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SIMON HYDRO-SEARCH

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MACHIAS GRAVEL PIT FEASIBILITY STUDY SITE NUMBER 905013

5/91

May 21, 1991

Prepared for:

Motorola, Inc.
4000 Commercial Avenue
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Prepared by:

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Golden, Colorado 80401

426116032

SIMON Environmental

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Appendix

1.0 INTRODUCTION

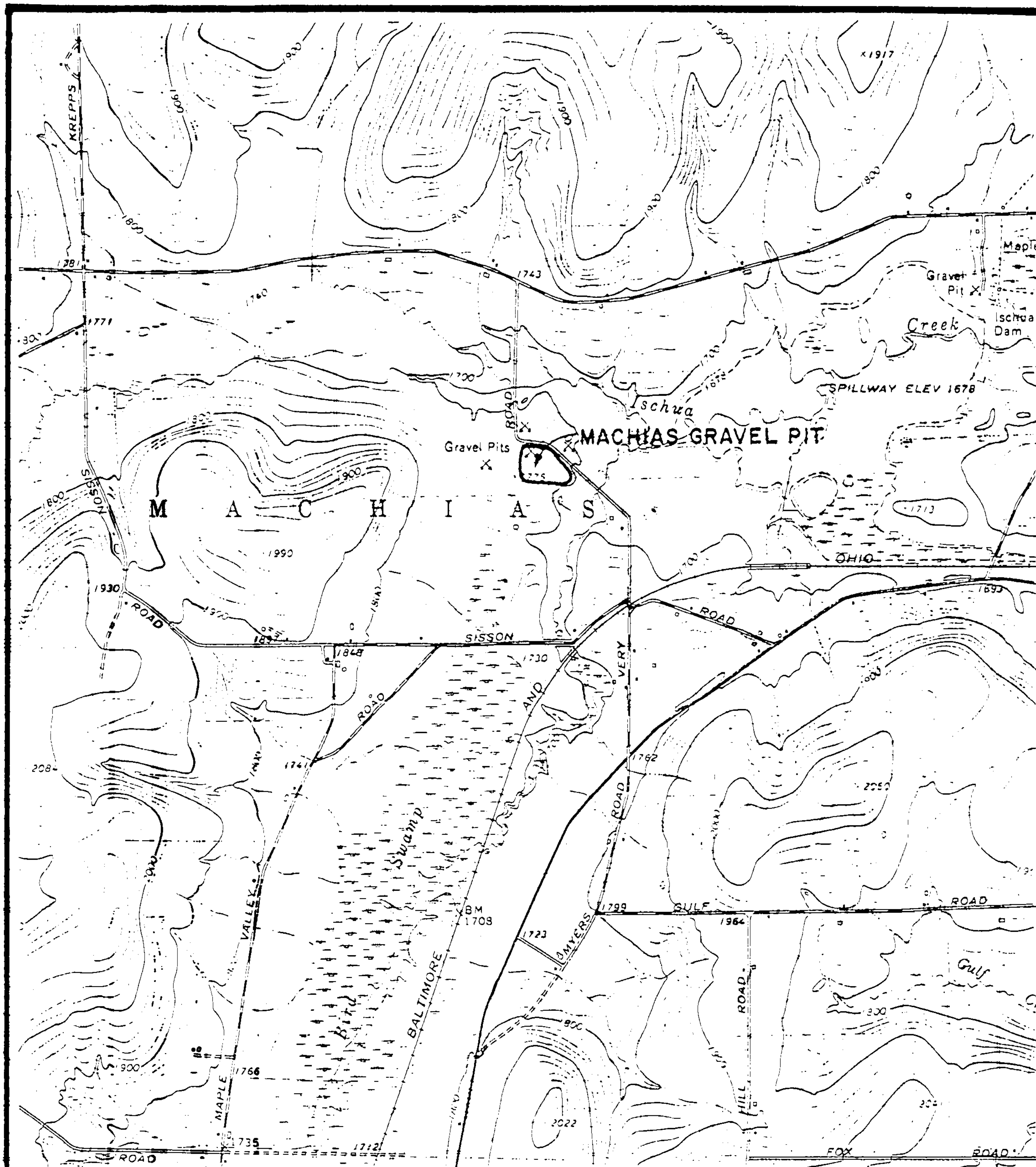
1.1 Purpose

Hydro-Search, Inc. (HSI) was contracted by the Motorola, Inc. to conduct a feasibility study (FS) for the Machias Gravel Pit site in Machias, New York. The purpose of the FS is to provide the Motorola with a range of feasible alternatives for remediation of soil and ground water contamination occurring at the site, as deemed necessary. The scope of the FS was to consider only proven technologies and processes for remediation and, as a result, considers fewer alternatives.

1.2 Background

The Machias Gravel Pit site (NYSDEC #905013) is located on Very Road approximately 2 miles west of the town of Machias, New York in Cattaraugus County (Figure 1). The site is approximately 20 acres in size and consists of an active gravel pit operation in the southern portion of the site and an inactive gravel pit in the northern portion (Figure 2). The inactive gravel pit was reportedly used for the storage of approximately 600 drums of waste material from the former Motorola Plant in Arcade, New York, between March and September 1978. There are currently no drums remaining on site. The drums were suspected to contain wastes such as epoxy resins, acids, flammable and non-flammable solvents and cutting oils. Based on available background information, it is estimated that the contents of approximately 300 drums were released directly on the ground surface. The oils received at the site were reportedly spread on local roads for dust control by town personnel. The gravel pit was used as the transfer point to fill a tank on a truck prior to spraying on rural roads. The remaining drummed wastes were allegedly stacked on the ground surface along the inactive gravel pit wall.

The New York State Department of Environmental Conservation (NYSDEC) initiated an investigation of the site in 1985. In 1986 and 1987, the NYSDEC provided oversight during



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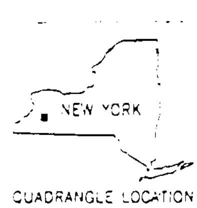

LAT. 42°22'05" N
LONG. 75°30'7.5" W

SOURCE: USGS TOPOGRAPHIC MAP
WEST VALLEY, N.Y.

LOCATION MAP

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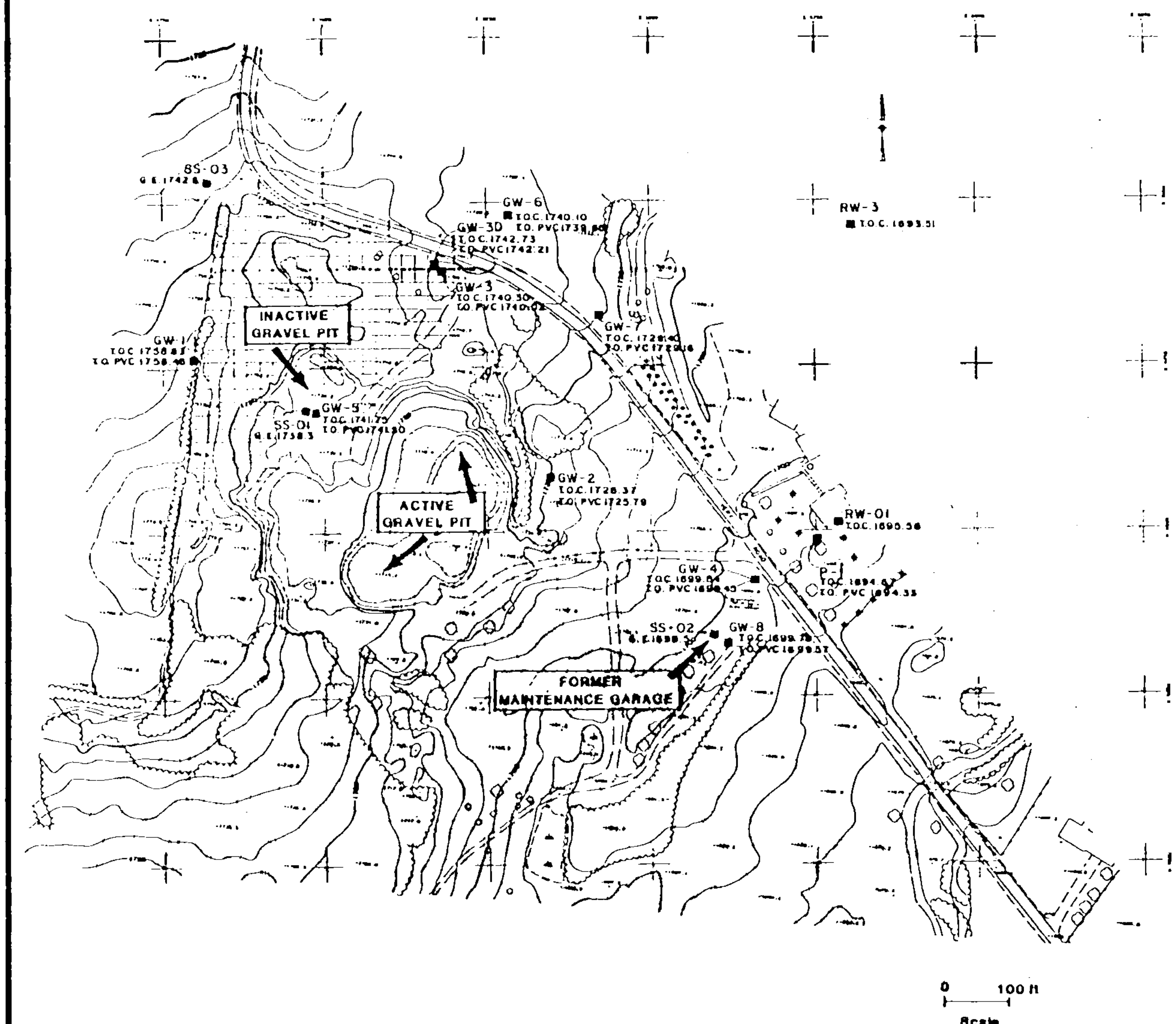
FIGURE 1



LEGEND

■ GW-1	Ground Water Monitoring Well
■ RW-1	Residential Well
■ P-1	Piezometer
● SS-01	Surface Soil Sampling Location

LAT. 42°22'05" N
LONG. 73°30'25" W

SITE FEATURES

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FIGURE 2

a drum removal and soil remediation project on the site. Approximately 184 drums were removed from the site for proper disposal by the Town of Machias which is the property owner. There were no documents available to determine if the remaining drums were spilled, placed within the fill adjacent to the inactive pit area, or moved off-site for proper disposal. A small volume of contaminated soil was removed from the area where the drums were stored and stockpiled on plastic sheets. There are no drums (i.e., waste sources) remaining at the site. No records documenting soil disposal have been identified.

The NYSDEC conducted a Phase II investigation in 1988 at which time four ground water monitoring wells (GW-1 through GW-4) were installed in the locations shown in Figure 2. Sampling of these wells has shown the presence of volatile and semi-volatile compounds in the ground water, namely trichloroethylene (TCE) and 1,1,1-trichloroethane (TCA) in one well, GW-3.

Motorola voluntarily took over the site investigation in 1990 and has conducted an expanded site investigation. The site investigation involves the installation of five additional ground water monitoring wells, ground water monitoring well sampling, a geophysical survey and test pit excavations to confirm or refute the presence of buried drums, surface soil sampling and residential well sampling.

The results of the investigations conducted to date are detailed in a separate report entitled Machias Gravel Pit Remedial Investigation Report (April 1991) and are summarized in the following section.

1.3 Nature and Extent of Contamination

1.3.1 Soils

Three types of soil samples were collected during the remedial investigation (RI):

- Surface soil
- Test pit soil
- Subsurface soil

Analytical results of surface soil samples show clean conditions relative to the background soil sample, except for lead within the inactive gravel pit area (Figure 2). At this location, lead was detected at 608 mg/kg relative to a background sample concentration of 13.6 ug/kg. The areal extent of the elevated lead is believed to be limited to the inactive gravel pit area which is a known location of past waste handling/storage activities.

Analytical results from test pit soil samples within the suspect drum burial area north of the inactive gravel pit show elevated levels of polyaromatic hydrocarbons (PAHs) in only two of the five samples. Field notes from both test pits indicate the presence of asphalt debris mixed with the fill in these areas. PAHs are a common constituent of asphalt and are believed to be associated with this debris rather than potential drum disposal.

Subsurface soil field screening and laboratory analyses show clean conditions except for two volatile organic compounds detected in the subsurface soil just above the ground water table (approximately 43 feet below the ground surface) beneath the inactive gravel pit area. This sample showed elevated levels of TCE (291 ug/kg) and 1,1,1-TCA (27 ug/kg). This is believed to be residual contamination associated with the ground water table fluctuation as ground water is also contaminated in this area with the same constituents. It is not believed to be associated with residual contamination from the percolation of spilled liquid waste based on a lack of visual and field screening evidence for major residual contamination in unsaturated zone materials.

The preliminary risk assessment of the soils data suggest no significant risks associated with any of the levels of compounds detected.

1.3.2 <u>Ground Water</u>

Two types of ground water samples were collected during the RI:

- Monitoring well
- Residential well

Analytical results of monitoring well ground water samples show a slug of TCE and 1,1,1-TCA ground water contamination migrating from the inactive gravel pit source area toward the northeast, in a downgradient direction. Based on field observations and analytical ground water modeling, the contaminated ground water slug has approximate dimensions of 640 feet along the longitudinal axis, 375 feet along the transverse axis and approximately 45 feet in thickness. Assuming an aquifer porosity of 0.30 yields an estimated 24,235,000 gallons of impacted or contaminated ground water. The extent of ground water contamination is shown in Figure 3 for TCE and Figure 4 for 1,1,1-TCA.

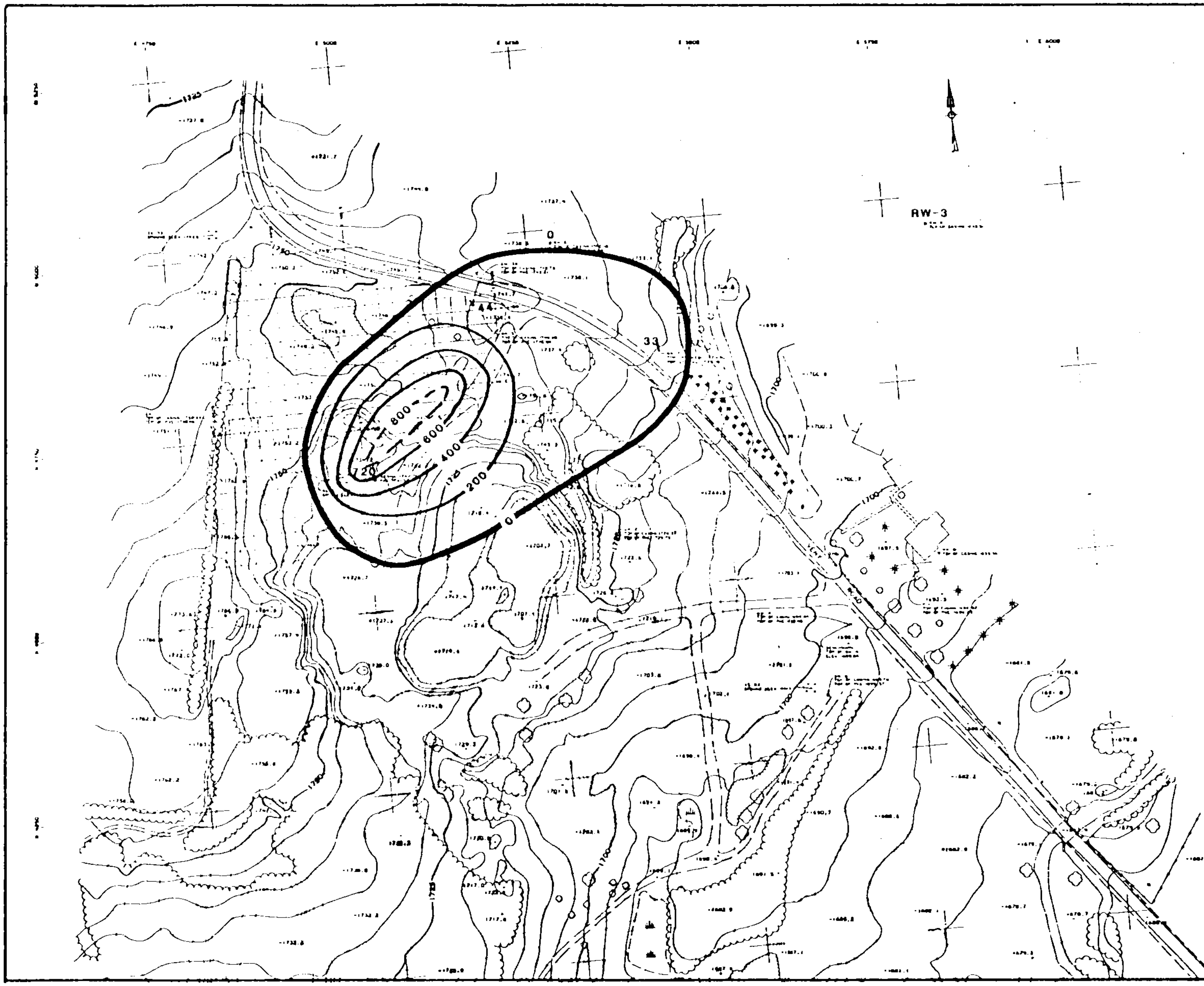
Ground water samples were also analyzed for total and dissolved chromium, nickel and lead. Although some elevated total lead was detected in ground water samples, dissolved metal concentrations reported dissolved lead as non-detected, indicating that the lead is not mobile in the ground water system.

Ground water samples from residential wells were analyzed only for volatile organic compounds (VOCs). The residential wells were not analyzed for inorganics based on data from previous site studies showing the primary concerns being focused on volatile organic constituents. