materials	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No __0
a. Availability of prospective technologies.	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No __0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No __0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		13

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Soil/Sediment Remediation
3A) Capping

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___0 No _X_4
	o Can the Short-term risk be easily controlled?	Yes ___1 No ___0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___0 No ___2
Subtotal (maximum = 4)		4
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___0 No _X_4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___3 No ___0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr _X_1 ≥2yr ___0
	o Required duration of the mitigative effort to control short-term risk.	<2yr _X_1 >2yr ___0
Subtotal (maximum = 2)		2
4. On-site or off-site treatment or land disposal	o On-site treatment*	___ 3
	o Off-site treatment*	___ 1
	o On-site or off-site land disposal	_X_ 0
Subtotal (maximum = 3)		0
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	Yes ___3 No _X_0
Subtotal (maximum = 3)		0

Table 4.1 (cont'd) Soil/Sediment Remediation
3A) Capping

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr X 3 20-25yr ___ 2 15-20yr ___ 1 <15yr ___ 0
Subtotal (Maximum = 3)		3
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None ___ 3 <25% ___ 2 25-50% ___ 1 ≥50% X 0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 8.)**	Yes ___ 0 No X 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		2
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr ___ 1 >5yr X 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no, go to "IV")**	Yes X 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident X 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required **(compare with other remedial alternatives)**	Minimum ___ 2 Moderate ___ 1 Extensive X 0
Subtotal (maximum = 4)		1
TOTAL (maximum = 25)		**16**

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. <u>Technical Feasibility</u>		
a. Ability to construct technology.	i) Not difficult to construct.	__3
	ii) Somewhat difficult to construct. No uncertainities in construction.	X 2
	iii) Very difficult to construct and/or significant uncertainities in construction.	__1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	__3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	__1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	__2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		7
2. <u>Administrative Feasibility</u>		
a. Coordination with other agencies.	i) Minimal coordination is required	__2
	ii) Required coordination is normal.	X 1
	iii) Extensive Coordination is required.	__0
Subtotal (maximum = 2)		1
3. <u>Availability of Services and Materials</u>		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No __0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No __0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No __0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		11

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Soil/Sediment Remediation
3B) Capping and Cut-Off Wall

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___0 No _X_4
	o Can the Short-term risk be easily controlled?	Yes ___1 No ___0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___0 No ___2
Subtotal (maximum = 4)		4
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___0 No _X_4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___3 No ___0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr _X_1 ≥2yr ___0
	o Required duration of the mitigative effort to control short-term risk.	<2yr _X_1 >2yr ___0
Subtotal (maximum = 2)		2
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	___ 3 ___ 1 _X_ 0
Subtotal (maximum = 3)		0
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	Yes ___3 No _X_0
Subtotal (maximum = 3)		0

Table 4.1 (cont'd) | Soil/Sediment Remediation 3B) Capping and Cut-Off Wall

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr X 3 20-25yr ___ 2 15-20yr ___ 1 <15yr ___ 0
Subtotal (Maximum = 3)		3
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None ___ 3 <25% ___ 2 25-50% ___ 1 ≥50% X 0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 8.)**	Yes ___ 0 No X 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		2
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr ___ 1 >5yr X 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no, go to "IV")**	Yes X 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident X 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required **(compare with other remedial alternatives)**	Minimum ___ 2 Moderate X 1 Extensive ___ 0
Subtotal (maximum = 4)		2
TOTAL (maximum = 25)		**17**

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	___3
	ii) Somewhat difficult to construct. No uncertainities in construction.	X 2
	iii) Very difficult to construct and/or significant uncertainities in construction.	___1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		7
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	__ 2
	ii) Required coordination is normal.	X 1
	iii) Extensive Coordination is required.	___0
Subtotal (maximum = 2)		1
3. Availability of Services and Materials a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		**11**

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Soil/Sediment Remediation
3C) Capping and Consolidation

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___0 No _X_4
	o Can the Short-term risk be easily controlled?	Yes ___1 No ___0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___0 No ___2
Subtotal (maximum = 4)		4
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___0 No _X_4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___3 No ___0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr _X_1 ≥2yr ___0
	o Required duration of the mitigative effort to control short-term risk.	<2yr _X_1 >2yr ___0
Subtotal (maximum = 2)		2
4. On-site or off-site treatment or land disposal	o On-site treatment*	___ 3
	o Off-site treatment*	___ 1
	o On-site or off-site land disposal	_X_ 0
Subtotal (maximum = 3)		0
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	Yes ___3 No _X_0
Subtotal (maximum = 3)		0

Table 4.1 (cont'd)

Soil/Sediment Remediation
3C) Capping and Consolidation

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr X 3 20-25yr ___ 2 15-20yr ___ 1 <15yr ___ 0
Subtotal (Maximum = 3)		3
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None ___ 3 <25% ___ 2 25-50% ___ 1 ≥50% X 0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 8.)**	Yes ___ 0 No X 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		2
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr ___ 1 >5yr X 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no, go to "IV")**	Yes X 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident X 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required **(compare with other remedial alternatives)**	Minimum ___ 2 Moderate ___ 1 Extensive X 0
Subtotal (maximum = 4)		1
TOTAL (maximum = 25)		16

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. <u>Technical Feasibility</u>		
a. Ability to construct technology.	i) Not difficult to construct.	___3
	ii) Somewhat difficult to construct. No uncertainities in construction.	X 2
	iii) Very difficult to construct and/or significant uncertainities in construction.	___1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		7
2. <u>Administrative Feasibility</u>		
a. Coordination with other agencies.	i) Minimal coordination is required	__ 2
	ii) Required coordination is normal.	X 1
	iii) Extensive Coordination is required.	___0
Subtotal (maximum = 2)		1
3. <u>Availability of Services and Materials</u>	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___0
a. Availability of prospective technologies.	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		11

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Soil/Sediment Remediation
3D) Capping and Consolidation
and Cut-Off Wall

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___0 No _X_4
	o Can the Short-term risk be easily controlled?	Yes ___1 No ___0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___0 No ___2
Subtotal (maximum = 4)		4
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___0 No _X_4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___3 No ___0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr _X_1 ≥2yr ___0
	o Required duration of the mitigative effort to control short-term risk.	<2yr _X_1 >2yr ___0
Subtotal (maximum = 2)		2
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	___ 3 ___ 1 _X_ 0
Subtotal (maximum = 3)		0
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	Yes ___3 No _X_0
Subtotal (maximum = 3)		0

Table 4.1 (cont'd)

Soil/Sediment Remediation
3D) Capping and Consolidation and Cut-Off Wall

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr _X_ 3 20-25yr ___ 2 15-20yr ___ 1 <15yr ___ 0
Subtotal (Maximum = 3)		3
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None ___ 3 <25% ___ 2 25-50% ___ 1 ≥50% _X_ 0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 8.)**	Yes ___ 0 No _X_ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		2
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr ___ 1 >5yr _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no, go to "IV")**	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident _X_ 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required **(compare with other remedial alternatives)**	Minimum _X_ 2 Moderate ___ 1 Extensive _X_ 0
Subtotal (maximum = 4)		3
TOTAL (maximum = 25)		18

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	___3
	ii) Somewhat difficult to construct. No uncertainities in construction.	X 2
	iii) Very difficult to construct and/or significant uncertainities in construction.	___1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	X 2
	ii) Some future remedial actions may be necessary.	___1
Subtotal (maximum = 10)		8
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	__ 2
	ii) Required coordination is normal.	X 1
	iii) Extensive Coordination is required.	___0
Subtotal (maximum = 2)		1
3. Availability of Services and Materials a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		12

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Soil/Sediment Remediation
4A) Off-Site Landfill
(Above Cleanup Levels)

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes _X_ 0 No ___ 4
	o Can the Short-term risk be easily controlled?	Yes _X_ 1 No ___ 0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___ 0 No _X_ 2
Subtotal (maximum = 4)		3
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___ 0 No _X_ 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___ 3 No ___ 0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr _X_ 1 ≥2yr ___ 0
	o Required duration of the mitigative effort to control short-term risk.	<2yr _X_ 1 >2yr ___ 0
Subtotal (maximum = 2)		2
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	___ 3 ___ 1 _X_ 0
Subtotal (maximum = 3)		0
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	Yes ___ 3 No _X_ 0
Subtotal (maximum = 3)		0

Table 4.1 (cont'd)

Soil/Sediment Remediation
4A) Off-Site Landfill
(Above Cleanup Levels)

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr _X_ 3 20-25yr ___ 2 15-20yr ___ 1 <15yr ___ 0
Subtotal (Maximum = 3)		3
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None _X_ 3 <25% ___ 2 25-50% ___ 1 ≥50% _X_ 0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 8.)**	Yes ___ 0 No _X_ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		5
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr _X_ 1 >5yr ___ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no, go to "IV")**	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident _X_ 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required **(compare with other remedial alternatives)**	Minimum _X_ 2 Moderate ___ 1 Extensive _X_ 0
Subtotal (maximum = 4)		4
TOTAL (maximum = 25)		21

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	X 3
	ii) Somewhat difficult to construct. No uncertainities in construction.	___2
	iii) Very difficult to construct and/or significant uncertainities in construction.	___1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	___2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	X 2
	ii) Some future remedial actions may be necessary.	___1
Subtotal (maximum = 10)		10
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	_ 2
	ii) Required coordination is normal.	X 1
	iii) Extensive Coordination is required.	___0
Subtotal (maximum = 2)		1
3. Availability of Services and Materials	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___0
a. Availability of prospective technologies.	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		14

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Soil/Sediment Remediation
4B) Off-Site Landfill
(Outside Clay Layer)

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes _X_ 0 No ___ 4
	o Can the Short-term risk be easily controlled?	Yes _X_ 1 No ___ 0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___ 0 No _X_ 2
Subtotal (maximum = 4)		3
2. Environmental Impacts		
	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___ 0 No _X_ 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___ 3 No ___ 0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr _X_ 1 ≥2yr ___ 0
	o Required duration of the mitigative effort to control short-term risk.	<2yr _X_ 1 >2yr ___ 0
Subtotal (maximum = 2)		2
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	___ 3 ___ 1 _X_ 0
Subtotal (maximum = 3)		0
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	Yes ___ 3 No _X_ 0
Subtotal (maximum = 3)		0

Table 4.1 (cont'd)

Soil/Sediment Remediation
4B) Off-Site Landfill
(Outside Clay Layer)

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr X 3 20-25yr __2 15-20yr __1 <15yr __0
Subtotal (Maximum = 3)		3
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None____ 3 <25%____ 2 25-50%__ 1 ≥50% X 0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 8.)**	Yes ____ 0 No X 2
	iii) Is the treated residual toxic?	Yes ____ 0 No ____ 1
	iv) Is the treated residual mobile?	Yes ____ 0 No ____ 1
Subtotal (maximum = 5)		2
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr____ 1 >5yr X 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no, go to "IV")**	Yes X 0 No ____ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident X 1 Somewhat to not confident ____0
	iv) Relative degree of long-term monitoring required **(compare with other remedial alternatives)**	Minimum __2 Moderate X1 Extensive_0
Subtotal (maximum = 4)		2
TOTAL (maximum = 25)		16

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Soil/Sediment Remediation
4B) Off-Site Landfill
(Outside Clay Layer)

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	___3
	ii) Somewhat difficult to construct. No uncertainities in construction.	X 2
	iii) Very difficult to construct and/or significant uncertainities in construction.	___1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	___2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		8
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	___2
	ii) Required coordination is normal.	X 1
	iii) Extensive Coordination is required.	___0
Subtotal (maximum = 2)		1
3. Availability of Services and Materials	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___0
a. Availability of prospective technologies.	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		12

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Soil/Sediment Remediation
5A) Soil Washing

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___ 0 No _X_ 4
	o Can the Short-term risk be easily controlled?	Yes ___ 1 No ___ 0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___ 0 No ___ 2
Subtotal (maximum = 4)		4
2. Environmental Impacts		
	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___ 0 No _X_ 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___ 3 No ___ 0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr _X_ 1 ≥2yr ___ 0
	o Required duration of the mitigative effort to control short-term risk.	<2yr _X_ 1 >2yr ___ 0
Subtotal (maximum = 2)		2
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	_X_ 3 ___ 1 ___ 0
Subtotal (maximum = 3)		3
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	Yes _X_ 3 No ___ 0
Subtotal (maximum = 3)		3

Table 4.1 (cont'd) — Soil/Sediment Remediation
5A) Soil Washing

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr___3 20-25yr___2 15-20yr___1 <15yr ___0
Subtotal (Maximum = 3)		0
7. Quantity and nature of waste or residual left at the site after remediation.	**i) Quantity of untreated hazardous waste left at the site.**	**None_X_ 3** **<25%___ 2** 25-50%___ 1 ≥50% ___ 0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 8.)**	Yes _X_ 0 No ___ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		3
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr_X_ 1 >5yr___ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no, go to "IV")**	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident ___1 Somewhat to not confident _X_0
	iv) Relative degree of long-term monitoring required **(compare with other remedial alternatives)**	Minimum ___2 Moderate_X_1 Extensive__0
Subtotal (maximum = 4)		2
TOTAL (maximum = 25)		21

