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Report

Focused Feasibility Study for Accelerated Remedial Action Orange County Landfill

September 1993

FOCUSED FEASIBILITY STUDY
FOR ACCELERATED REMEDIAL ACTION
ORANGE COUNTY LANDFILL

Prepared for

ORANGE COUNTY, NEW YORK

Prepared by

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Cazenovia, NY 13035

September 1993

Project No. 2535

Stearns & Wheler

ENVIRONMENTAL
ENGINEERS & SCIENTISTS

September 29, 1993

Mr. Joseph S. Provost, P.E.
Commissioner
Orange County Department
of Public Works
Route 17M, P.O. Box 509
Goshen, NY 10924-0509

Re: Focused Feasibility Study
Accelerated Remedial Action
Remediation/Closure of the Orange County Landfill
S&W No. 2535.0

Dear Mr. Provost:

In accordance with the basic Scope of Services described in Schedule A-3 of our engineering Agreement, we are pleased to submit the Focused Feasibility Study (F-FS) as part of the Accelerated Remedial Action (ARA) for the County's landfill closure program. This study was performed in conformance with NYSDEC's Strategic Plan dated January 14, 1992. The purpose of the draft report is to identify an appropriate interim remedial action at the landfill that would provide immediate benefits to public health and safety while the full Remedial Investigation/Feasibility Study (RI/FS) program progresses over the next two to three years.

We have identified landfill capping in accordance with state regulations as the most appropriate interim remedial action at this stage of the RI/FS program. The benefits of proceeding with the landfill cap are summarized as follows:

1. A 6 NYCRR Part 360 cap will significantly reduce the quantities of rainwater and snowmelt infiltrating into the waste mass, thus minimizing the generation of leachate and reducing the impact of leachate on groundwater.

2. The County will eventually have to cap the landfill at some point in the future as part of a remedial action program. Early capping may result in construction cost savings.

3. A cap would provide a physical barrier between the leachate seeps and surface water and eliminate the need to collect and treat surface water.

4. The existing gas collection and recovery system can be integrated into the design of the cap to minimize off-site migration of gases.

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5. The cap will not limit the County's ability to implement further remedial actions upon completion of the full RI/FS study. In fact, it may allow for more precise groundwater information to determine the most effective areas for placement of leachate collection lines.

The NYSDEC's Proposed Remedial Action Plan (PRAP) will summarize the accelerated action as recommended by this report. The PRAP and report will be subject to public review and comment. Upon completion of the public comment period and finalization of the PRAP, the NYSDEC will issue a Record of Decision (ROD) on the accelerated remedial action.

If you have any questions, please call us.

Very truly yours,

Howard B. LaFever, P.E.
Partner

HBL/ct
Enclosure

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FOR ACCELERATED REMEDIAL ACTION
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SECTION 1 - PURPOSE

The Orange County Landfill has been classified as a Class 2 inactive hazardous waste site in accordance with the rules and procedures established by the State and administered by the New York State Department of Environmental Conservation (NYSDEC). As such, Orange County is required to evaluate site conditions and propose appropriate remedial action(s) for the landfill through a Remedial Investigation/Feasibility Study (RI/FS). The Remedial Investigation (RI) is prepared to determine the extent and type of site-related contamination, and to include an assessment of the threat to public health and the environment which the contamination poses. The Feasibility Study (FS) then evaluates the possible remedial alternatives for each potential route of exposure and evaluates these alternatives based on technical capabilities and relative costs. The RI/FS is conducted in phases so that it remains focused on areas of concern identified in each progressing phase. After the RI/FS is reviewed and sufficient time for public comment has transpired, the NYSDEC issues a Proposed Remedial Action Plan (PRAP), followed by an official Record of Decision (ROD), which documents the final selection of a cost-effective remedy for the site in question.

Since the RI/FS process may take several years to complete, Orange County is proposing the use of an Accelerated Remedial Action (ARA) in accordance with NYSDEC's Strategic Plan dated January 14, 1992. The objectives of the ARA include:

1. Enhancement of environmental protection during the RI/FS program.
2. Reduction of landfill leachate and contaminated runoff that contacts surface leachate.

The purpose of this Focused Feasibility Study is to evaluate available remedial actions based on existing information to arrive at a recommended **interim** remedial action for the landfill that will meet the above objectives.

SECTION 2 - BACKGROUND

2.1 HISTORY OF SITE

The Orange County landfill is located south of Route 17M in the Town of Goshen, New York. The landfill site is approximately 300 acres in size and is bounded on the southeast by the Cheechunk Canal along the Wallkill River, and on the northwest and southwest by the Old Channel of the Wallkill River.

The Orange County Department of Public Works began operating the landfill in 1974. The landfill ceased accepting waste on January 31, 1992. During that time, approximately 75 acres of the site received fill.

2.2 WASTE CHARACTERIZATION

The volume of material disposed of at the Orange County landfill was estimated using existing physical information of the site. A preliminary cut/fill analysis compared a 1988 topographic survey of the landfill with estimated contours below the landfill based upon information provided by groundwater well installations. The volume of the landfill was found to be approximately 7,000,000 cubic yards. This waste mass is predominantly municipal solid waste. However, documentation also shows that small quantities of waste oil, septic sludge, industrial waste, and hazardous waste were also disposed of at this site. Wastes include still bottom residues (D001 waste); acids (nitro, hydrofluoric, and glacial acetic); tetrachloroethylene (F001, F002 waste); and solvents methanol, ethanol, toluene, and benzene (F005).

2.3 REGULATORY ACTION

A. **Inactive Hazardous Waste Classification.** On March 11, 1992, the NYSDEC classified the Orange County landfill as a Class 2 inactive hazardous waste disposal site under Article 27, Title 13 of the Environmental Conservation Law (ECL) of the State of New York. The landfill was classified as an inactive hazardous waste site based on documented hazardous waste disposal, groundwater contamination, and the possibility of contamination of the principal aquifer underlying the landfill.

Documented hazardous wastes disposed at the landfill include still bottom residues, acids (nitric, hydrofluoric and glacial acetic), tetrachloroethylene, solvents (methanol, ethanol, toluene, benzene) and filters containing tetrachloroethylene.

Groundwater contamination at the landfill revealed elevated levels of tetrachloroethene, 1,1,1-trichloroethane, trichloroethene, benzene, and toluene. Tetrachloroethene, 1,1,1-trichloroethane, and trichloroethene were identified in samples from groundwater monitoring well MW-232 during 1990.

Since the landfill is considered an inactive hazardous waste site, Orange County will be eligible for reimbursement of 75 percent of the allowable costs under the 1986 Environment Quality Bond Act, Title 3 - Municipal Hazardous Waste Site Remediation.

B. **Consent Order**. Orange County and the NYSDEC entered into a consent order for the landfill on January 11, 1993. The consent order outlined the conditions for a Remedial Program for the landfill as an Inactive Hazardous Waste Disposal Site.

The Consent Order requires that "the owner of such site (Inactive Hazardous Waste Disposal Site) and/or any person responsible for the disposal of hazardous wastes at such site (i) to develop an inactive hazardous waste disposal site remedial program, subject to the approval of the Department (NYSDEC), at such site, and (ii) to implement such program within reasonable time limits specified in the Order."

The elements of the remedial program included:

1. Preparation of a RI/FS.
2. Design and implementation of the selected remedial alternative.
3. Operation, maintenance and monitoring of the selected remedial alternative.

The specific requirements of the RI/FS are detailed in the consent order.

The consent order allows Orange County to propose interim remedial measures (IRMs) prior to the completion of the full RI/FS and the subsequent ROD on the proposed remedial action. The interim remedial measures are the basis for the preparation of this Focused Feasibility Study for Accelerated Remedial Action.

SECTION 3 - EVALUATION OF ALTERNATIVES

3.1 INTRODUCTION

In general, the purpose of a Feasibility Study is to document the steps whereby the most appropriate method for managing site-related contamination is chosen. As such, this selection process can be viewed as occurring in three phases: (1) development of alternatives; (2) screening of alternatives; and (3) detailed evaluation of alternatives. The alternatives are usually developed by combining site-specific and appropriate remedial technology options. Depending on the site contamination, these alternatives usually encompass both source control options and groundwater control options. During the initial screening, technologies are evaluated for inclusion as part of a remedial alternative (source control or groundwater control option) based on only documented implementability, reliability, and effectiveness of the process for controlling site conditions.

At the same time, the alternative development process must take into account that the NYSDEC, using USEPA criteria, gives preference to treatment technologies "that whole, or in part, result in a permanent and significant decrease in the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants" to the maximum extent practicable (NYSDEC, 1990). Based on this preference, the hierarchy of remedial technologies, from most to least desirable, is outlined below:

A. **Destruction.** This type of remedy irreversibly destroys or detoxifies all or most of the hazardous wastes to "acceptable cleanup levels." The treated materials then have no residue containing unacceptable levels of hazardous wastes. Destruction remedies result in permanent reduction in the toxicity of all or most of the hazardous wastes to "acceptable cleanup levels." An example of a destruction option is incineration of soil with organic contaminants.

B. **Separation and Treatment.** This type of remedy separates or concentrates the hazardous wastes, thereby resulting in a treated waste stream with acceptable levels of hazardous wastes and a concentrated waste stream with high levels of contaminants. An example of this remedy is treatment of contaminated leachate by activated carbon. Separation and treatment remedies result in permanent and significant reduction in volume of waste mixed with hazardous wastes.

C. **Solidification and Chemical Fixation.** This type of remedy is most appropriate for a site containing predominantly inorganic hazardous wastes. It significantly reduces the mobility of inorganic hazardous wastes. Solidification and chemical fixation remedies may not significantly

reduce the toxicity or volume of the inorganic hazardous wastes, but significantly and permanently reduce the mobility, and hence the availability, of the inorganic hazardous wastes to environmental transport and uptake. Solidification and chemical fixation can be used to improve waste handling from the landfill or limit contaminant solubility in the landfill. Common methods of solidification and chemical fixation include cement, pozzolanic, thermoplastic, and organic polymers.

D. **Control and Isolation Technologies.** This type of remedial action reduces the mobility of the hazardous wastes, but does not reduce the volume or toxicity of the hazardous wastes. Included in these actions are construction of physical barriers, such as a cap, to control run-off and infiltration.

However, the NYSDEC has recognized that this policy favoring permanent remedies may not be appropriate for large sites with mixed waste, such as Class 2 landfills. While a complete investigation is necessary to determine the extent of contamination and potential risks posed by the site, some remedial options should be evaluated early for possible accelerated implementation. This is the purpose for conducting this Focused Feasibility Study (F-FS).

3.2 INITIAL SCREENING

The NYSDEC has issued a policy memorandum concerning accelerated remedial actions at Class 2 regulated landfills. The purpose of the memo is to outline procedures for identifying remedial measures for accelerated implementation at such landfills. The guidance provided in the memorandum have been utilized in the preparation of this F-FS. At this point, technology options need to be identified which will satisfy the remedial goals, i.e. reduction of landfill leachate and run-off production. Since this study is not intended to provide an exhaustive analysis of alternatives, a limited number of options will be evaluated through the preliminary screening. The elements used to evaluate these options are:

1. An effectiveness evaluation.
2. An implementability evaluation.

Alternatives were selected as being representative of each of the options as described by the NYSDEC hierarchy for remedy selection, as described in Section 3.1. The following sections describe the alternatives for the ARA at the site and the screening for each.

A. **No Action Alternative**. A no action response means that no remedial action will be performed at the landfill site until the completion of the RI/FS and the subsequent ROD. This alternative would allow the landfill to continue to be recharged by the precipitation which results in a strong potential for leachate seeps and groundwater contamination. This alternative would be easy to implement, as no action, other than continued monitoring, is required. However, it would not be effective in reducing leachate generation.

B. **Control and Isolation Alternative**. The control and isolation alternative may consist of either a 6 NYCRR Part 360 cap or a RCRA cap. Leachate collection may be used in conjunction with the cap. The main advantage of a cap is that a cap provides an impermeable boundary between precipitation and the waste mass. Based on the Hydraulic Evaluation of Landfill Performance (HELP) model analysis, it was estimated that a standard 6 NYCRR Part 360 cap is able to reduce percolation through the waste by 99.5 percent. The HELP model estimates a surface runoff fraction, an evapotranspiration fraction, a percolation fraction, and a lateral drainage fraction of the precipitation that falls over the landfill.

Possible options for capping include use of a Part 360 cap, use of a RCRA cap, and implementation of either cap along with leachate collection and treatment.

Caps are relatively easy to design and construct, and would not require construction of temporary treatment facilities at the site. In addition, a cap is required for closure of the landfill as part of the 6 NYCRR Part 360 regulations. Thus, the control and isolation alternative is both an effective and implementable alternative for achieving the goal of reduction in leachate generation from the site.

C. **Permanent Action Alternative.** Based upon current knowledge of contamination present at the landfill, few options are available for providing for destruction, or separation and treatment of waste sources at the landfill. Site investigations conducted to date have not identified any hot spot areas of high organic or inorganic contaminants which could be excavated and treated, either on-site or off-site. Therefore, the only potential remaining option for a permanent remedy is solidification/stabilization. However, this type of remedy requires knowledge of "hot spot" areas requiring stabilization similar to that required for destruction options. In addition, the NYSDEC endorses solidification/stabilization remedies for treatment of inorganic wastes only. Most of the documented hazardous materials disposed of at the site were organics. Solidification methods have not been demonstrated to effectively immobilize organic contaminants.

3.3 RESULTS OF PRELIMINARY SCREENING

Based on preliminary screening results, an appropriate alternative for accelerated remedial action is the control and isolation alternative using a landfill cap (barrier). Capping will minimize the infiltration of precipitation into the landfill and its resulting percolation through the waste mass. This will fulfill the two objectives of the Focused FS:

1. Enhancement of environmental protection during the RI/FS program.
2. Reduction of landfill leachate and contaminated runoff that contacts surface leachate.

The capping alternative is a readily available technology and can be constructed within one to two years. A cap also provides a versatile interim solution. If it is determined at the completion of the RI/FS that additional "permanent" actions are required within isolated sections of the landfill, the cap can be removed in those sections to allow "permanent" actions and later replaced. A secondary benefit of the early cap is the reduction in leachate/runoff treatment. This cost benefit would appear to at least offset future cost if sections of the cap needed to be removed in two or three years, based upon final recommendations for remedial action.

SECTION 4 - EVALUATION OF ACCELERATED REMEDIAL ACTION (SOURCE CONTROL TECHNOLOGY NO. 1 - CAPPING)

The following sections describe the possible remedial alternatives for capping the landfill.

4.1 6 NYCRR PART 360 VERSUS RCRA CAPPING

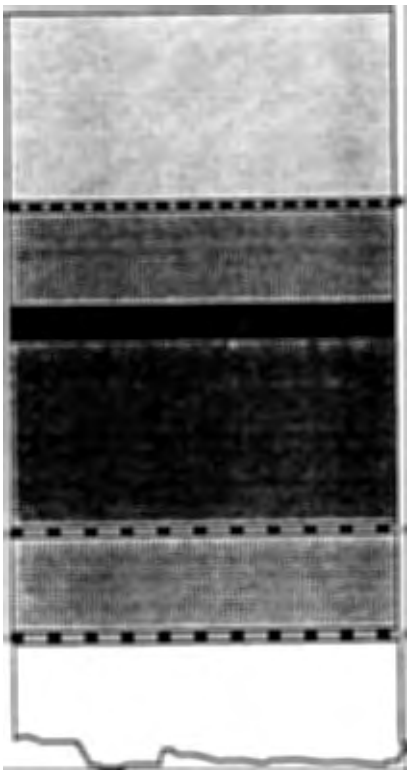
Two design alternatives were evaluated for the final cover system. The two alternatives included:

1. A final cover system constructed in accordance with 6NYCRR Part 360 regulations for solid waste management facilities.

2. A final cover system constructed in accordance with Resource Conservation and Recovery Act (RCRA) regulations for hazardous waste sites.

As shown in Figure 4-1, the major difference between the capping systems is that the RCRA cap uses a composite barrier layer consisting of a 20 mil geomembrane overlying a low permeability

Standard RCRA Cap



24" Vegetative Top Cover

Filtration Geotextile

12" Drainage Layer (k= 1 x 10^-3 cm/sec)

20 mil Geomembrane

24" Low Permeability Layer
(1 x 10-7 cm/sec)

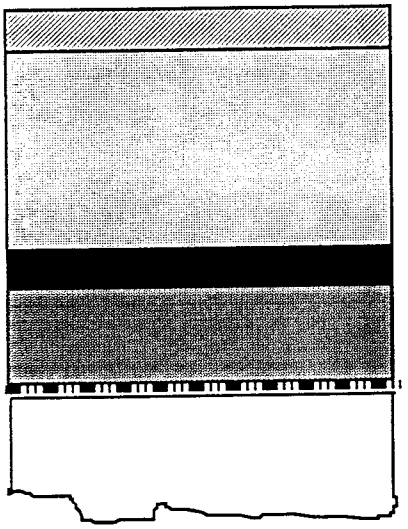
Separation Geotextile

12" Gas Venting Layer (k= 1 x 10^-3 cm/sec)

Separation Geotextile

Waste

Standard Part 360 Cap



6" Topsoil Layer

24" Barrier Protection Layer

40 mil Geomembrane or
18" Low Permeability Layer (k= 1 x 10^-7 cm/sec)*

12" Gas Venting Layer (k= 1 x 10^-3 cm/sec)

Separation Geotextile

Waste

*Separation Geotextile required under 18" Low Permeability Layer.

FIGURE 4-1
RCRA CAP VS. 6NYCRR PART 360 CAP

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soil (clay) layer. The Part 360 cap uses a 40 mil geomembrane layer or an 18-inch low permeability soil (clay) layer as the barrier layer in the capping system.

The mechanism used in the evaluation of the two capping systems was the HELP model analysis. A separate HELP model simulation was performed for each final cover system. The HELP model estimates a surface run-off fraction, an evapotranspiration fraction, a percolation fraction, and a lateral drainage fraction of the precipitation that falls over the landfill. The results of the first simulation indicated that the Part 360 cover system is 99.5 percent efficient in reducing percolation into the waste mass when using a 40 mil geomembrane when compared to the existing uncapped landfill. The results of the second simulation indicated that the RCRA cover system is nearly 100 percent efficient in reducing percolation into the waste mass when compared to the existing uncapped landfill. As shown with the HELP model analysis, both systems significantly reduce leachate generation.

Although the RCRA cap provides a slightly higher efficiency, there are several other factors that should be addressed. The RCRA cap requires an additional 24-inch low permeability soil layer and it may require an additional 6 to 12 inches of cover layer over the low permeability soil layer for frost protection. The effects of frost on the low permeability layer are covered in Section 4.5, Frost Penetration.

If the standard RCRA cap is used, the potential exists for tensile failure of the 20 mil geomembrane. The drainage layer above the geomembrane will develop greater friction at the geomembrane interface than the geomembrane-low permeability layer below. This will require the geomembrane to carry a higher tensile load. With the relatively long, steep slopes of the landfill, the resulting tensile load may exceed the strength (design strain) of the 20 mil geomembrane, especially when considering the loading of construction equipment.

Another important consideration is the ability of the capping systems to maintain their integrity when settlement occurs within the boundaries of the landfill footprint. Settlement naturally occurs in landfills within the limits of the footprint as waste decomposes. However, the rate of settlement decreases over time. The greatest settlement occurs the first two to three years after filling stops. The low permeability soils can generally withstand a 1 to 2 percent strain before cracking will occur. Greater strain than this could allow increased percolation into the waste mass through the cap. In addition, a 20 mil geomembrane cannot withstand as much strain as a 40 mil geomembrane. In other words, the 40 mil geomembrane has a greater ability to stretch.

In summary, there are a number of issues that must be considered when evaluating the effectiveness of a landfill cap. Based upon recent experience for the two capping systems, the short-term performance of a Part 360 cap is comparable to a RCRA cap, but may actually offer greater long-term benefits with its ability to maintain performance while dealing with subsidence (settlement), the effects of frost, cover stability, and quality control during construction.

4.2 GAS VENTING ISSUES

Wastes in landfills are subject to biological decomposition which result in the generation of gases. These gases can pose health and safety hazards if they are allowed to accumulate and migrate off site through the soil. To control the accumulation of these gases, Orange County entered into a contract with a private operator to install and operate the existing active gas collection system. In an active gas system, a series of gas extraction wells are connected together by a header pipe to a blower that collects the gas for energy reuse. The blower actively draws the gases from the landfill. A schematic of the existing active gas collection and recovery system is shown on Figure 4-2.

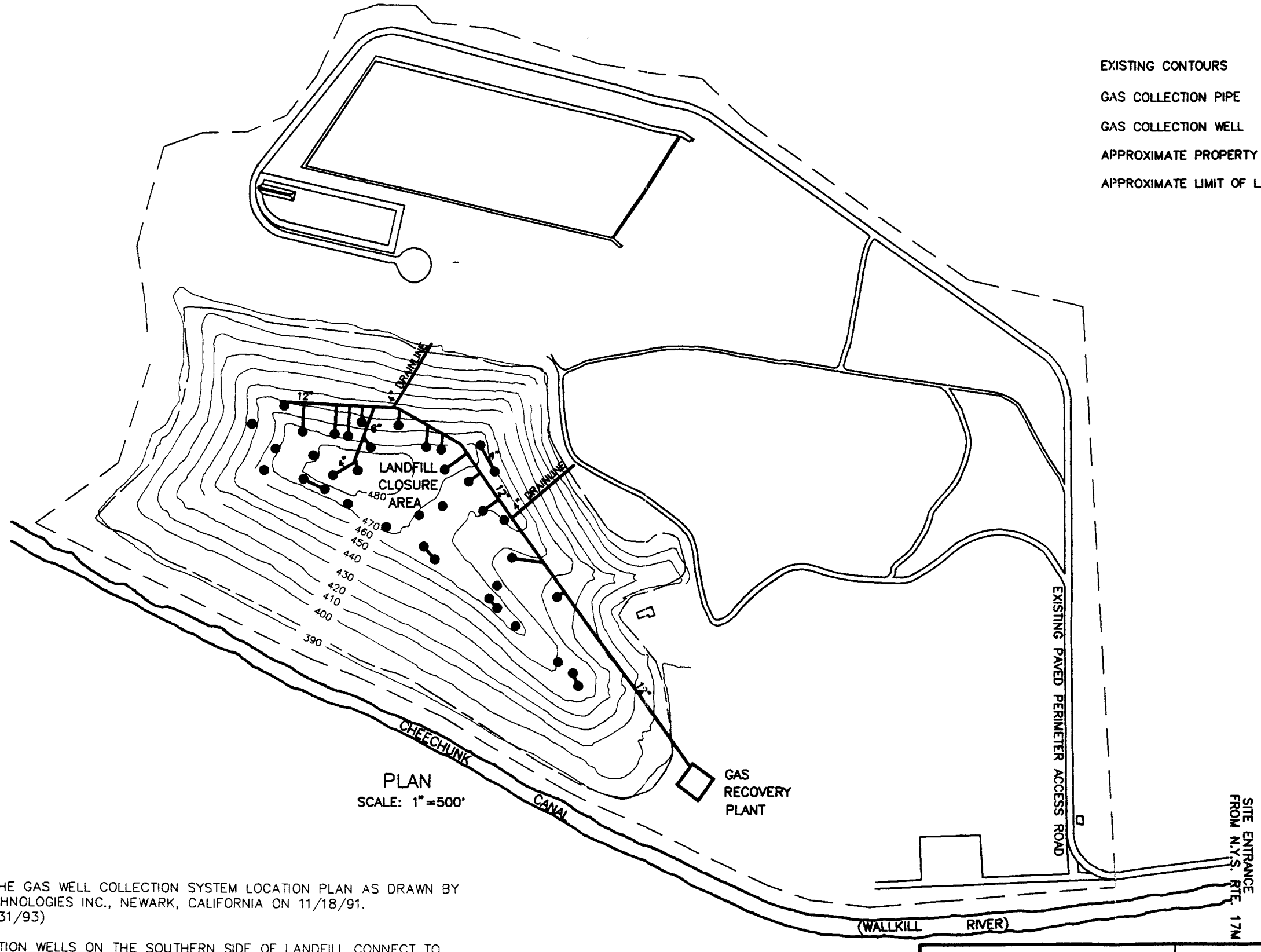
The alternative to the active gas collection system is a passive gas collection system. A passive gas collection system consists of isolated gas vents that are vented directly to the air.

The existing active gas system is preferred to the passive gas system for two reasons:

1. In a passive system, methane gas is vented into the air. Methane gas causes an odor that may create a nuisance condition.

2. An active gas system is able to better draw gases than a passive system by the use of a blower. This reduces the possibility of gas buildup and gas migration through the soils around the landfill.

The proposed landfill cap will incorporate gas venting procedures into the existing active gas system.



PLAN
SCALE: 1"=500'

NOTES:

1. BASED ON THE GAS WELL COLLECTION SYSTEM LOCATION PLAN AS DRAWN BY LAIDLAW TECHNOLOGIES INC., NEWARK, CALIFORNIA ON 11/18/91. (REVISED 3/31/93)
2. GAS COLLECTION WELLS ON THE SOUTHERN SIDE OF LANDFILL CONNECT TO A 10"-INCH HEADER PIPE. INFORMATION IS NOT AVAILABLE REGARDING THE CONFIGURATION OF THE 10-INCH HEADER PIPE AND THE COLLECTION WELLS.

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DATE: 9/93 JOB No.: 2535

ORANGE COUNTY LANDFILL
TOWN OF GOSHEN, NEW YORK
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FIGURE 4-2
GAS WELL COLLECTION SYSTEM

4.3 RUNOFF AND DRAINAGE

An integral component of the landfill cap design is the management of stormwater runoff and drainage. A comprehensive evaluation of peak stormwaters flows and design of stormwater conveyance facilities will be performed to limit cap erosion and optimize slope stability along the long, relatively steep slopes of the landfill. Drainage structures will be designed, at a minimum, using the peak discharge for a 24-hour, 25-year frequency storm.

To minimize erosion on the landfill cap, it is anticipated that terracing will be provided at a maximum of 30-foot vertical intervals when the slopes exceed 20 percent, or as required by a detailed geotechnical engineering analysis.

Runoff from the landfill cap will be channeled in perimeter ditches to detention basin(s) where the peak discharges can be regulated prior to release to receiving streams.

Vegetation will be established as part of the capping system to protect slopes from excessive erosion, enhance evapotranspiration, and improve aesthetics.

4.4 SUBSIDENCE OF WASTE

The ability of the final cover system to withstand settlements is an important consideration in capping system. Typical waste disposal sites have a highly heterogeneous waste mass that will settle at different rates within the waste mass. This is generally referred to as differential settlement. Waste subsidence usually has two components: a primary component caused by a reduction in pore volume (voids) within the mass; and a secondary component caused by waste mass decomposition. Since the majority of older waste disposal sites did not maintain records of waste types deposited, both settlement components can be very hard to assess. In addition, because waste decay is usually an anaerobic decomposition process, the secondary component of settlement can be very slow, taking many years to complete. Since actual settlements are hard to predict, an evaluation of waste subsidence focuses on how settlements could potentially effect the capping system.

The evaluation of a final cover systems ability to withstand settlements would include an assessment of how each layer may be affected by depressions and voids. With regard to the two capping systems previously discussed, the crucial layer that must first be evaluated is the barrier

protection. For capping systems, a very low density polyethylene or polyvinyl chloride geomembrane offers a reasonable solution to the effects of subsidence. These two geomembranes can withstand strains of much greater than 100 percent. From the standpoint of actual field conditions for landfill caps, this level of strain would not be anticipated. For differential settlement, a 20 mil geomembrane (RCRA cap) is more susceptible to puncture than a 40 mil (Part 360 cap) geomembrane.

When a soil (clay) is used for the barrier protection layer, the analysis should show that settlement would not occur beyond 1 to 2 percent strain. If this strain is exceeded, it is likely that cracking will occur within this soil layer and open pathways for water to enter the waste mass. However, if the analysis supports the use of a clay layer, it can be an effective barrier.

4.5 FROST PENETRATION

Freeze-thaw degradation is a concern when using a cap that contains a low permeability soil layer. The action caused by cyclical freezing and thawing tends to produce cracking in low permeability soil, which can increase its permeability. That is, water will tend to move through the soil at a faster rate. Therefore, the cover layers must be thick enough to protect against frost penetration into the low permeability soil layer. Based on a discussion with the Orange County Soil Conservation Service (SCS) and a review of existing literature, the maximum depth of frost penetration at the landfill site is approximately 4 feet. This means that the cover layer over the low permeability soil layer would need to be increased from its minimum requirement of 30 inches (6 inches topsoil and 24 inches barrier material) to 42 inches (6 inches topsoil and 36 inches barrier material).

4.6 SLOPE REMEDIATION/REGRADING OF REFUSE

Based on the most recent survey information for the landfill dated March 1988, it appears that there will be minimal requirements for regrading of refuse. The landfill appears to meet the maximum 33 percent grades required by 6 NYCRR Part 360 with most slopes under 25 percent. A thorough evaluation of the slopes will be performed when the survey is updated in mid-1993. During the design process, a stability analysis will be performed for the elements of the cap and the need for reinforcement materials will be evaluated. The stability analysis will include an evaluation of the interface strengths of the proposed cap materials during construction.

The construction of terraces on the slopes may be required to improve the cover stability of the cap system.

4.7 HOT SPOTS IDENTIFICATION AND EVALUATION

Based on the available information, there does not appear to be any obvious "hot spots" evident within the landfill mass. Historical records of waste oil, tetrachloloroethylene, waste solvents, and still bottom residues, and acids do not show that the contaminants were disposed of in discrete area(s). The following constituents in previous groundwater samples have been found to exceed NYSDEC standards (or are otherwise elevated): iron, manganese, magnesium, chloride, sulfates, VOCs, and total dissolved solids. The elevated levels for the constituents mentioned above were found in most of the wells around the landfill perimeter and do not necessarily indicate the presence of hot spots in the landfill mass. Low levels of arsenic and cadmium have been found in leachate samples. The samples do not show significant differences in arsenic concentrations between the upgradient and downgradient wells.

A thorough review of the analytical data, as well as additional testing, will be performed during the RI portion of the full RI/FS.

4.8 CONSOLIDATION OF ON-SITE OR OFF-SITE WASTES

On-site and off-site soils may potentially be contaminated as the result of surface water runoff, leachate seeps, and groundwater. Runoff pond sediments and leachate collection line spoils are two obvious locations where soils contamination should be evaluated. If contaminated soils are identified prior to capping, they can be consolidated into landfill as shaping material used to obtain final grades and slopes; however, this will be subject to NSYDEC approval. If contaminated soils are identified after capping, they can be remediated or landfilled based on the outcome of the RI/FS.

4.9 METHOD OF DETERMINING FINAL GRADES

Prior to the design of the cap, the landfill will be surveyed to determine the existing grades. From the existing survey data, a cap will be designed that will meet the NYSDEC requirements for minimum and maximum slopes. The limit of the cap will be determined by an evaluation of the obvious changes in slope at the toe of the landfill, a visual evaluation of the limits of waste,

comparison of past and present surveys, and an evaluation of past disposal practices. If waste is encountered beyond the designed edge of cap during construction, it can be relocated within the cap limit or the cap can be extended to cover the waste. The contractor will survey the final grades after the completion of each major component of the landfill cap. The contractors' surveys will be performed on a 100-foot grid system across the landfill.

4.10 EVALUATION OF PHASED CONSTRUCTION

As part of the F-FS, the County must consider the future need for the deposition of spoil materials (e.g., contaminated soils) generated during the remedial investigation or as the result of the Feasibility Study. One possibility is to keep a portion of the landfill without a cap and pursue a phased closure.

It is recommended that the construction be performed in one phase. The amount of spoils generated during the remedial investigation are expected to be small since the monitoring wells have already been installed and a leachate/surface water ditch has been constructed. If the remedial measures resulting from the feasibility study produce spoils, a portion of the cap can be removed and replaced to allow for spoils deposition or the spoils can be remediated and/or landfilled elsewhere, whichever is more cost effective.

Other disadvantages of phased construction include:

1. Continued precipitation recharge of the uncapped portion of the waste.

2. Potential contamination of surface water and the continued need to treat large volumes of water.

3. Increased costs of construction resulting from:

    a. Loss of economies of scale.
    b. Increased mobilization and demobilization requirements.

4.11 PERIMETER ROAD STABILIZATION

Studies have previously been conducted to evaluate the stability of the perimeter road along the Cheechunk Canal and to recommend remedial measures. These studies include:

1. Wehran Envirotech, "Wallkill River Bank Stabilization," May 1990.

2. Melick-Tully and Associates, Inc., "Geotechnical Engineering Report and Landfill Slope Stability," February 1993.

Both studies recommended that the soil be excavated along the slopes of the road to meet a minimum grade of three horizontal to one vertical. It is anticipated that the resultant remedial measures will be incorporated into the cap design and construction will occur as part of the accelerated remedial action.

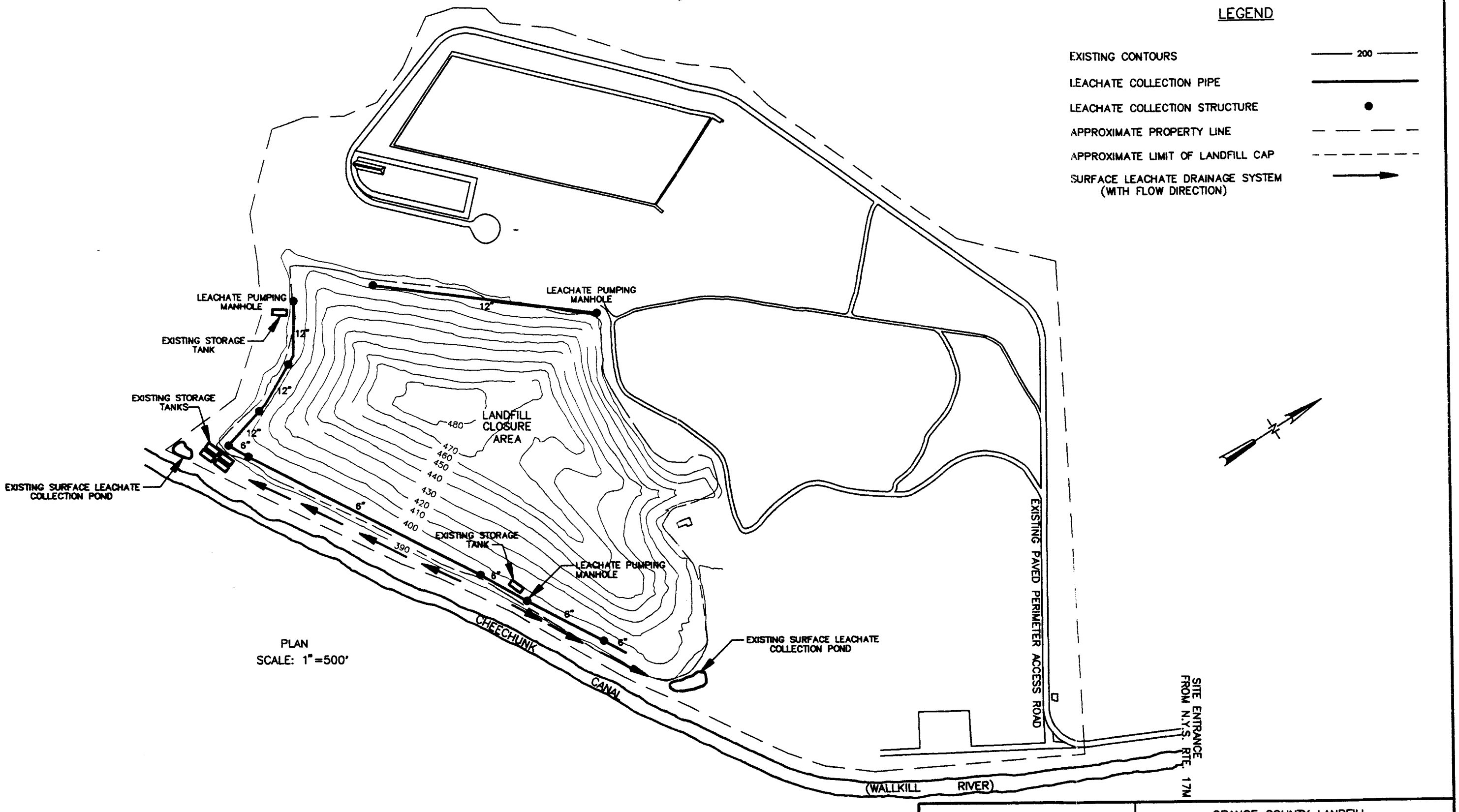
SECTION 5 - REVIEW OF LEACHATE COLLECTION REQUIREMENTS (SOURCE CONTROL TECHNOLOGY NO. 2 - LEACHATE COLLECTION)

5.1 EXISTING SYSTEM OF COLLECTION AND TREATMENT

Leachate and surface runoff are collected by the use of perimeter leachate collection systems located along the northwestern, western, and southeastern sides of the landfill, as shown on Figure 5-1. The collection system consists of both a buried perforated collection pipe and a runoff collection trench along the Cheechunk Canal. The runoff collection trench drains to a collection pond situated at the southeastern corner of the site. Leachate from the perimeter collection pipes is collected in storage tanks. The runoff from the collection pond and leachate from the tanks are transported by tanker trucks to the City of Newburgh Sewage Treatment Plant for treatment and disposal.

5.2 DEPTH AND LIMIT OF WASTE

The depth of the waste mass of the landfill will be determined by comparing the most recent survey information with the County's topographic survey of the landfill prior to its initial operation. Preliminary review of past reports has shown that the base of the landfill is at a minimum elevation of approximately 365 feet and maximum elevation of approximately 485 feet (1988 survey). This yields a maximum depth of waste of approximately 120 feet.



PLAN
SCALE: 1"=500'

Stearns&Wheler
ENVIRONMENTAL ENGINEERS & SCIENTISTS

DATE: 9/93 JOB No.: 2535

ORANGE COUNTY LANDFILL
TOWN OF GOSHEN, NEW YORK
FOCUSED FEASIBILITY STUDY

FIGURE 5-1
LEACHATE COLLECTION SYSTEM

The limit of waste will be determined by obvious changes in slope at the toe of the landfill, a visual evaluation of the limits of waste (test pits), a comparison of past and present surveys of the landfill, and an evaluation of past disposal practices.

5.3 CONSOLIDATION EFFECTS ON DESIGN OF SYSTEM

It is anticipated that the on-site consolidation of wastes will not affect the final location of additional leachate collection system. The limit of the waste will be established to minimize the relocation of landfilled wastes back into the designated cap limits. Areas will be designated on the landfill cap subgrade plan for the relocation waste to locations where the slopes are stable and maximum grades have not been exceeded. Most on-site consolidation is expected to be in the form of contaminated soils (i.e. from runoff pond sediments) which can be used for shaping the landfill before capping. Large-scale consolidation is not practical, since the existing landfill slopes would not allow a great deal of reshaping to reduce the overall "footprint" area occupied by the landfill.

5.4 REVIEW OF POTENTIAL LEACHATE PATHWAYS

The landfill mass is generally underlain by a thick (25-foot to 50-foot) silt/clay layer. This silt/clay layer appears to provide a low permeability boundary between the landfill leachate and the sand/gravel stratum below. The sand and gravel layer outcrops at the northern end of the landfill. Three hydrostratigraphic units appear to exist in the landfill area:

1. A refuse generated leachate mound perched on the impermeable silts and clays. The groundwater flow from the leachate mound may be radial.

2. A sand and gravel aquifer underlying the silts and clays.

3. A bedrock aquifer.

The possible radial flow from the leachate mound could be addressed by an additional perimeter leachate collection system. However, the long-term effectiveness of a perimeter collection system would be limited to the elevation of the leachate mound. After the landfill is capped, the leachate mound should begin to dissipate as a result of the reduction of precipitation recharge. This may cause the groundwater elevation to fall below the elevation of the perimeter collection pipe, resulting in little or no leachate collected.

The applicability of leachate collection or groundwater extraction will require detailed evaluation of the site conditions. Long-term solutions will be addressed in the RI/FS.

5.5 VERTICAL SEPARATION

Vertical separation can be provided to limit the collection of uncontaminated groundwater by a leachate collection trench. The vertical separation may come in the form of low permeable soil or low permeable geosynthetic material placed along the non landfill side of the leachate trench. The need for vertical separation will be determined in the full RI/FS based on the groundwater elevation and the elevation of the leachate line, as well as the cost of installation versus leachate treatment.

SECTION 6 - REVIEW OF LEACHATE TREATMENT TECHNOLOGIES

6.1 CHARACTERIZATION OF LEACHATE AS HAZARDOUS OR NON-HAZARDOUS

Leachate collected at the landfill will be analyzed to determine if it requires handling as a hazardous waste or as a non-hazardous waste. Determination of leachate as a hazardous waste will be made based upon whether:

1. The leachate contains listed hazardous wastes which could have been derived from the landfill. The listing of hazardous wastes will be derived from 6NYCRR Part 371 - Identification and Listing of Hazardous Waste. Any hazardous wastes identified will be compared with groundwater background data to determine if it may have been derived from the landfill; or

2. The leachate fails any ignitability, corrosivity, reactivity, or TCLP tests used to characterize a substance as a RCRA hazardous waste. The USEPA characterization tests will be used as defined by Code of Federal Registry (CFR), Title 40, Part 261, "Identification and Listing of Hazardous Waste."

6.2 CURRENT AND PROJECTED LEACHATE QUANTITIES

Presently, the Orange County Landfill collects and treats approximately 1.8 million gallons of leachate per month. The construction of a cap will eliminate the need for collection and treatment of surface water runoff. It will also significantly reduce the quantity of precipitation infiltrating

into the waste mass. Based on this reduction, it is estimated that approximately 130,000 gallons per month of leachate will be collected. This number may initially increase as a result of the loading caused by the cap, but as the leachate mound under the landfill begins to dissipate due to the lack of precipitation recharge, the leachate quantity collected will decrease.

6.3 POSSIBLE SHORT-TERM SOLUTIONS

The short-term preferred solution for the treatment and disposal of leachate collected at the landfill is continued hauling and treatment at wastewater treatment plant. The City of Newburgh Sewage Treatment Plant is currently able to handle the flows and loadings of the leachate and other area treatment plants have expressed interest in accepting leachate from the landfill. If a cap is constructed, surface run-off will no longer require collection and treatment. This will reduce the total quantity of landfill leachate requiring treatment.

6.4 POSSIBLE LONG-TERM SOLUTIONS

Long-term solutions to leachate and/or groundwater treatment will require a thorough analysis of the historical analytical sampling/results. This analysis will be performed during the remedial investigation phase of the RI/FS.

The long-term solutions to leachate treatment could include:

1. Continued hauling to a wastewater treatment plant.

2. Pretreatment of leachate on-site followed by secondary treatment of leachate off-site at a wastewater treatment plant.

3. Treatment and disposal of leachate on-site.

The determination of which solution should be used will consider the quantities and nature of contamination of leachate requiring treatment, the cost of both on-site or off-site transportation and treatment, and the ability of wastewater treatment plants to handle the leachate loadings and flows.

On-site treatment or pretreatment of leachate may be either temporary or permanent. Temporary modular units are commonly used for on-site treatment. Based on a brief review of the nature of

the contaminants found at site during ground sampling, the following technologies may be of use in the on-site treatment of specific contaminants:

1. Removal of metals (arsenic, cadmium, iron, manganese, and magnesium). Common technologies used for on-site removal of metals may include: ion exchange, oxidation, pH adjustment, and/or filtration.

2. Removal of halogenated hydrocarbons (tetrachloroethene, 1,1,1-trichloroethane, and trichloroethene), and aromatic hydrocarbons (benzene, toluene). Common technologies used for on-site removal of halogenate hydrocarbons and aromatic hydrocarbons include air stripping, advanced oxidation, biological treatment, and/or carbon adsorption.

SECTION 7 - ACCELERATED REMEDIAL ACTION

7.1 COST COMPARISON OF ALTERNATIVES

Based upon the results of the preliminary screening, there appears to be three alternatives for the County with respect to immediate remedial action. The first alternative is to continue collecting and treating leachate and surface water (No Action). The second and third alternatives focus on control and isolation of leachate generation utilizing a landfill cap (barrier). The type of cap can either be constructed in accordance with the New York State's 6 NYCRR Part 360 solid waste regulations (Alternative II), or in accordance with the Federal Resource and Recovery Action (RCRA) regulations for hazardous waste sites (Alternative III). A summary of each of the alternatives and potential costs is described as follows:

A. **Alternative I - No Action.** The no action alternative means that the County will continue to collect and treat leachate and surface water. This alternative primarily provides a baseline for comparison to other accelerated remedial actions in terms of effectiveness and economic feasibility. No action would allow the landfill to continue to be recharged by precipitation, which could result in the continuation of leachate seeps and groundwater contamination. The estimated cost associated with this action is summarized as follows:

Capital Costs: $0
Annual Operation and Maintenance: $2,600,000/year
Present-worth Cost: $39,920,000 (i = 5%; n = 30 years)

Note: The annual operation and maintenance cost is based on recent average expenditures associated with leachate collection and treatment.

B. **Alternative II - Source Control, Part 360 Cap.** This accelerated remedial action would serve as a source control technology and would consist of constructing a landfill cap in accordance with New York State Solid Waste Management Regulations (6 NYCRR Part 360). The work would include:

1. Stabilization of the roadway embankment between the landfill and the Cheechunk Canal.

2. Continued collection and off-site treatment of leachate from the existing collection system (the effectiveness of the existing collection system and treatment of leachate will be further evaluated under the RI/FS for the entire site).

3. A landfill cover system meeting the requirements of Part 360 (refer to Figure 4-1).

4. Utilizing the existing gas collection system to prevent off-site migration of gases.

The estimated cost associated with this action is summarized as follows:

Capital Costs: $17,300,000
Annual Operation and Maintenance: $200,000/year
Present-worth Cost: $20,370,000 (i = 5%; n = 30 years)

C. **Alternative III - Source Control, RCRA Cap.** This action is similar to Alternative II, except that the landfill cap would utilize a composite cap (clay and membrane) instead of a Part 360 cap (refer to Figure 4-1). The estimated cost associated with this action is summarized as follows:

Capital Costs: $26,000,000
Annual Operation and Maintenance: $200,000/year
Present-worth Cost: $29,100,000 (i = 5%; n = 30 years)

7.2 REVIEW OF ACCELERATED REMEDIAL ACTION PROCESS AND PUBLIC PARTICIPATION

The Accelerated Remedial Action process consists of four steps. The first step is the preparation of this Focused Feasibility Study (F-FS) to evaluate several interim remedial alternatives to arrive at a recommended accelerated remedial action for the landfill. The County and NYSDEC then perform a technical review of the F-FS. Following the completion of the technical review, the NYSDEC drafts a Proposed Remedial Action Plan (PRAP) for the accelerated action incorporating the technical review comments and recommended course of action.

The PRAP will be made available for public review and comment during a 30-day public comment period. The public review process will include one public meeting. At the end of the public comment period, a Record of Decision (ROD) will be prepared by the NYSDEC and signed by the commissioner of the NYSDEC defining the Accelerated Remedial Action to be performed at the site. Figure 7-1 illustrates the steps of the Accelerated Remedial Action review process through the ROD. Table 7-1 sets both completed and anticipated target dates for the completion of the Accelerated Remedial Action review process.

SECTION 8 - SUMMARY AND RECOMMENDATIONS

This Focused Feasibility Study was completed in conformance with New York State Department of Environmental Conservation's (NYSDEC) Strategic Plan dated January 14, 1992 for Accelerated Remedial Actions at Class 2 inactive hazardous waste landfills. The two basic objectives for the F-FS study were: (1) enhancement of environmental protection during the Remedial Investigation/Feasibility Study (RI/FS) program; and (2) reduction of landfill leachate and contaminated runoff that contacts surface leachate.

To determine an appropriate action to meet the objectives of the study, a progression of steps was taken. In the first step, remedial technologies were identified to evaluate potential remedial action(s). The remedial technologies reviewed included: (1) destruction; (2) separation and treatment; (3) solidification and chemical fixation; and (4) control and isolation. From the review of the remedial technologies, three alternatives were deemed most appropriate. These actions included:

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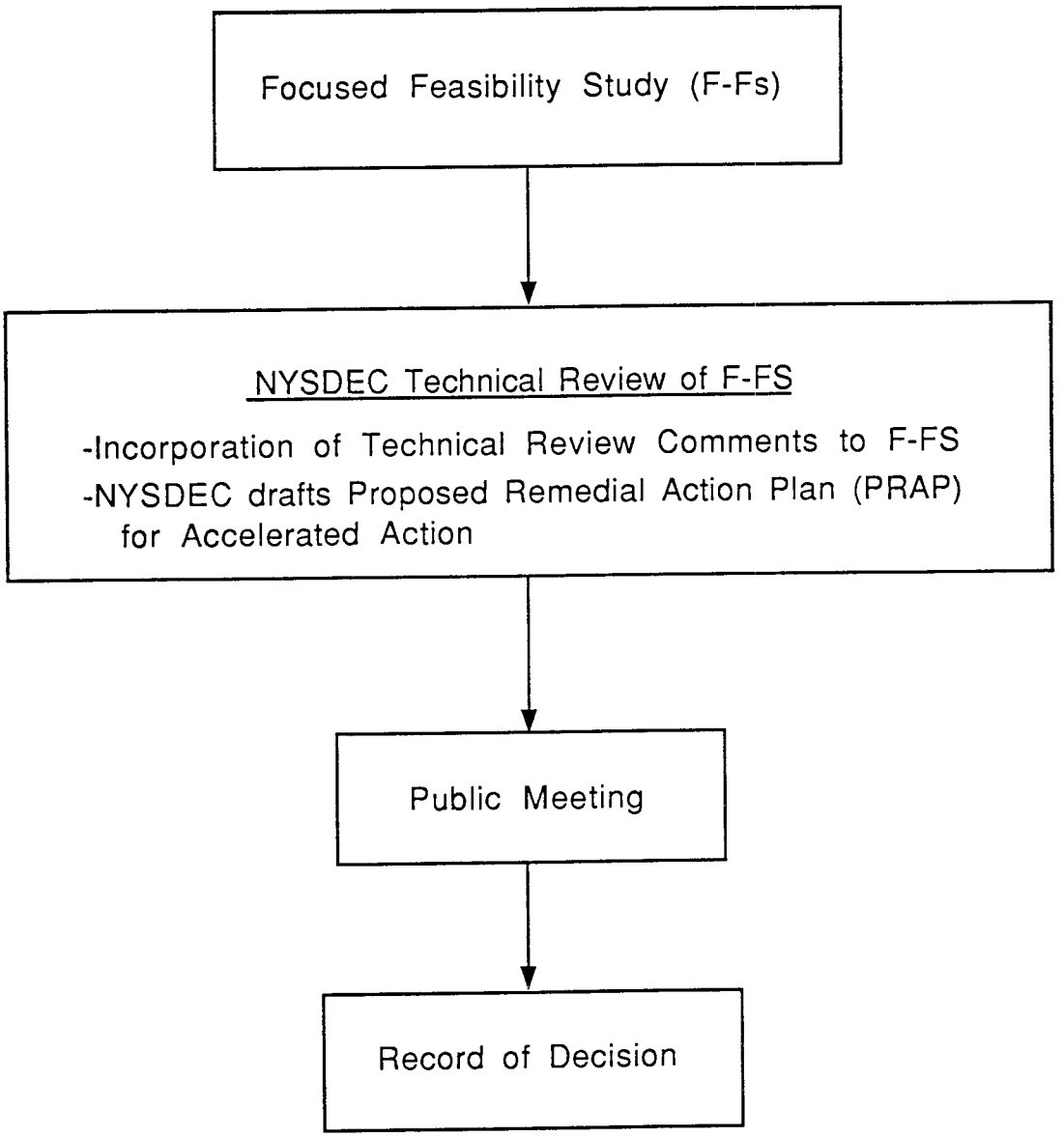

FIGURE 7-1 Decision Flow Path of Accelerated Remedial Action

Focused Feasibility Study
Orange County Landfill

Stearns & Wheler
ENVIRONMENTAL ENGINEERS & SCIENTISTS

PROJECT NO. 2535

TABLE 7-1

TARGET COMPLETION DATES
ACCELERATED REMEDIAL ACTION PROCESS
ORANGE COUNTY LANDFILL

1.	Notice Published for Public Information Meeting	April 12, 1993
2.	Outline for Draft Focused Feasibility Study (F-FS) Submitted to NYSDEC	April 30, 1993
3.	Public Information Meeting	May 19, 1993
4.	Complete Draft Focused Feasibility Study (F-FS)	June 4, 1993
5.	County's technical review of F-FS	June 11, 1993
6.	NYSDEC Technical Review of F-FS	September 28, 1993
7.	Incorporation of Technical Review Comments to F-FS	October 1, 1993
8.	NYSDEC Drafts Proposed Remedial Action Plan (PRAP) for Accelerated Action	October 1, 1993
9.	Notice Published for Public Meeting	October 5, 1993
10.	Public Meeting	October 26, 1993
11.	Thirty-Day Public Comment Period Ends	November 10, 1993
12.	Commissioner Signs ROD for Accelerated Remedial Action	December 10, 1993

1. No action.
2. Control and isolation.
3. Permanent action.

The technology options were then evaluated using the guidance of the NYSDEC policy memorandum concerning accelerated remedial actions at Class 2 regulated landfills. Since the study is not intended to provide an exhaustive analysis of available technology, it was limited to a preliminary screening utilizing an effectiveness evaluation and an implementability evaluation. Based on preliminary screening using information available at this time, the most appropriate technology for accelerated remedial action was determined to be control and isolation. The recommended control and isolation option is a landfill cap (barrier). The capping alternative is a source control technology that is intended to minimize infiltration of precipitation into the landfill, thus minimizing the generation of leachate and meeting the objectives of the accelerated remedial action as an interim remedy.

The study then evaluated and/or identified design issues that must be considered for site-specific applications. From the preliminary analysis, it is recommended that the accelerated action consist of the following work elements:

1. Construction of a 6 NYCRR Part 360 cap.

2. Utilization of the existing active gas collection system.

3. Utilization of the existing perimeter leachate collection system until completion and assessment of the final RI/FS program.

4. Stabilization of the roadway embankment between the landfill and the Cheechunk Canal.

This Accelerated Remedial Action was conducted to establish <u>interim</u> measures to minimize leachate production during the time frame of the RI/FS program. The full RI/FS program will address the long-term solutions to site contamination, leachate pathway, and health and safety issues.

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