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	___3
	ii) Somewhat difficult to construct. No uncertainities in construction.	___2
	iii) Very difficult to construct and/or significant uncertainities in construction.	X 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	___2
	ii) Somewhat likely	X 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	X 2
	ii) Some future remedial actions may be necessary.	___1
Subtotal (maximum = 10)		6
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	___2
	ii) Required coordination is normal.	X 1
	iii) Extensive Coordination is required.	___0
Subtotal (maximum = 2)		1
3. Availability of Services and Materials	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___0
a. Availability of prospective technologies.	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		10

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Soil/Sediment Remediation
5B) Solidification/Stabilization

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___0 No X_4
	o Can the Short-term risk be easily controlled?	Yes ___1 No _0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes __0 No __2
Subtotal (maximum = 4)		4
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___0 No X__4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___3 No X__0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr X 1 ≥2yr ___0
	o Required duration of the mitigative effort to control short-term risk.	<2yr X 1 >2yr ___0
Subtotal (maximum = 2)		2
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	X 3 ___ 1 ___ 0
Subtotal (maximum = 3)		3
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	Yes X 3 No ___0
Subtotal (maximum = 3)		3

Table 4.1 (cont'd) — Soil/Sediment Remediation, 5B) Solidification/Stabilization

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr___3 20-25yr___2 15-20yr___1 <15yr _X_0
Subtotal (Maximum = 3)		0
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None____ 3 <25%__X_ 2 25-50%___ 1 ≥50% ___ 0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 8.)**	Yes _X_ 0 No ___ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		2
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr_X_ 1 >5yr____ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no, go to "IV")**	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident ___1 Somewhat to not confident _X_0
	iv) Relative degree of long-term monitoring required **(compare with other remedial alternatives)**	Minimum __2 Moderate X_1 Extensive_0
Subtotal (maximum = 4)		2
TOTAL (maximum = 25)		20

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	___3
	ii) Somewhat difficult to construct. No uncertainities in construction.	___2
	iii) Very difficult to construct and/or significant uncertainities in construction.	X 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	___2
	ii) Somewhat likely	X 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		5
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	__ 2
	ii) Required coordination is normal.	___1
	iii) Extensive Coordination is required.	X 0
Subtotal (maximum = 2)		0
3. Availability of Services and Materials	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___0
a. Availability of prospective technologies.	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		8

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Groundwater Remediation
1) No Action

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___0 No _X_4
	o Can the Short-term risk be easily controlled?	Yes ___1 No ___0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___0 No ___2
Subtotal (maximum = 4)		4
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___0 No _X_4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___3 No ___0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr___1 ≥2yr_X_0
	o Required duration of the mitigative effort to control short-term risk.	<2yr___1 >2yr_X_0
Subtotal (maximum = 2)		0
4. On-site or off-site treatment or land disposal	o On-site treatment*	___ 3
	o Off-site treatment*	___ 1
	o On-site or off-site land disposal	_X_ 0
Subtotal (maximum = 3)		0
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	Yes ___3 No _X_0
Subtotal (maximum = 3)		0

Table 4.1 (cont'd)

Groundwater Remediation
1) No Action

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr ___ 3 20-25yr ___ 2 15-20yr ___ 1 <15yr _X_ 0
Subtotal (Maximum = 3)		0
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None ___ 3 <25% ___ 2 25-50% ___ 1 ≥50% _X_ 0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 8.)**	Yes ___ 0 No _X_ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		2
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr ___ 1 >5yr _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no, go to "IV")**	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident ___ 1 Somewhat to not confident _X_ 0
	iv) Relative degree of long-term monitoring required **(compare with other remedial alternatives)**	Minimum ___ 2 Moderate ___ 1 Extensive _X_ 0
Subtotal (maximum = 4)		0
TOTAL (maximum = 25)		**10**

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Groundwater Remediation
1) No Action

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	X 3
	ii) Somewhat difficult to construct. No uncertainities in construction.	___2
	iii) Very difficult to construct and/or significant uncertainities in construction.	___1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	___2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		9
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	X 2
	ii) Required coordination is normal.	___1
	iii) Extensive Coordination is required.	___0
Subtotal (maximum = 2)		2
3. Availability of Services and Materials	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___0
a. Availability of prospective technologies.	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		14

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Groundwater Remediation
2) Limited Action

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___0 No _X_4
	o Can the Short-term risk be easily controlled?	Yes ___1 No ___0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___0 No ___2
Subtotal (maximum = 4)		4
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___0 No _X_4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___3 No ___0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr___1 ≥2yr_X_0
	o Required duration of the mitigative effort to control short-term risk.	<2yr___1 >2yr_X_0
Subtotal (maximum = 2)		0
4. On-site or off-site treatment or land disposal	o On-site treatment*	___ 3
	o Off-site treatment*	___ 1
	o On-site or off-site land disposal	_X_ 0
Subtotal (maximum = 3)		0
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	Yes ___3 No _X_0
Subtotal (maximum = 3)		0

Table 4.1 (cont'd)

Groundwater Remediation
Limited Action

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr___3 20-25yr___2 15-20yr___1 <15yr _X_0
Subtotal (Maximum = 3)		0
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None____ 3 <25%____ 2 25-50%___ 1 >50% _X_ 0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 8.)**	Yes _X_ 0 No ____ 2
	iii) Is the treated residual toxic?	Yes ____ 0 No ____ 1
	iv) Is the treated residual mobile?	Yes ____ 0 No ____ 1
Subtotal (maximum = 5)		2
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr____ 1 >5yr_X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "IV")	Yes _X_ 0 No ____ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident ____1 Somewhat to not confident _X_0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives)	Minimum ___2 Moderate __1 Extensive_X0
Subtotal (maximum = 4)		1
TOTAL (maximum = 25)		11

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	X 3
	ii) Somewhat difficult to construct. No uncertainities in construction.	__2
	iii) Very difficult to construct and/or significant uncertainities in construction.	__1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	__2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	__1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	__2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		9
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	X 2
	ii) Required coordination is normal.	__1
	iii) Extensive Coordination is required.	__0
Subtotal (maximum = 2)		1
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No __0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No __0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No __0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		13

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Groundwater Remediation
3A) Extraction

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___0 No _X_4
	o Can the Short-term risk be easily controlled?	Yes ___1 No ___0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___0 No ___2
Subtotal (maximum = 4)		4
2. Environmental Impacts		
	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___0 No _X_4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___3 No ___0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr___1 ≥2yr_X_0
	o Required duration of the mitigative effort to control short-term risk.	<2yr_X_1 >2yr___0
Subtotal (maximum = 2)		1
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	___ 3 ___ 1 _X_ 0
Subtotal (maximum = 3)		0
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	Yes ___3 No _X_0
Subtotal (maximum = 3)		0

Table 4.1 (cont'd)

Groundwater Remediation
3A) Extraction

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr X 3 20-25yr ___ 2 15-20yr ___ 1 <15yr ___ 0
Subtotal (Maximum = 3)		3
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None X 3 <25% ___ 2 25-50% ___ 1 ≥50% ___ 0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 8.)**	Yes ___ 0 No X 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		5
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr ___ 1 >5yr X 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no, go to "IV")**	Yes X 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident ___ 1 Somewhat to not confident X 0
	iv) Relative degree of long-term monitoring required **(compare with other remedial alternatives)**	Minimum ___ 2 Moderate X 1 Extensive ___ 0
Subtotal (maximum = 4)		**1**
TOTAL (maximum = 25)		**18**

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	X 3
	ii) Somewhat difficult to construct. No uncertainities in construction.	__2
	iii) Very difficult to construct and/or significant uncertainities in construction.	__1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	__3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	__1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	__2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		8
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	__2
	ii) Required coordination is normal.	X 1
	iii) Extensive Coordination is required.	__0
Subtotal (maximum = 2)		1
3. Availability of Services and Materials	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No __0
a. Availability of prospective technologies.	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No __0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No __0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		12

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Groundwater Remediation
3B) Extraction/Injection

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___ 0 No _X_ 4
	o Can the Short-term risk be easily controlled?	Yes ___ 1 No ___ 0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___ 0 No ___ 2
Subtotal (maximum = 4)		4
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___ 0 No _X_ 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___ 3 No ___ 0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr ___ 1 ≥2yr _X_ 0
	o Required duration of the mitigative effort to control short-term risk.	<2yr _X_ 1 >2yr ___ 0
Subtotal (maximum = 2)		1
4. On-site or off-site treatment or land disposal	o On-site treatment*	___ 3
	o Off-site treatment*	___ 1
	o On-site or off-site land disposal	_X_ 0
Subtotal (maximum = 3)		0
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	Yes ___ 3 No _X_ 0
Subtotal (maximum = 3)		0

Table 4.1 (cont'd)

Groundwater Remediation
3B) Extraction/Injection

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr X 3 20-25yr ___2 15-20yr ___1 <15yr ___0
Subtotal (Maximum = 3)		3
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None X 3 <25% ___ 2 25-50% ___ 1 ≥50% ___ 0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 8.)**	Yes ___ 0 No X 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		5
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr___ 1 >5yr X 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no, go to "IV")**	Yes X 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident ___1 Somewhat to not confident X 0
	iv) Relative degree of long-term monitoring required **(compare with other remedial alternatives)**	Minimum ___2 Moderate X 1 Extensive__0
Subtotal (maximum = 4)		1
TOTAL (maximum = 25)		18

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Groundwater Remediation
6D) Groundwater Injection

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___0 No _X_4
	o Can the Short-term risk be easily controlled?	Yes ___1 No ___0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___0 No ___2
Subtotal (maximum = 4)		4
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___0 No ___4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes _X_3 No ___0
Subtotal (maximum = 4)		3
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr___1 ≥2yr_X_0
	o Required duration of the mitigative effort to control short-term risk.	<2yr_X_1 >2yr___0
Subtotal (maximum = 2)		1
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	_X_ 3 ___ 1 ___ 0
Subtotal (maximum = 3)		3
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	Yes _X_3 No ___0
Subtotal (maximum = 3)		3

Table 4.1 (cont'd)

Groundwater Remediation
6D) Groundwater Injection

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr___ 3 20-25yr___ 2 15-20yr___ 1 <15yr ___ 0
Subtotal (Maximum = 3)		0
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None _X_ 3 <25% ___ 2 25-50% ___ 1 ≥50% ___ 0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 8.)**	Yes _X_ 0 No ___ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No _X_ 1
	iv) Is the treated residual mobile?	Yes _X_ 0 No ___ 1
Subtotal (maximum = 5)		4
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr___ 1 >5yr _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "IV")	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident _X_ 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives)	Minimum ___ 2 Moderate ___ 1 Extensive _X_ 0
Subtotal (maximum = 4)		1
TOTAL (maximum = 25)		19

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	___3
	ii) Somewhat difficult to construct. No uncertainities in construction.	X 2
	iii) Very difficult to construct and/or significant uncertainities in construction.	___1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	___2
	ii) Somewhat likely	X 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		6
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	___2
	ii) Required coordination is normal.	___1
	iii) Extensive Coordination is required.	X 0
Subtotal (maximum = 2)		0
3. Availability of Services and Materials	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___0
a. Availability of prospective technologies.	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		9

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	X 3
	ii) Somewhat difficult to construct. No uncertainities in construction.	___2
	iii) Very difficult to construct and/or significant uncertainities in construction.	___1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		8
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	__ 2
	ii) Required coordination is normal.	___1
	iii) Extensive Coordination is required.	X 0
Subtotal (maximum = 2)		0
3. Availability of Services and Materials	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___0
a. Availability of prospective technologies.	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		11

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Groundwater Remediation
3C) Interceptor Trenches

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___0 No _X_4
	o Can the Short-term risk be easily controlled?	Yes ___1 No ___0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___0 No ___2
Subtotal (maximum = 4)		4
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___0 No _X_4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___3 No ___0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr___1 ≥2yr_X_0
	o Required duration of the mitigative effort to control short-term risk.	<2yr_X_1 >2yr___0
Subtotal (maximum = 2)		1
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	___3 ___1 _X_0
Subtotal (maximum = 3)		0
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 7.)	Yes ___3 No _X_0
Subtotal (maximum = 3)		0

Table 4.1 (cont'd)

Groundwater Remediation
3C) Interceptor Trenches

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr ___ 3 20-25yr _X_ 2 15-20yr ___ 1 <15yr ___ 0
Subtotal (Maximum = 3)		2
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None _X_ 3 <25% ___ 2 25-50% ___ 1 ≥50% _X_ 0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 8.)**	Yes ___ 0 No _X_ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		5
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr ___ 1 >5yr _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no, go to "IV")**	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident _X_ 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives)	Minimum ___ 2 Moderate _X_ 1 Extensive ___ 0
Subtotal (maximum = 4)		2
TOTAL (maximum = 25)		18

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	X 3
	ii) Somewhat difficult to construct. No uncertainities in construction.	___2
	iii) Very difficult to construct and/or significant uncertainities in construction.	___1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	___2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		9
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	X 2
	ii) Required coordination is normal.	___1
	iii) Extensive Coordination is required.	___0
Subtotal (maximum = 2)		2
3. Availability of Services and Materials a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		14

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Groundwater Remediation
4A) Conventional Precipitation

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___0 No _X_4
	o Can the Short-term risk be easily controlled?	Yes ___1 No ___0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___0 No ___2
Subtotal (maximum = 4)		4
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___0 No _X_4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___3 No ___0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr___1 ≥2yr_X_0
	o Required duration of the mitigative effort to control short-term risk.	<2yr_X_1 >2yr___0
Subtotal (maximum = 2)		1
4. On-site or off-site treatment or land disposal	o On-site treatment*	_X_ 3
	o Off-site treatment*	___ 1
	o On-site or off-site land disposal	_X_ 0
Subtotal (maximum = 3)		3
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	Yes _X_3 No ___0
Subtotal (maximum = 3)		3

Table 4.1 (cont'd)

Groundwater Remediation
4A) Conventional Precipitation

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr___3 20-25yr___2 15-20yr___1 <15yr ___0
Subtotal (Maximum = 3)		0
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None _X_ 3 <25%____ 2 25-50%___ 1 ≥50% ___ 0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 8.)**	Yes ___ 0 No _X_ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		5
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr____ 1 >5yr_X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "IV")	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident _X_1 Somewhat to not confident ___0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives)	Minimum ___2 Moderate _X_1 Extensive__0
Subtotal (maximum = 4)		2
TOTAL (maximum = 25)		22

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	___3
	ii) Somewhat difficult to construct. No uncertainities in construction.	X 2
	iii) Very difficult to construct and/or significant uncertainities in construction.	___1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	X 2
	ii) Some future remedial actions may be necessary.	___1
Subtotal (maximum = 10)		8
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	___2
	ii) Required coordination is normal.	X 1
	iii) Extensive Coordination is required.	___0
Subtotal (maximum = 2)		1
3. Availability of Services and Materials a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		12

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Groundwater Remediation
4B) Sulfide Precipitation

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___0 No _X_4
	o Can the Short-term risk be easily controlled?	Yes ___1 No ___0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___0 No ___2
Subtotal (maximum = 4)		4
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___0 No _X_4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___3 No ___0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr___1 ≥2yr_X_0
	o Required duration of the mitigative effort to control short-term risk.	<2yr_X_1 >2yr___0
Subtotal (maximum = 2)		1
4. On-site or off-site treatment or land disposal	o On-site treatment*	_X_ 3
	o Off-site treatment*	___ 1
	o On-site or off-site land disposal	___ 0
Subtotal (maximum = 3)		3
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	Yes _X_3 No ___0
Subtotal (maximum = 3)		3

Table 4.1 (cont'd)

Groundwater Remediation
4B) Sulfide Precipitation

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr___3 20-25yr___2 15-20yr___1 <15yr ___0
Subtotal (Maximum = 3)		0
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None_X_ 3 <25%___ 2 25-50%___ 1 >50% ___ 0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 8.)**	Yes ___ 0 No _X_ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		5
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr___ 1 >5yr_X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "IV")	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident _X_ 1 Somewhat to not confident ___0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives)	Minimum ___2 Moderate _X_1 Extensive__0
Subtotal (maximum = 4)		2
TOTAL (maximum = 25)		22

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	___3
	ii) Somewhat difficult to construct. No uncertainities in construction.	X 2
	iii) Very difficult to construct and/or significant uncertainities in construction.	___1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	X 2
	ii) Some future remedial actions may be necessary.	___1
Subtotal (maximum = 10)		8
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	__ 2
	ii) Required coordination is normal.	X 1
	iii) Extensive Coordination is required.	___0
Subtotal (maximum = 2)		1
3. Availability of Services and Materials a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		12

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Groundwater Remediation
4C) Ion Exchange

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___0 No _X_4
	o Can the Short-term risk be easily controlled?	Yes ___1 No ___0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___0 No ___2
Subtotal (maximum = 4)		4
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___0 No _X_4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___3 No ___0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr___1 ≥2yr_X_0
	o Required duration of the mitigative effort to control short-term risk.	<2yr_X_1 >2yr___0
Subtotal (maximum = 2)		1
4. On-site or off-site treatment or land disposal	o On-site treatment*	_X_ 3
	o Off-site treatment*	___ 1
	o On-site or off-site land disposal	___ 0
Subtotal (maximum = 3)		3
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	Yes _X_3 No ___0
Subtotal (maximum = 3)		3

Table 4.1 (cont'd)

Groundwater Remediation
4C) Ion Exchange

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr___3 20-25yr___2 15-20yr___1 <15yr ___0
Subtotal (Maximum = 3)		0
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None_X_ 3 <25%___ 2 25-50%___ 1 ≥50% ___ 0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 8.)**	Yes ___ 0 No _X_ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		5
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr___ 1 >5yr_X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no, go to "IV")**	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident _X_1 Somewhat to not confident ___0
	iv) Relative degree of long-term monitoring required **(compare with other remedial alternatives)**	Minimum ___2 Moderate _X_1 Extensive___0
Subtotal (maximum = 4)		2
TOTAL (maximum = 25)		22

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	X 3
	ii) Somewhat difficult to construct. No uncertainities in construction.	___2
	iii) Very difficult to construct and/or significant uncertainities in construction.	___1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	X 2
	ii) Some future remedial actions may be necessary.	___1
Subtotal (maximum = 10)		9
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	X 2
	ii) Required coordination is normal.	___1
	iii) Extensive Coordination is required.	___0
Subtotal (maximum = 2)		2
3. Availability of Services and Materials	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___0
a. Availability of prospective technologies.	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		14

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Groundwater Remediation
4D) Resin Sorption

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___0 No _X_4
	o Can the Short-term risk be easily controlled?	Yes ___1 No ___0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___0 No ___2
Subtotal (maximum = 4)		4
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___0 No _X_4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___3 No ___0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr___1 ≥2yr_X_0
	o Required duration of the mitigative effort to control short-term risk.	<2yr_X_1 >2yr___0
Subtotal (maximum = 2)		1
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	_X_ 3 ___ 1 ___ 0
Subtotal (maximum = 3)		3
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	Yes _X_3 No ___0
Subtotal (maximum = 3)		3

Table 4.1 (cont'd) Groundwater Remediation
4D) Resin Sorption

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr___3 20-25yr___2 15-20yr___1 <15yr ___0
Subtotal (Maximum = 3)		0
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None_X_ 3 <25%____ 2 25-50%___ 1 ≥50% ___ 0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 8.)**	Yes ___ 0 No _X_ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		5
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr___ 1 >5yr_X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no, go to "IV")**	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident _X_1 Somewhat to not confident ___0
	iv) Relative degree of long-term monitoring required **(compare with other remedial alternatives)**	Minimum ___2 Moderate _X_1 Extensive__0
Subtotal (maximum = 4)		2
TOTAL (maximum = 25)		22

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	X 3
	ii) Somewhat difficult to construct. No uncertainities in construction.	__2
	iii) Very difficult to construct and/or significant uncertainities in construction.	__1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	__3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	__1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	__2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		8
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	__2
	ii) Required coordination is normal.	X 1
	iii) Extensive Coordination is required.	__0
Subtotal (maximum = 2)		1
3. Availability of Services and Materials	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No __0
a. Availability of prospective technologies.	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No __0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No __0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		12

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___0 No _X_4
	o Can the Short-term risk be easily controlled?	Yes ___1 No ___0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___0 No ___2
Subtotal (maximum = 4)		4
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___0 No _X_4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___3 No ___0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr___1 ≥2yr_X_0
	o Required duration of the mitigative effort to control short-term risk.	<2yr_X_1 >2yr___0
Subtotal (maximum = 2)		1
4. **On-site or off-site treatment or land disposal**	o On-site treatment*	_X_ 3
	o Off-site treatment*	___ 1
	o On-site or off-site land disposal	___ 0
Subtotal (maximum = 3)		3
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	Yes _X_3 No ___0
Subtotal (maximum = 3)		3

Table 4.1 (cont'd)

Groundwater Remediation
4E) Resin Sorption

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr___ 3 20-25yr___ 2 15-20yr___ 1 <15yr ___ 0
Subtotal (Maximum = 3)		0
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None _X_ 3 <25%___ 2 25-50%___ 1 ≥50% ___ 0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 8.)**	Yes ___ 0 No _X_ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		5
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr___ 1 >5yr_X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "IV")	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident _X_ 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives)	Minimum ___ 2 Moderate _X_ 1 Extensive___ 0
Subtotal (maximum = 4)		2
TOTAL (maximum = 25)		22

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. <u>Technical Feasibility</u>		
a. Ability to construct technology.	i) Not difficult to construct.	X 3
	ii) Somewhat difficult to construct. No uncertainities in construction.	___2
	iii) Very difficult to construct and/or significant uncertainities in construction.	___1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	___2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		9
2. <u>Administrative Feasibility</u>		
a. Coordination with other agencies.	i) Minimal coordination is required	X 2
	ii) Required coordination is normal.	___1
	iii) Extensive Coordination is required.	___0
Subtotal (maximum = 2)		2
3. <u>Availability of Services and Materials</u>	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___0
a. Availability of prospective technologies.	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		14

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Groundwater Remediation
4E & 5A) Activated Carbon

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___0 No _X_4
	o Can the Short-term risk be easily controlled?	Yes ___1 No ___0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___0 No ___2
Subtotal (maximum = 4)		4
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___0 No _X_4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___3 No ___0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr___1 ≥2yr_X_0
	o Required duration of the mitigative effort to control short-term risk.	<2yr_X_1 >2yr___0
Subtotal (maximum = 2)		1
4. On-site or off-site treatment or land disposal	o On-site treatment*	_X_ 3
	o Off-site treatment*	___ 1
	o On-site or off-site land disposal	___ 0
Subtotal (maximum = 3)		3
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	Yes _X_3 No ___0
Subtotal (maximum = 3)		3

Table 4.1 (cont'd)

Groundwater Remediation
4E & 5A) Activated Carbon

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr___3 20-25yr___2 15-20yr___1 <15yr ___0
Subtotal (Maximum = 3)		0
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None_X_ 3 <25%___ 2 25-50%___ 1 ≥50% ___ 0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 8.)**	Yes ___ 0 No _X_ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		5
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr___ 1 >5yr_X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "IV")	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident _X_1 Somewhat to not confident ___0
	iv) Relative degree of long-term monitoring required **(compare with other remedial alternatives)**	Minimum __2 Moderate_X_1 Extensive _0
Subtotal (maximum = 4)		2
TOTAL (maximum = 25)		22

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Groundwater Remediation
4E & 5A) Activated Carbon

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	X 3
	ii) Somewhat difficult to construct. No uncertainities in construction.	__2
	iii) Very difficult to construct and/or significant uncertainities in construction.	__1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	__2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	__1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	__2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		9
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	X 2
	ii) Required coordination is normal.	__1
	iii) Extensive Coordination is required.	__0
Subtotal (maximum = 2)		2
3. Availability of Services and Materials a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No __0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No __0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No __0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		14

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Groundwater Remediation
5B) Air Stripping

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___0 No _X_4
	o Can the Short-term risk be easily controlled?	Yes ___1 No ___0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___0 No ___2
Subtotal (maximum = 4)		4
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___0 No _X_4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___3 No ___0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr___1 ≥2yr_X_0
	o Required duration of the mitigative effort to control short-term risk.	<2yr_X_1 >2yr___0
Subtotal (maximum = 2)		1
4. On-site or off-site treatment or land disposal	o On-site treatment*	_X_ 3
	o Off-site treatment*	___ 1
	o On-site or off-site land disposal	___ 0
Subtotal (maximum = 3)		3
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	Yes _X_3 No ___0
Subtotal (maximum = 3)		3

Table 4.1 (cont'd)

Groundwater Remediation
5B) Air Stripping

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr___3 20-25yr___2 15-20yr___1 <15yr ___0
Subtotal (Maximum = 3)		0
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None_X_ 3 <25%___ 2 25-50%___ 1 ≥50% ___ 0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 8.)	Yes ___ 0 No _X_ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		5
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr___ 1 >5yr_X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "IV")	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident _X_1 Somewhat to not confident ___0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives)	Minimum ___2 Moderate_X_1 Extensive__0
Subtotal (maximum = 4)		2
TOTAL (maximum = 25)		22

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Groundwater Remediation
5B) Air Stripping

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	X 3
	ii) Somewhat difficult to construct. No uncertainities in construction.	__2
	iii) Very difficult to construct and/or significant uncertainities in construction.	__1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	__3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	__1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	__2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		8
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	__2
	ii) Required coordination is normal.	__1
	iii) Extensive Coordination is required.	X 0
Subtotal (maximum = 2)		0
3. Availability of Services and Materials a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No __0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No __0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No __0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		11

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Groundwater Remediation
5C) UV-Peroxidation

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___0 No _X_4
	o Can the Short-term risk be easily controlled?	Yes ___1 No ___0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___0 No ___2
Subtotal (maximum = 4)		4
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___0 No _X_4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___3 No ___0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr___1 ≥2yr_X_0
	o Required duration of the mitigative effort to control short-term risk.	<2yr_X_1 >2yr___0
Subtotal (maximum = 2)		1
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	_X_ 3 ___ 1 ___ 0
Subtotal (maximum = 3)		3
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	Yes _X_3 No ___0
Subtotal (maximum = 3)		3

Table 4.1 (cont'd)

Groundwater Remediation
5C) UV-Peroxidation

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr___3 20-25yr___2 15-20yr___1 <15yr ___0
Subtotal (Maximum = 3)		0
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None_X_ 3 <25%____ 2 25-50%___ 1 ≥50% ___ 0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 8.)**	Yes ___ 0 No _X_ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		5
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr___ 1 >5yr_X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "IV")	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident _X_1 Somewhat to not confident ___0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives)	Minimum ___2 Moderate _X_1 Extensive__0
Subtotal (maximum = 4)		2
TOTAL (maximum = 25)		22

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. <u>Technical Feasibility</u>		
a. Ability to construct technology.	i) Not difficult to construct.	X 3
	ii) Somewhat difficult to construct. No uncertainities in construction.	__2
	iii) Very difficult to construct and/or significant uncertainities in construction.	__1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	__3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	__1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	__2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		8
2. <u>Administrative Feasibility</u>		
a. Coordination with other agencies.	i) Minimal coordination is required	X 2
	ii) Required coordination is normal.	__1
	iii) Extensive Coordination is required.	__0
Subtotal (maximum = 2)		2
3. <u>Availability of Services and Materials</u>	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No __0
a. Availability of prospective technologies.	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No __0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No __0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		13

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Groundwater Remediation
6A) Off-Site Treatment
and Disposal

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes X 0 No ___ 4
	o Can the Short-term risk be easily controlled?	Yes X 1 No ___ 0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___ 0 No X 2
Subtotal (maximum = 4)		3
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___ 0 No X 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___ 3 No ___ 0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr ___ 1 ≥2yr X 0
	o Required duration of the mitigative effort to control short-term risk.	<2yr X 1 >2yr ___ 0
Subtotal (maximum = 2)		1
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	___ 3 X 1 ___ 0
Subtotal (maximum = 3)		1
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	Yes X 3 No ___ 0
Subtotal (maximum = 3)		3

Table 4.1 (cont'd)

Groundwater Remediation
6A) Off-Site Treatment and Disposal

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr___3 20-25yr___2 15-20yr___1 <15yr ___0
Subtotal (Maximum = 3)		0
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None_X_ 3 <25%___ 2 25-50%___ 1 ≥50% ___ 0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 8.)	Yes ___ 0 No _X_ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		5
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr_X_ 1 >5yr___ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "IV")	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident _X_1 Somewhat to not confident ___0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives)	Minimum ___2 Moderate X 1 Extensive__0
Subtotal (maximum = 4)		3
TOTAL (maximum = 25)		20

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	X 3
	ii) Somewhat difficult to construct. No uncertainities in construction.	__2
	iii) Very difficult to construct and/or significant uncertainities in construction.	__1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	__2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	__1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	__2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		9
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	__ 2
	ii) Required coordination is normal.	X 1
	iii) Extensive Coordination is required.	__0
Subtotal (maximum = 2)		1
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No __0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No __0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No __0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		13

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Groundwater Remediation
6B) POTW

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___0 No _X_4
	o Can the Short-term risk be easily controlled?	Yes ___1 No ___0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___0 No ___2
Subtotal (maximum = 4)		4
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___0 No _X_4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___3 No ___0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr___1 ≥2yr_X_0
	o Required duration of the mitigative effort to control short-term risk.	<2yr_X_1 >2yr___0
Subtotal (maximum = 2)		1
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	___3 _X_1 ___0
Subtotal (maximum = 3)		1
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	Yes _X_3 No ___0
Subtotal (maximum = 3)		3

Table 4.1 (cont'd)

Groundwater Remediation
6B) POTW

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr___3 20-25yr___2 15-20yr___1 <15yr ___0
Subtotal (Maximum = 3)		0
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None_X_ 3 <25%___ 2 25-50%___ 1 ≥50% ___ 0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 8.)**	Yes ___ 0 No _X_ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		5
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr___ 1 >5yr_X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "IV")	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident _X_1 Somewhat to not confident ___0
	iv) Relative degree of long-term monitoring required **(compare with other remedial** alternatives)	Minimum ___2 Moderate _X_1 Extensive__0
Subtotal (maximum = 4)		2
TOTAL (maximum = 25)		20

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	X 3
	ii) Somewhat difficult to construct. No uncertainities in construction.	__2
	iii) Very difficult to construct and/or significant uncertainities in construction.	__1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	__2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	__1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	__2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		9
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	__ 2
	ii) Required coordination is normal.	X 1
	iii) Extensive Coordination is required.	__0
Subtotal (maximum = 2)		1
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No __0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No __0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No __0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		13

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Groundwater Remediation
6C) Surface Water

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___ 0 No _X_ 4
	o Can the Short-term risk be easily controlled?	Yes ___ 1 No ___ 0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___ 0 No ___ 2
Subtotal (maximum = 4)		4
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes _X_ 0 No ___ 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes _X_ 3 No ___ 0
Subtotal (maximum = 4)		3
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr ___ 1 ≥2yr _X_ 0
	o Required duration of the mitigative effort to control short-term risk.	<2yr _X_ 1 >2yr ___ 0
Subtotal (maximum = 2)		1
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	_X_ 3 ___ 1 ___ 0
Subtotal (maximum = 3)		3
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	Yes _X_ 3 No ___ 0
Subtotal (maximum = 3)		3

Table 4.1 (cont'd)

Groundwater Remediation
6C) Surface Water

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr___ 3 20-25yr___ 2 15-20yr___ 1 <15yr ___ 0
Subtotal (Maximum = 3)		0
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None X 3 <25% ___ 2 25-50% ___ 1 ≥50% ___ 0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 8.)**	Yes X 0 No ___ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No X 1
	iv) Is the treated residual mobile?	Yes X 0 No ___ 1
Subtotal (maximum = 5)		4
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr ___ 1 >5yr X 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no, go to "IV")**	Yes X 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident X 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required **(compare with other remedial alternatives)**	Minimum ___ 2 Moderate ___ 1 Extensive X 0
Subtotal (maximum = 4)		1
TOTAL (maximum = 25)		19

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	___3
	ii) Somewhat difficult to construct. No uncertainities in construction.	X 2
	iii) Very difficult to construct and/or significant uncertainities in construction.	___1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	___2
	ii) Somewhat likely	X 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		6
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	__ 2
	ii) Required coordination is normal.	___1
	iii) Extensive Coordination is required.	X 0
Subtotal (maximum = 2)		0
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		9

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

APPENDIX B

REMEDIAL ALTERNATIVE COST ESTIMATE TABLES

ALTERNATIVE 2
LIMITED ACTION
DETAILED COST ANALYSIS
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

DESCRIPTION(a)	QUANTITY	UNIT	UNIT COST(b)	CAPITAL COST	YEARLY O & M	TOTAL COST(c)
INSTITUTIONAL ACTIONS						
Deed restrictions	1	LS	$20,000	$20,000	$0	$20,000
Groundwater Monitoring Activities						
Install wells	2	Well	$2,500	$5,000	$0	$5,000
Monitoring	9	Well	$1,000	$0	$9,000	$121,617
Site Restrictions (Fence, Gate, Signs)	7,000	LF	$13	$91,000	$4,550	$152,484
Maintenance Activities (Mowing, Insp.)	1	Year	$2,000	$0	$2,000	$27,026
TOTAL DIRECT COST (TDC)				$116,000		$326,128
INDIRECT COSTS						
Engineering - 15% of TDC				$17,400	$0	$17,400
Contingency - 25% of TDC				$29,000	$0	$29,000
Health & Safety monitoring - 4% of TDC				$4,640	$0	$4,640
Legal Fees - 3% of TDC				$3,480	$0	$3,480
License/Deed/Permit - 2% of TDC				$2,320	$0	$2,320
Mobilization/DeMobilization - 2% of TDC				$2,320	$0	$2,320
TOTAL COSTS				**$175,160**	**$15,550**	**$385,288**

NOTES:
a. See Appendix C for Direct Capital Cost Basis Forms.
b. Labor & Equipment unit rate @ level D protection.
c. Includes capital costs plus present worth O&M costs for 30 years.

ALTERNATIVE 3A
CONTAINMENT (CAP LANDFILL & JUNKYARD)
DETAILED COST ANALYSIS
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

DESCRIPTION(a)	QUANTITY	UNIT	UNIT COST(b)	CAPITAL COST	YEARLY O & M	TOTAL COST(c)
INSTITUTIONAL ACTIONS						
Deed restrictions	1	LS	$20,000	$20,000	$0	$20,000
Groundwater Monitoring Activities						
Install wells	4	Well	$2,500	$10,000	$0	$10,000
Monitoring	8	Well	$1,000	$0	$8,000	$108,104
Site Restrictions (Fence, Gate, Signs)	7,000	LF	$13	$91,000	$4,550	$152,484
Maintenance Activities (Mowing, Insp.)	1	Year	$15,000	$0	$15,000	$202,696
COMPOSITE CAP						
Clearing & Grubbing	61	Ac	$1,300	$79,300	$0	$79,300
Subbase prep. (6 in. X 61 Ac.)	49,207	CY	$4	$196,827	$0	$196,827
Geotextile (61 Ac.)	2,657,160	SF	$0.2	$531,432	$0	$531,432
Gas Venting Layer (12 in. X 61 Ac.)	98,413	CY	$12	$1,180,960	$0	$1,180,960
HDPE Liner (60 Mil X 61 Ac.)	2,657,160	SF	$0.5	$1,328,580	$0	$1,328,580
Soil Fill (24 in. X 61 Ac.)	196,827	CY	$12	$2,361,920	$0	$2,361,920
Topsoil (6 in. X 61 Ac.)	49,207	CY	$15	$738,100	$0	$738,100
Revegetation	61	Ac	$4,000	$244,000	$0	$244,000
SURFACE WATER/SEDIMENT CONTROL						
Excavation/Const. of Drainage Structures	84,000	CY	$7	$588,000	$0	$588,000
Temporary Silt Fence	7,000	LF	$2.5	$17,500	$0	$17,500
PERIMETER ACCESS ROAD(s)	7,000	LF	$5	$35,000	$0	$35,000
GAS VENTING SYSTEM	61	Nos.	$1,500	$91,500	$0	$91,500
JUNK YARD PURCHASE	1	LS	$250,000	$250,000	$0	$250,000
TOTAL DIRECT COST (TDC)				$7,764,119		$8,136,403
INDIRECT COSTS						
Engineering - 15% of TDC				$1,164,618	$0	$1,164,618
Contingency - 25% of TDC				$1,941,030	$0	$1,941,030
Health & Safety monitoring - 4% of TDC				$310,565	$0	$310,565
Legal Fees - 3% of TDC				$232,924	$0	$232,924
License/Deed/Permit - 2% of TDC				$155,282	$0	$155,282
Mobilization/DeMobilization - 2% of TDC				$155,282	$0	$155,282
TOTAL COSTS				**$11,723,819**	**$27,550**	**$12,096,103**

NOTES:

a. See Appendix C for Direct Capital Cost Basis Forms.

b. Labor & Equipment unit rate @ level D protection.

c. Includes capital costs plus present worth O&M costs for 30 years.

ALTERNATIVE 3B
CONSOLIDATE SOIL AND SEDIMENT/CAP LANDFILL
DETAILED COST ANALYSIS
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

DESCRIPTION(a)	QUANTITY	UNIT	UNIT COST(b)	CAPITAL COST	YEARLY O & M	TOTAL COST(c)
INSTITUTIONAL ACTIONS						
Deed restrictions	1	LS	$20,000	$20,000	$0	$20,000
Groundwater Monitoring Activities						
Install wells	2	Well	$2,500	$5,000	$0	$5,000
Monitoring	7	Well	$1,000	$0	$7,000	$94,591
Site Restrictions (Fence, Gate, Signs)	5,100	LF	$13	$66,300	$6,630	$155,891
Maintenance Activities (Mowing, Insp.)	1	Year	$15,000	$0	$15,000	$202,696
COMPOSITE CAP						
Clearing & Grubbing	30	Ac	$1,300	$39,000	$0	$39,000
Subbase prep. (6 in. X 23 Ac.)	18,553	CY	$4	$74,213	$0	$74,213
Geotextile (23 Ac.)	1,001,880	SF	$0.2	$200,376	$0	$200,376
Gas Venting Layer (12 in. X 23 Ac.)	37,107	CY	$12	$445,280	$0	$445,280
HDPE Liner (60 Mil X 23 Ac.)	1,001,880	SF	$0.5	$500,940	$0	$500,940
Soil Fill (24 in. X 23 Ac.)	74,213	CY	$12	$890,560	$0	$890,560
Topsoil (6 in. X 30 Ac.)	24,200	CY	$15	$363,000	$0	$363,000
Revegetation	30	Ac	$4,000	$120,000	$0	$120,000
SURFACE WATER/SEDIMENT CONTROL						
Excavation/Const. of Drainage Structures	61,200	CY	$7	$428,400	$0	$428,400
Temporary Silt Fence	5,100	LF	$2.5	$12,750	$0	$12,750
PERIMETER ACCESS ROAD(s)	5,100	LF	$5	$25,500	$0	$25,500
GAS VENTING SYSTEM	23	Nos.	$1,500	$34,500	$0	$34,500
CONSOLIDATE SOIL/SEDIMENTS	30,000	CY	$13	$390,000	$0	$390,000
AREA RESTORATION	30,000	CY	$15	$450,000	$0	$450,000
GROUNDWATER EXTRACTION SYSTEM						
Collection Trench	18,650	SF	$13	$242,450	$0	$242,450
Collection Wells/Pumps/Station	3	Unit	$10,000	$30,000	$0	$30,000
Pre-Treatment (Contingency)	3,140,000	GPY	$0.025	$650,000	$78,500	$1,710,774
Discharge to POTW (Contingency)	3,140,000	GPY	$0.015	$0	$47,100	$636,464
TOTAL DIRECT COST (TDC)				$4,988,269		$7,072,386
INDIRECT COSTS						
Engineering - 15% of TDC				$748,240	$0	$748,240
Contingency - 25% of TDC				$1,247,067	$0	$1,247,067
Health & Safety monitoring - 4% of TDC				$199,531	$0	$199,531
Legal Fees - 3% of TDC				$149,648	$0	$149,648
License/Deed/Permit - 2% of TDC				$99,765	$0	$99,765
Mobilization/DeMobilization - 2% of TDC				$99,765	$0	$99,765
TOTAL COSTS				**$7,532,287**	**$154,230**	**$9,616,403**

NOTES:
a. See Appendix C for Direct Capital Cost Basis Forms.
b. Labor & Equipment unit rate @ level D protection.
c. Includes capital costs plus present worth O&M costs for 30 years.

ALTERNATIVE 3C
CONSOLIDATE SOIL & SEDIMENT/CAP LANDFILL & JUNKYARD
DETAILED COST ANALYSIS
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

DESCRIPTION(a)	QUANTITY	UNIT	UNIT COST(b)	CAPITAL COST	YEARLY O & M	TOTAL COST(c)
INSTITUTIONAL ACTIONS						
Deed restrictions	1	LS	$20,000	$20,000	$0	$20,000
Groundwater Monitoring Activities						
Install wells	2	Well	$2,500	$5,000	$0	$5,000
Monitoring	8	Well	$1,000	$0	$8,000	$108,104
Site Restrictions (Fence, Gate, Signs)	5,900	LF	$13	$76,700	$7,670	$180,345
Maintenance Activities (Mowing, Insp.)	1	Year	$15,000	$0	$15,000	$202,696
COMPOSITE CAP						
Clearing & Grubbing	61	Ac	$1,300	$79,300	$0	$79,300
Subbase prep. (6 in. X 34 Ac.)	27,427	CY	$4	$109,707	$0	$109,707
Geotextile (34 Ac.)	1,481,040	SF	$0.2	$296,208	$0	$296,208
Gas Venting Layer (12 in. X 34 Ac.)	54,853	CY	$12	$658,240	$0	$658,240
HDPE Liner (60 Mil X 34 Ac.)	1,481,040	SF	$0.5	$740,520	$0	$740,520
Soil Fill (24 in. X 34 Ac.)	109,707	CY	$12	$1,316,480	$0	$1,316,480
Topsoil (6 in. X 61 Ac.)	49,207	CY	$15	$738,100	$0	$738,100
Revegetation	61	Ac	$4,000	$244,000	$0	$244,000
SURFACE WATER/SEDIMENT CONTROL						
Excavation/Const. of Drainage Structures	70,800	CY	$7	$495,600	$0	$495,600
Temporary Silt Fence	5,900	LF	$2.5	$14,750	$0	$14,750
PERIMETER ACCESS ROAD(s)	5,900	LF	$5	$29,500	$0	$29,500
GAS VENTING SYSTEM	34	Nos.	$1,500	$51,000	$0	$51,000
CONSOLIDATE SOIL/SEDIMENTS	30,000	CY	$13	$390,000	$0	$390,000
AREA RESTORATION	30,000	CY	$15	$450,000	$0	$450,000
GROUNDWATER EXTRACTION SYSTEM						
Collection Trench	18,650	SF	$13	$242,450	$0	$242,450
Collection Wells/Pumps/Station	3	Unit	$10,000	$30,000	$0	$30,000
Pre-Treatment (Contingency)	3,140,000	GPY	$0.025	$650,000	$78,500	$1,710,774
Discharge to POTW (Contingency)	3,140,000	GPY	$0.015	$0	$47,100	$636,464
JUNK YARD PURCHASE	1	LS	$250,000	$250,000	$0	$250,000
TOTAL DIRECT COST (TDC)				$6,887,555		$8,999,238
INDIRECT COSTS						
Engineering - 15% of TDC				$1,033,133	$0	$1,033,133
Contingency - 25% of TDC				$1,721,889	$0	$1,721,889
Health & Safety monitoring - 4% of TDC				$275,502	$0	$275,502
Legal Fees - 3% of TDC				$206,627	$0	$206,627
License/Deed/Permit - 2% of TDC				$137,751	$0	$137,751
Mobilization/DeMobilization - 2% of TDC				$137,751	$0	$137,751
TOTAL COSTS				**$10,400,208**	**$156,270**	**$12,511,890**

NOTES:
a. See Appendix C for Direct Capital Cost Basis Forms.
b. Labor & Equipment unit rate @ level D protection.
c. Includes capital costs plus present worth O&M costs for 30 years.

ALTERNATIVE 3D
CONSOLIDATE SOIL AND SEDIMENT & JUNKYARD/CAP LANDFILL
DETAILED COST ANALYSIS
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

DESCRIPTION(a)	QUANTITY	UNIT	UNIT COST(b)	CAPITAL COST	YEARLY O & M	TOTAL COST(c)
INSTITUTIONAL ACTIONS						
Deed restrictions	1	LS	$20,000	$20,000	$0	$20,000
Groundwater Monitoring Activities						
Install wells	2	Well	$2,500	$5,000	$0	$5,000
Monitoring	8	Well	$1,000	$0	$8,000	$108,104
Site Restrictions (Fence, Gate, Signs)	5,100	LF	$13	$66,300	$6,630	$155,891
Maintenance Activities (Mowing, Insp.)	1	Year	$15,000	$0	$15,000	$202,696
COMPOSITE CAP						
Clearing & Grubbing	45	Ac	$1,300	$58,500	$0	$58,500
Subbase prep. (6 in. X 23 Ac.)	18,553	CY	$4	$74,213	$0	$74,213
Geotextile (23 Ac.)	1,001,880	SF	$0.2	$200,376	$0	$200,376
Gas Venting Layer (12 in. X 23 Ac.)	37,107	CY	$12	$445,280	$0	$445,280
HDPE Liner (60 Mil X 23 Ac.)	1,001,880	SF	$0.5	$500,940	$0	$500,940
Soil Fill (24 in. X 23 Ac.)	74,213	CY	$12	$890,560	$0	$890,560
Topsoil (6 in. X 45 Ac.)	36,300	CY	$15	$544,500	$0	$544,500
Revegetation	45	Ac	$4,000	$180,000	$0	$180,000
SURFACE WATER/SEDIMENT CONTROL						
Excavation/Const. of Drainage Structures	61,200	CY	$7	$428,400	$0	$428,400
Temporary Silt Fence	5,100	LF	$2.5	$12,750	$0	$12,750
PERIMETER ACCESS ROAD(s)	5,100	LF	$5	$25,500	$0	$25,500
GAS VENTING SYSTEM	23	Nos.	$1,500	$34,500	$0	$34,500
CONSOLIDATE SOIL/SEDIMENTS	103,000	CY	$13	$1,339,000	$0	$1,339,000
AREA RESTORATION	103,000	CY	$15	$1,545,000	$0	$1,545,000
GROUNDWATER EXTRACTION SYSTEM						
Collection Trench	18,650	SF	$13	$242,450	$0	$242,450
Collection Wells/Pumps/Station	3	Unit	$10,000	$30,000	$0	$30,000
Pre-Treatment (Contingency)	3,140,000	GPY	$0.025	$650,000	$78,500	$1,710,774
Discharge to POTW (Contingency)	3,140,000	GPY	$0.015	$0	$47,100	$636,464
JUNKYARD TEMPORARY RELOCATION	12	Month	$20,000	$240,000		$240,000
TOTAL DIRECT COST (TDC)				$7,533,269		$9,630,899
INDIRECT COSTS						
Engineering - 15% of TDC				$1,129,990	$0	$1,129,990
Contingency - 25% of TDC				$1,883,317	$0	$1,883,317
Health & Safety monitoring - 4% of TDC				$301,331	$0	$301,331
Legal Fees - 3% of TDC				$225,998	$0	$225,998
License/Deed/Permit - 2% of TDC				$150,665	$0	$150,665
Mobilization/DeMobilization - 2% of TDC				$150,665	$0	$150,665
TOTAL COSTS				**$11,375,237**	**$155,230**	**$13,472,866**

NOTES:

a. See Appendix C for Direct Capital Cost Basis Forms.

b. Labor & Equipment unit rate @ level D protection.

c. Includes capital costs plus present worth O&M costs fro 30 years.

ALTERNATIVE 3E
CONSOLIDATE SOIL & SEDIMENT/CAP LANDFILL/INSTALL CUT-OFF WALL
DETAILED COST ANALYSIS
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

DESCRIPTION(a)	QUANTITY	UNIT	UNIT COST(b)	CAPITAL COST	YEARLY O & M	TOTAL COST(c)
INSTITUTIONAL ACTIONS						
Deed restrictions	1	LS	$20,000	$20,000	$0	$20,000
Groundwater Monitoring Activities						
Install wells	2	Well	$2,500	$5,000	$0	$5,000
Monitoring	7	Well	$1,000	$0	$7,000	$94,591
Site Restrictions (Fence, Gate, Signs)	5,100	LF	$13	$66,300	$6,630	$155,891
Maintenance Activities (Mowing, Insp.)	1	Year	$15,000	$0	$15,000	$202,696
COMPOSITE CAP						
Clearing & Grubbing	30	Ac	$1,300	$39,000	$0	$39,000
Subbase prep. (6 in. X 23 Ac.)	18,553	CY	$4	$74,213	$0	$74,213
Geotextile (23 Ac.)	1,001,880	SF	$0.2	$200,376	$0	$200,376
Gas Venting Layer (12 in. X 23 Ac.)	37,107	CY	$12	$445,280	$0	$445,280
HDPE Liner (60 Mil X 23 Ac.)	1,001,880	SF	$0.5	$500,940	$0	$500,940
Soil Fill (24 in. X 23 Ac.)	74,213	CY	$12	$890,560	$0	$890,560
Topsoil (6 in. X 30 Ac.)	24,200	CY	$15	$363,000	$0	$363,000
Revegetation	30	Ac	$4,000	$120,000	$0	$120,000
SURFACE WATER/SEDIMENT CONTROL						
Excavation/Const. of Drainage Structures	61,200	CY	$7	$428,400	$0	$428,400
Temporary Silt Fence	5,100	LF	$2.5	$12,750	$0	$12,750
PERIMETER ACCESS ROAD(s)	5,100	LF	$5	$25,500	$0	$25,500
CUT-OFF WALL (18 IN. THICK)	76,500	SF	$11.3	$864,450	$0	$864,450
GAS VENTING SYSTEM	23	Nos.	$1,500	$34,500	$0	$34,500
CONSOLIDATE SOIL/SEDIMENTS	30,000	CY	$13	$390,000	$0	$390,000
AREA RESTORATION	30,000	CY	$15	$450,000	$0	$450,000
GROUNDWATER TREATMENT SYSTEM						
Collection Trenches	51,000	SF	$13	$663,000		$663,000
Collection Wells/Pumps/Station	5	Units	$10,000	$50,000		$50,000
Pre-Treatment	400,000	GPY	$0.025	$650,000	$10,000	$785,130
Discharge to POTW	400,000	GPY	$0.015	$0	$6,000	$81,078
TOTAL DIRECT COST (TDC)				$6,293,269		$6,896,356
INDIRECT COSTS						
Engineering - 15% of TDC				$943,990	$0	$943,990
Contingency - 25% of TDC				$1,573,317	$0	$1,573,317
Health & Safety monitoring - 4% of TDC				$251,731	$0	$251,731
Legal Fees - 3% of TDC				$188,798	$0	$188,798
License/Deed/Permit - 2% of TDC				$125,865	$0	$125,865
Mobilization/DeMobilization - 2% of TDC				$125,865	$0	$125,865
TOTAL COSTS				**$9,502,837**	**$44,630**	**$10,105,924**

NOTES:
a. See Appendix C for Direct Capital Cost Basis Forms.
b. Labor & Equipment unit rate @ level D protection.
c. Includes capital costs plus present worth O&M costs for 30 years.

ALTERNATIVE 3F
CONSOLIDATE SOIL & SEDIMENT/CAP LANDFILL & JUNKYARD/INSTALL CUT-OFF WALL
DETAILED COST ANALYSIS
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

DESCRIPTION(a)	QUANTITY	UNIT	UNIT COST(b)	CAPITAL COST	YEARLY O & M	TOTAL COST(c)
INSTITUTIONAL ACTIONS						
Deed restrictions	1	LS	$20,000	$20,000	$0	$20,000
Groundwater Monitoring Activities						
Install wells	2	Well	$2,500	$5,000	$0	$5,000
Monitoring	8	Well	$1,000	$0	$8,000	$108,104
Site Restrictions (Fence, Gate, Signs)	5,900	LF	$13	$76,700	$7,670	$180,345
Maintenance Activities (Mowing, Insp.)	1	Year	$15,000	$0	$15,000	$202,696
COMPOSITE CAP						
Clearing & Grubbing	61	Ac	$1,300	$79,300	$0	$79,300
Subbase prep. (6 in. X 61 Ac.)	27,427	CY	$4	$109,707	$0	$109,707
Geotextile (34 Ac.)	1,481,040	SF	$0.2	$296,208	$0	$296,208
Gas Venting Layer (12 in. X 34 Ac.)	54,853	CY	$12	$658,240	$0	$658,240
HDPE Liner (60 Mil X 34 Ac.)	1,481,040	SF	$0.5	$740,520	$0	$740,520
Soil Fill (24 in. X 34 Ac.)	109,707	CY	$12	$1,316,480	$0	$1,316,480
Topsoil (6 in. X 61 Ac.)	49,207	CY	$15	$738,100	$0	$738,100
Revegetation	61	Ac	$4,000	$244,000	$0	$244,000
SURFACE WATER/SEDIMENT CONTROL						
Excavation/Const. of Drainage Structures	70,800	CY	$7	$495,600	$0	$495,600
Temporary Silt Fence	5,900	LF	$2.5	$14,750	$0	$14,750
PERIMETER ACCESS ROAD(s)	5,900	LF	$5	$29,500	$0	$29,500
CUT-OFF WALL (18 IN. THICK)	88,500	SF	$11.3	$1,000,050	$0	$1,000,050
GAS VENTING SYSTEM	34	Nos.	$1,500	$51,000	$0	$51,000
CONSOLIDATE SOIL/SEDIMENTS	30,000	CY	$13	$390,000	$0	$390,000
AREA RESTORATION	30,000	CY	$15	$450,000	$0	$450,000
GROUNDWATER TREATMENT SYSTEM						
Collection Trenches	59,000	SF	$13	$767,000		$767,000
Collection Wells/Pumps/Station	7	Units	$10,000	$70,000		$70,000
Pre-Treatment	650,000	GPY	$0.025	$650,000	$16,250	$869,587
Discharge to POTW	650,000	GPY	$0.015	$0	$9,750	$131,752
JUNK YARD PURCHASE	1	LS	$250,000	$250,000	$0	$250,000
TOTAL DIRECT COST (TDC)				$8,452,155		$9,217,939
INDIRECT COSTS						
Engineering - 15% of TDC				$1,267,823	$0	$1,267,823
Contingency - 25% of TDC				$2,113,039	$0	$2,113,039
Health & Safety monitoring - 4% of TDC				$338,086	$0	$338,086
Legal Fees - 3% of TDC				$253,565	$0	$253,565
License/Deed/Permit - 2% of TDC				$169,043	$0	$169,043
Mobilization/DeMobilization - 2% of TDC				$169,043	$0	$169,043
TOTAL COSTS				**$12,762,754**	**$56,670**	**$13,528,538**

NOTES:

a. See Appendix C for Direct Capital Cost Basis Forms.

b. Labor & Equipment unit rate @ level D protection.

c. Includes capital costs plus presetn worth O&M costs for 30 years.

ALTERNATIVE 3G
CONSOLIDATE SOIL & SEDIMENT & JUNKYARD/CAP LANDFILL/INSTALL CUT-OFF WALL
DETAILED COST ANALYSIS
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

DESCRIPTION(a)	QUANTITY	UNIT	UNIT COST(b)	CAPITAL COST	YEARLY O & M	TOTAL COST(c)
INSTITUTIONAL ACTIONS						
Deed restrictions	1	LS	$20,000	$20,000	$0	$20,000
Groundwater Monitoring Activities						
Install wells	2	Well	$2,500	$5,000	$0	$5,000
Monitoring	8	Well	$1,000	$0	$8,000	$108,104
Site Restrictions (Fence, Gate, Signs)	5,100	LF	$13	$66,300	$6,630	$155,891
Maintenance Activities (Mowing, Insp.)	1	Year	$15,000	$0	$15,000	$202,696
COMPOSITE CAP						
Clearing & Grubbing	45	Ac	$1,300	$58,500	$0	$58,500
Subbase prep. (6 in. X 23 Ac.)	18,553	CY	$4	$74,213	$0	$74,213
Geotextile (23 Ac.)	1,001,880	SF	$0.2	$200,376	$0	$200,376
Gas Venting Layer (12 in. X 23 Ac.)	37,107	CY	$12	$445,280	$0	$445,280
HDPE Liner (60 Mil X 23 Ac.)	1,001,880	SF	$0.5	$500,940	$0	$500,940
Soil Fill (24 in. X 23 Ac.)	74,213	CY	$12	$890,560	$0	$890,560
Topsoil (6 in. X 45 Ac.)	36,300	CY	$15	$544,500	$0	$544,500
Revegetation	45	Ac	$4,000	$180,000	$0	$180,000
SURFACE WATER/SEDIMENT CONTROL						
Excavation/Const. of Drainage Structures	61,200	CY	$7	$428,400	$0	$428,400
Temporary Silt Fence	5,100	LF	$2.5	$12,750	$0	$12,750
PERIMETER ACCESS ROAD(s)	5,100	LF	$5	$25,500	$0	$25,500
CUT-OFF WALL (18 IN. THICK)	76,500	SF	$11.3	$864,450	$0	$864,450
GAS VENTING SYSTEM	23	Nos.	$1,500	$34,500	$0	$34,500
CONSOLIDATE SOIL/SEDIMENTS	103,000	CY	$13	$1,339,000	$0	$1,339,000
AREA RESTORATION	103,000	CY	$15	$1,545,000	$0	$1,545,000
GROUNDWATER TREATMENT SYSTEM						
Collection Trenches	51,000	SF	$13	$663,000	$0	$663,000
Collection Wells/Pumps/Station	5	Units	$10,000	$50,000	$0	$50,000
Pre-Treatment	400,000	GPY	$0.025	$650,000	$10,000	$785,130
Discharge to POTW	400,000	GPY	$0.015	$0	$6,000	$81,078
JUNKYARD TEMPORARY RELOCATION	12	Month	$20,000	$240,000	$0	$240,000
TOTAL DIRECT COST (TDC)				$8,838,269		$9,454,869
INDIRECT COSTS						
Engineering - 15% of TDC				$1,325,740	$0	$1,325,740
Contingency - 25% of TDC				$2,209,567	$0	$2,209,567
Health & Safety monitoring - 4% of TDC				$353,531	$0	$353,531
Legal Fees - 3% of TDC				$265,148	$0	$265,148
License/Deed/Permit - 2% of TDC				$176,765	$0	$176,765
Mobilization/DeMobilization - 2% of TDC				$176,765	$0	$176,765
TOTAL COSTS				**$13,345,787**	**$45,630**	**$13,962,387**

NOTES:
a. See Appendix C for Direct Capital Cost Basis Forms.
b. Labor & Equipment unit rate @ level D protection.
c. Includes capital costs plu present worth O&M costs for 30 years.

ALTERNATIVE 4
OFF-SITE DISPOSAL
DETAILED COST ANALYSIS
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

DESCRIPTION(a)	QUANTITY	UNIT	UNIT COST(b)	CAPITAL COST	YEARLY O & M	TOTAL COST(c)
INSTITUTIONAL ACTIONS						
Deed restrictions	1	LS	$20,000	$20,000	$0	$20,000
Groundwater Monitoring Activities						
Install wells	2	Well	$2,500	$5,000	$0	$5,000
Monitoring	8	Well	$1,000	$0	$8,000	$108,104
Site Restrictions (Fence, Gate, Signs)	5,100	LF	$13	$66,300	$6,630	$155,891
Maintenance Activities (Mowing, Insp.)	1	Year	$15,000	$0	$15,000	$202,696
EXCAVATE, TRANSPORT & DISPOSE CONTAMINATED SOILS/SEDIMENTS	873,000	CY	$70	$61,110,000	$0	$61,110,000
CONTROL MEASURES						
Construct Diversion Dikes/Berms	52,000	CY	$7	$364,000	$0	$364,000
Temporary Silt Fence	6,500	LF	$2.5	$16,250	$0	$16,250
SITE RESTORATION					$0	$0
Clean Fill/Topsoil	200,000	CY	$15	$3,000,000	$0	$3,000,000
Revegetation	34	Ac	$4,000	$136,000	$0	$136,000
JUNK YARD TEMPORARY RELOCATION	12	Mon.	$20,000	$240,000	$0	$240,000
TOTAL DIRECT COST (TDC)				$64,957,550		$65,357,941
INDIRECT COSTS						
Engineering - 4% of TDC				$2,598,302	$0	$2,598,302
Contingency - 20% of TDC				$12,991,510	$0	$12,991,510
Health & Safety monitoring - 4% of TDC				$2,598,302	$0	$2,598,302
Legal Fees - 3% of TDC				$1,948,727	$0	$1,948,727
License/Deed/Permit - 2% of TDC				$1,299,151	$0	$1,299,151
Mobilization/DeMobilization - 2% of TDC				$1,299,151	$0	$1,299,151
TOTAL COSTS				**$87,692,693**	**$29,630**	**$88,093,084**

NOTES:
a. See Appendix C for Direct Capital Cost Basis Forms.
b. Labor & Equipment unit rate @ level D protection.
c. Includes capital costs plus present worth O&M costs for 30 years.

APPENDIX C

COST ESTIMATE BASIS FORMS

BASIS FOR DIRECT CAPITAL COSTS FOR:
SITE RESTRICTIONS
INSTITUTIONAL ACTION
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS: Direct Capital Costs for installation of fence along the perimeter of the site, gate at the site entrance, and placement of signs.
Includes:
- labor for installing fence, gate(s) and signs
- material for fencing, gate(s), and signs
- equipment for installing fence, gate(s), and signs

CALCULATION: The length of the fence was estimated by measuring the perimeter of the site from the site base map. Direct Capital Cost was derived by multiplying the quantity of fence required by the unit cost for a 10 feet high chain link fence. Cost of signs and gate(s) was incorporated in the unit cost for the fence.

SOURCE: Unit Cost was based on vendor quotation.

SUMMARY OF UNIT COST:

LABOR, MATERIAL, & EQUIPMENT: $ 13 PER LINEAR FOOT

TOTAL UNIT COST: $ 13 PER LINEAR FOOT

BASIS FOR YEARLY O & M COSTS FOR:
MAINTENANCE ACTIVITIES
INSTITUTIONAL ACTION
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS: Yearly costs for Operation & Maintenance of the landfill.
Includes:

- labor for periodic grass mowing, check for deterioration, etc.
- equipment costs for these activities
- maintenance activities of storm water control structures
- report writing and submission requirements

CALCULATION: Annual costs were estimated based on the unit costs for maintenance activities performed at the following intervals:

1. The landfill will be inspected 4 times per year and grass will be mowed
2. The storm water control structures will be dredged annually.

SOURCE: Unit Cost was based on engineering estimates.

SUMMARY OF UNIT COST:

LABOR:	$ 12,000 PER YEAR
REPORT COST:	$ 3,000 PER YEAR
TOTAL UNIT COST:	$ 15,000 PER YEAR

BASIS FOR DIRECT CAPITAL COSTS FOR:
CLEARING & GRUBBING
COMPOSITE CAP INSTALLATION
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS: Direct Capital Costs for Clearing & Grubbing the landfill and adjacent area(s) to the extent of the fence.
Includes:
- labor to clear and grub
- material handling & disposal
- equipment cost

CALCULATION: The approximate surface area was measured from the base map.
Direct Capital Cost was derived by multiplying surface area by the unit clearing and grubbing cost.

SOURCE: Unit Cost is based on vendor information.

SUMMARY OF UNIT COST:

LABOR, EQUIPMENT & DISPOSAL: $ 1,300 PER ACRE

TOTAL UNIT COST: $ 1,300 PER ACRE

BASIS FOR DIRECT CAPITAL COSTS FOR:
SUBBASE PREPARATION
COMPOSITE CAP INSTALLATION
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS: Direct Capital Costs for preparing the subbase to place the cap on the landfill (area within the proposed toe of the landfill). The existing landfill will be regraded and the top 6 inches will be compacted using conventional earth moving equipment. Includes:

- labor to regrade and compact subbase
- material handling/temporary stockpiling
- equipment cost

CALCULATION: Approximate area (within the proposed toe of the landfill) was measured from a base map of the site and Direct Capital Cost was derived by multiplying the area with the estimated unit cost.

SOURCE: Unit Cost is based on costs incurred at other similar projects.

SUMMARY OF UNIT COST:

LABOR & EQUIPMENT: $ 4 PER CUBIC YARD

TOTAL UNIT COST: $ 4 PER CUBIC YARD

BASIS FOR DIRECT CAPITAL COSTS FOR:
GEOTEXTILE
COMPOSITE CAP INSTALLATION
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS: Direct Capital Costs for placement of Geotextile over the compacted subgrade of the landfill (including anchor trench).
Includes:
- labor to install
- cost of material
- equipment to install
- cost for anchor trench

CALCULATION: Approximate area (within the proposed toe of the landfill) was measured from a base map of the site and Direct Capital Cost was derived by multiplying the area with the estimated unit cost.

SOURCE: Unit Cost is based on vendor information.

SUMMARY OF UNIT COST:

MATERIAL & INSTALLATION COSTS: $ 0.2 PER SQUARE FOOT

TOTAL COST: $ 0.2 PER SQUARE FOOT

BASIS FOR DIRECT CAPITAL COSTS FOR:
GAS VENTING LAYER
COMPOSITE CAP INSTALLATION
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS: Direct Capital Costs for placement of a 12 inch Gas Venting Layer above the geotextile.
Includes:
- material cost
- transportation and placement of material
- equipment costs for spreading material
- labor costs

CALCULATION: Approximate volume was calculated by multiplying 12 inches by the measured area (within the proposed toe of the landfill). Direct Capital Cost was derived by multiplying this volume by the estimated unit cost.

SOURCE: Transportation and material costs were based on vendor quotation. Labor and equipment costs were based on information in the "Remedial Action at Waste Disposal Sites, Handbook (Revised)", October 1985.
Costs were updated to 1994 dollars using ENR Construction Cost Index data.

SUMMARY OF UNIT COST:

MATERIAL COST:	$ 7 PER CUBIC YARD
LABOR COST:	$ 3.5 PER CUBIC YARD
EQUIPMENT COST:	$ 1.5 PER CUBIC YARD
TOTAL UNIT COST:	$ 12 PER CUBIC YARD

BASIS FOR DIRECT CAPITAL COSTS FOR:
HDPE LINER (60 MIL.)
COMPOSITE CAP INSTALLATION
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS: Direct Capital Costs for placement of High Density PolyEthylene liner of 60 Mil. thickness over the Gas Venting Layer (including anchor trench). Includes:

- labor to install
- cost of material
- equipment to install
- cost for anchor trench

CALCULATION: Approximate area (within the proposed toe of the landfill) was measured from a base map of the site and Direct Capital Cost was derived by multiplying the area with the estimated unit cost.

SOURCE: Unit Cost is based on vendor information.

SUMMARY OF UNIT COST:

MATERIAL & INSTALLATION COSTS: $ 0.5 PER SQUARE FOOT

TOTAL UNIT COST: $ 0.5 PER SQUARE FOOT

BASIS FOR DIRECT CAPITAL COSTS FOR:
SOIL FILL (24 IN.)
COMPOSITE CAP INSTALLATION
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS: Direct Capital Costs for placement of 24 inches of Soil Fill over the HDPE liner.
Includes:

- material cost
- transportation and placement of fill
- equipment costs for spreading fill
- labor costs

CALCULATION: Approximate volume was calculated by multiplying 24 inches by the measured area within the proposed toe of the landfill. Direct Capital Cost was derived by multiplying this volume by the estimated unit cost.

SOURCE: Transportation and material costs were based on vendor quotation. Labor and equipment costs were based on information in the "Remedial Action at Waste Disposal Sites, Handbook (Revised)", October 1985.
Costs were updated to 1994 dollars using ENR Construction Cost Index data.

SUMMARY OF UNIT COST:

MATERIAL COST:	$ 7 PER CUBIC YARD
LABOR COST:	$ 3.5 PER CUBIC YARD
EQUIPMENT COST:	$ 1.5 PER CUBIC YARD
TOTAL UNIT COST:	$ 12 PER CUBIC YARD

BASIS FOR DIRECT CAPITAL COSTS FOR:
TOPSOIL (6 IN.)
COMPOSITE CAP INSTALLATION
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS: Direct Capital Costs for placement of 6 inches topsoil over the soil fill area and other disturbed areas of the site. The topsoil will be graded and spread using conventional earthmoving equipment.
Includes:
- labor to spread topsoil
- purchase material/material handling/temporary stockpiling
- equipment cost to spread topsoil

CALCULATION: Approximate volume was calculated by multiplying 6 inches with the measured area within the proposed toe of the landfill and other disturbed areas. Direct Capital Cost was derived by multiplying this volume by the estimated unit cost.

SOURCE: Transportation and material costs were based on vendor quotation. Labor and equipment costs were based on information in the "Remedial Action at Waste Disposal Sites, Handbook (Revised)", October 1985.
Costs were updated to 1994 dollars using ENR Construction Cost Index data.

SUMMARY OF UNIT COST:

MATERIAL & TRANSPORTATION COST:	$ 10 PER CUBIC YARD
LABOR COST:	$ 3.5 PER CUBIC YARD
EQUIPMENT COST:	$ 1.5 PER CUBIC YARD
TOTAL UNIT COST:	$ 15 PER CUBIC YARD

BASIS FOR DIRECT CAPITAL COSTS FOR:
REVEGETATION
COMPOSITE CAP INSTALLATION
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS: Direct Capital Costs for revegetation of the landfill cap, pond/wetland areas, and southern portion of landfill. Lime, fertilizer, and seed will be spread hydraulically over the areas.

Includes:

- labor to spread lime, fertilizer and seed
- purchase material/material handling/temporary stockpiling
- equipment cost to spread lime, fertilizer and seed

CALCULATION: Approximate area requiring vegetation was measured from the base map of the site. Direct Capital Cost was derived by multiplying the area with the estimated unit cost.

SOURCE: Unit Cost was based on vendor information.

SUMMARY OF UNIT COST:

LABOR, MATERIAL & EQUIPMENT	$ 4,000 PER ACRE
TOTAL UNIT COST:	$ 4,000 PER ACRE

BASIS FOR DIRECT CAPITAL COSTS FOR:
DEED RESTRICTIONS
INSTITUTIONAL ACTION
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS: Direct Capital Costs for obtaining groundwater use restrictions for the site, junkyard, and neighboring properties and excavation restrictions at the site and junkyard.
Includes:
- application and/or permit fees
- attorney fees
- associated meeting(s) costs

CALCULATION: Based on total administrative fees associated with previous deed restriction activities at similar sites.

SOURCE: Unit Cost was based on costs incurred at other similar projects and the nature of restrictions that are required.

SUMMARY OF UNIT COST:

ADMINISTRATIVE COSTS:	$20,000
TOTAL UNIT COST:	$20,000

BASIS FOR DIRECT CAPITAL COSTS FOR:
GROUNDWATER MONITORING ACTIVITIES (INSTALLATION OF WELLS)
INSTITUTIONAL ACTION
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS: Direct Capital Costs for installing monitoring wells along the perimeter of the landfill property to monitor groundwater quality.
Includes:
- labor for installing wells
- material for installing wells
- equipment for installing wells

CALCULATION: The number of wells was calculated based on the 6 NYCRR Part 360 spacing requirement (i.e., a minimum of 500 feet apart downgradient and a minimum of 1500 apart upgradient) for sanitary landfills.

SOURCE: Unit Cost was based on vendor quotation.

SUMMARY OF UNIT COST:

LABOR, MATERIAL, & EQUIPMENT: **(to install one well to a depth of 30')**	$ 2,500 PER WELL
TOTAL UNIT COST:	$ 2,500 PER WELL

BASIS FOR YEARLY O & M COSTS FOR:
GROUNDWATER MONITORING ACTIVITIES (ANNUAL MONITORING)
INSTITUTIONAL ACTION
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS: Yearly costs for Operation & Maintenance of monitoring wells along the perimeter of the site to monitor groundwater quality.
Includes:

- labor to sample the wells at specified intervals of time
- laboratory costs for analysis and QA/QC
- report writing and submission requirements
- associated maintenance activities

CALCULATION: The number of sampling events per year and number of samples to be collected for each event was based on 6 NYCRR 360 requirements (Quarterly for the first two years, and semi-annually thereafter). Unit cost was derived by incorporating labor costs, laboratory costs, and reporting costs for one year.

SOURCE: Laboratory Costs were based on vendor quotation and labor & reporting costs were based on engineering estimate.

SUMMARY OF UNIT COST:

LABOR:	$ 5,000 PER YEAR
LABORATORY COST:	$ 6,000 PER YEAR
REPORT COST:	$ 4,000 PER YEAR
TOTAL UNIT COST:	$ 15,000 PER YEAR

BASIS FOR DIRECT CAPITAL COSTS FOR:
JUNK YARD PURCHASE
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS: Direct Capital Costs for purchasing the Junkyard.
Includes:
- Property purchase

CALCULATION: Lump sum estimated cost.

SOURCE: Unit Cost was based on the assessed value of the property, from the city of Buffalo Assessor's office.

SUMMARY OF UNIT COST:

PURCHASE PRICE	$ 250,000 LUMPSUM
TOTAL UNIT COST:	$ 250,000 LUMPSUM

BASIS FOR DIRECT CAPITAL COSTS FOR:
JUNK YARD TEMPORARY RELOCATION
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS: Direct Capital Costs for temporarily relocating the junkyard.
Includes:

- Moving expenses
- application and/or permit fees
- rental cost for a similar piece of property

CALCULATION: Based on estimated number of cars requiring movement, estimated moving time and 12 month temporary relocation period.

SOURCE: Unit Cost was based on engineering estimates.

SUMMARY OF UNIT COST:

MOVING, RENTAL, & ASSOCIATED EXPENSES:	$ 20,000 PER MONTH
TOTAL UNIT COST:	$ 20,000 PER MONTH

BASIS FOR DIRECT CAPITAL COSTS FOR:
AREA RESTORATION
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS: Direct Capital Costs for restoration of the area subjected to excavation and/or dredging as part of the remedial action.
Includes:

- Cost of replacement material
- transportation and placement of replacement material
- equipment costs for spreading/grading
- labor costs

CALCULATION: Approximate volume was calculated by multiplying cross-sectional of excavated/dredge soil and/or sediment with the measured surface area subjected to consolidation.
Direct Capital Cost was derived by multiplying the volume and the estimated unit cost.

SOURCE: Transportation and material costs were based on vendor quotation. Labor and equipment costs were based on information in the "Remedial Action at Waste Disposal Sites, Handbook (Revised)", October 1985.
Costs were updated to 1994 dollars using ENR Construction Cost Index data.

SUMMARY OF UNIT COST:

MATERIAL & TRANSPORTATION COST:	$ 8 PER CUBIC YARD
LABOR COST:	$ 4 PER CUBIC YARD
EQUIPMENT COST:	$ 3 PER CUBIC YARD
TOTAL UNIT COST:	$ 15 PER CUBIC YARD

BASIS FOR DIRECT CAPITAL COSTS FOR:
EXCAVATION/CONSTRUCTION OF DRAINAGE STRUCTURES
SURFACE WATER/SEDIMENT CONTROL
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS: Direct Capital Costs for excavation and construction of trenches, sedimentation basin and, associated spillways for surface water management.
Includes:

- material cost for geotextile, riprap, etc.
- equipment costs for excavation, hauling, and grading
- labor costs

CALCULATION: The peak runoff was estimated using the HELP model for the landfill area. Approximate perimeter of the landfill was measured. The cross-sectional areas of the drainage control structures was estimated to handle the peak runoff for a 25 year storm event. Direct Capital Cost was derived by multiplying the quantity of material handled/placed times the estimated unit cost. Costs for sedimentation basin and spillways were incorporated into the unit cost of construction of trenches.

SOURCE: Transportation and material costs were based on vendor quotation. Labor and equipment costs were based on information in the "Remedial Action at Waste Disposal Sites, Handbook (Revised)", October 1985.
Costs were updated to 1994 dollars using ENR Construction Cost Index data.

SUMMARY OF UNIT COST:

LABOR, MATERIAL, & EQUIPMENT	$ 7 PER CUBIC YARD
TOTAL UNIT COST:	$ 7 PER CUBIC YARD

BASIS FOR DIRECT CAPITAL COSTS FOR:
GAS VENTING SYSTEM
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS: Direct Capital Costs for installation of Gas Venting Well, using conventional hydraulic rotary equipment.
Includes:
- material cost for drilling, stone, piping, etc.
- equipment costs for drilling, stone, piping, etc.
- labor costs

CALCULATION: Approximate number of wells was estimated based on 6 NYCRR Part 360 requirement of one minimum of one vent per acre of composite cap. The wells will be installed to an average depth of 17 feet into the refuse, and exposed 3 feet above final elevation of the composite cap.

SOURCE: Unit Cost was based on vendor information.

SUMMARY OF UNIT COST:

LABOR, MATERIAL, & EQUIPMENT **(to install one well, 20 feet X $ 50 per foot)**	$ 1,500 PER WELL
TOTAL UNIT COST:	$ 1,500 PER WELL

BASIS FOR DIRECT CAPITAL COSTS FOR:
CUT-OFF WALL
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS: Direct Capital Costs for construction of a bentonite slurry Cut-off wall (18 in. thick) along the perimeter of the proposed toe of the landfill.
Includes:
- labor for constructing wall
- bentonite purchase costs
- equipment for excavation, placement and compaction
- equipment for pumping water during construction
- material for temporary soil retaining requirements

CALCULATION: The perimeter of the proposed toe of the landfill was measured from a base map of the site and multiplied by an average depth of 15 feet. Direct Capital Cost was derived by multiplying the quantity of wall required by the unit cost. Costs to pump water and placement of temporary soil retaining structures during construction was incorporated in the unit cost.

SOURCE: Transportation and material costs were based on vendor quotation. Labor and equipment costs were based on information in the "Remedial Action at Waste Disposal Sites, Handbook (Revised)", October 1985.
Costs were updated to 1994 dollars using ENR Construction Cost Index data.

SUMMARY OF UNIT COST:

LABOR, MATERIAL, & EQUIPMENT: $ 11.3 PER SQUARE FOOT

TOTAL UNIT COST: $ 11.3 PER SQUARE FOOT

BASIS FOR DIRECT CAPITAL COSTS FOR:
ACCESS ROAD
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS:	Direct Capital Costs for construction of Access Road along the perimeter of the site. Includes: - labor for constructing perimeter road - material for stone and soil - equipment for placement and compaction
CALCULATION:	The perimeter of the site was measured from a base map of the site and the Direct Capital Cost was derived by multiplying this quantity by the estimated unit cost.
SOURCE:	Transportation and material costs were based on vendor quotation. Labor and equipment costs were based on information in the "Remedial Action at Waste Disposal Sites, Handbook (Revised)", October 1985. Costs were updated to 1994 dollars using ENR Construction Cost Index data.

SUMMARY OF UNIT COST:

LABOR, MATERIAL, & EQUIPMENT:	$ 5 PER LINEAR FOOT
TOTAL UNIT COST:	$ 5 PER LINEAR FOOT

BASIS FOR DIRECT CAPITAL COSTS FOR:
TEMPORARY SILT FENCE
SURFACE WATER/SEDIMENT CONTROL
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS: Direct Capital Costs for installation of perimeter silt fence and associated supports. Includes:

- material cost
- equipment costs for installation
- labor costs

CALCULATION: Approximate length of the perimeter of the site was measured and was multiplied by the estimated unit cost.

SOURCE: Transportation and material costs were based on vendor quotation. Labor and equipment costs were based on information in the "Remedial Action at Waste Disposal Sites, Handbook (Revised)", October 1985.
Costs were updated to 1994 dollars using ENR Construction Cost Index data.

SUMMARY OF UNIT COST:

LABOR, MATERIAL, & EQUIPMENT	$ 2.50 PER LINEAR FOOT
TOTAL UNIT COST:	$ 2.50 PER LINEAR FOOT

BASIS FOR DIRECT CAPITAL COSTS FOR:
EXCAVATION/CONSTRUCTION OF DRAINAGE STRUCTURES
SURFACE WATER/SEDIMENT CONTROL
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS: Direct Capital Costs for excavation and construction of trenches, sedimentation basin and, associated spillways for surface water management.
Includes:
- material cost for geotextile, riprap, etc.
- equipment costs for excavation, hauling, and grading
- labor costs

CALCULATION: The peak runoff was estimated using the HELP model for the landfill area. Approxim perimeter of the landfill was measured. The cross-sectional areas of the drainage contr structures was estimated to handle the peak runoff for a 25 year storm event. Direct Capital Cost was derived by multiplying the quantity of material handled/placed times the estimated unit cost. Costs for sedimentation basin and spillways was incorporated into the unit cost of construction of trenches.

SOURCE: Transportation and material costs were based on vendor quotation. Labor and equipment costs were based on information in the "Remedial Action at Waste Disposal Sites, Handbook (Revised)", October 1985.
Costs were updated to 1994 dollars using ENR Construction Cost Index data.

SUMMARY OF UNIT COST:

LABOR, MATERIAL, & EQUIPMENT	$ 7 PER CUBIC YARD
TOTAL UNIT COST:	$ 7 PER CUBIC YARD

BASIS FOR DIRECT CAPITAL COSTS FOR:
COLLECTION TRENCH
GROUNDWATER (TREATMENT AND EXTRACTION) SYSTEM
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS: Direct Capital Costs for excavation and construction of trenches for groundwater system.
Includes:

- material cost for geotextile and stone
- equipment costs for excavation, hauling, grading, and pumping
- labor costs

CALCULATION: The area and location of the drainage collection trenches was based on the depth of clay and the presumed direction of groundwater flow in the post closure condition. Direct Capital Cost was calculated by multiplying the required area of the trench by the estimated unit cost.

SOURCE: Transportation and material costs were based on vendor quotation. Labor and equipment costs were based on information in the "Remedial Action at Waste Disposal Sites, Handbook (Revised)", October 1985.
Costs were updated to 1994 dollars using ENR Construction Cost Index data.

SUMMARY OF UNIT COSTS:

EXCAVATION OF TRENCH	$ 7 PER CUBIC YARD
BACKFILL WITH STONE	$ 30 PER CUBIC YARD
PUMPING OF WATER DURING CONST. (open pumping)	$ 500 PER DAY

TOTAL UNIT COST:	$ 13 PER SQUARE FOOT

BASIS FOR DIRECT CAPITAL COSTS FOR:
COLLECTION WELLS/PUMPS/STATION
GROUNDWATER (TREATMENT AND EXTRACTION) SYSTEM
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS: Direct Capital Costs for Installation of shallow groundwater collection unit using conventional hydraulic rotary equipment.
Includes:

- material cost for drilling, stone, piping, etc.
- equipment costs for drilling, stone, piping, etc.
- labor costs

CALCULATION: Groundwater flow rate was estimated using empirical solutions based on Darcy's law for the post-closure conditions.
Direct Capital Cost was calculated by multiplying the required number of units to handle the peak groundwater flow by the estimated unit cost.

SOURCE: Transportation and material costs were based on vendor quotation. Labor and equipment costs were based on information in the "Remedial Action at Waste Disposal Sites, Handbook (Revised)", October 1985.
Costs were updated to 1994 dollars using ENR Construction Cost Index data.

SUMMARY OF COSTS:

LABOR, MATERIAL, & EQUIPMENT	$ 1,000 PER WELL
(to install one well, 20 feet X $ 50 per foot)	
4" SUBMERSIBLE PUMP	$ 2,500 EACH
COLLECTION STATION	$30,000
TOTAL UNIT COST:	$ 10,000 PER UNIT

BASIS FOR DIRECT CAPITAL COSTS FOR:
PRE-TREATMENT (CONTINGENCY)
GROUNDWATER (TREATMENT AND EXTRACTION) SYSTEM
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS: Direct Capital Costs for Pre-treatment of shallow groundwater collected from the groundwater extraction or treatment system.
Includes:

- material cost for installing the treatment system
- equipment costs for installing the treatment systems
- labor costs for installation

CALCULATION: Required treatment technologies for the contaminants present in groundwater were evaluated. Direct Capital Cost was estimated by adding the dollar amount for installing the treatment systems designed to satisfy POTW influent standards.

SOURCE: Unit Cost was based on information provided in "Remedial Action at Waste Disposal Sites, Handbook (Revised)", October 1985. If necessary, costs were updated to 1994 dollars using ENR Construction Cost Index data.

SUMMARY OF COSTS:

AIR STRIPPER	$ 175,000 LUMPSUM
HEAVY METAL PRECIPITATION	$ 300,000 LUMPSUM
ACTIVATED CARBON UNIT	$ 75,000 LUMPSUM
ASSOCIATED PIPING/STRUCTURES/CONTROL	$ 100,000 LUMPSUM
TOTAL UNIT COST:	$650,000

BASIS FOR YEARLY O & M COSTS FOR:
PRE-TREATMENT (CONTINGENCY)
GROUNDWATER (TREATMENT AND EXTRACTION) SYSTEM
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS: Yearly costs for Operation & Maintenance of the Pre-treatment system.
Includes:

- material cost for replenshing the treatment system
- equipment costs for maintaining the treatment systems
- labor costs for conducting the operations and documentation

CALCULATION: The approximate annual quantity of material required to replenish the system which handles the volume of water collected for pre-treatment was estimated.
Costs for maintenance were also estimated and a unit cost for pre-treatment per gallon of water was estimated. This cost was multiplied by the yearly estimated volume to estimate the Yearly costs for Operations and Maintenance.

SOURCE: Transportation and material costs were based on vendor quotation.
Labor costs was based on engineering estimates.

SUMMARY OF COSTS:

AIR STRIPPER	$ 15,000 PER YEAR
HEAVY METAL PRECIPITATION	$ 15,000 PER YEAR
ACTIVATED CARBON	$ 30, 000 PER YEAR
LABOR COSTS	$ 30,000 PER YEAR
TOTAL UNIT COST:	$ 0.025 PER GALLON

BASIS FOR YEARLY O & M COSTS FOR:
DISCHARGE TO POTW (CONTINGENCY)
GROUNDWATER (TREATMENT AND EXTRACTION) SYSTEM
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS: Yearly costs for Discharge of the treated water by the Pre-treatment system to a Publicly Owned Treatment Works.
Includes:

- disposal of treated water to POTW
- cost of connection to POTW sewer line
- annual monitoring

CALCULATION: The approximate volume of treated water was multiplied by the unit cost to dispose the water at the Buffalo Sewer Authority.

SOURCE: Unit Cost was based on BSA's cost estimate for treatment.

SUMMARY OF COSTS:

DISPOSAL COSTS AT BSA $ 0.015 PER GALLON

TOTAL UNIT COST: $ 0.015 PER GALLON

BASIS FOR DIRECT CAPITAL COSTS FOR:
EXCAVATION & TRANSPORTATION OF CONTAMINATED SOIL/SEDIMENTS
ALLTIFT LANDFILL SITE
BUFFALO, NEW YORK

BASIS: Direct Capital Costs for Excavation and Transportation of contaminated soil to an off-site landfill.

Includes:

- transportation and disposal costs
- equipment costs for excavating and loading
- labor costs
- associated quality control measures

CALCULATION: Approximate volume was calculated by multiplying estimated cross-sectional area of the excavated/dredged soil and/or sediment with the measured surface area. Volume of wastes within the landfill and contaminated soil volume in the junkyard was provided by AFI Environmental, Inc.. Sediment volume for Ramco pond was provided by Dames and Moore, Inc..

Direct Capital Cost was derived by multiplying the volume and the estimated unit cost.

SOURCE: Labor and equipment costs were based on information provided in "Remedial Action at Waste Disposal Sites, Handbook (Revised)", October 1985. Costs were updated to 1994 dollars using ENR Construction Cost Index data.

Transportation and Disposal Costs are based on vendor information.

SUMMARY OF UNIT COST:

TRANSPORTATION & OFF-SITE DISPOSAL:	$ 60 PER CUBIC YARD
LABOR COST:	$ 4 PER CUBIC YARD (AT LANDFILL)
EQUIPMENT COST:	$ 6 PER CUBIC YARD (AT LANDFILL)
TOTAL UNIT COST:	$ 70 PER CUBIC YARD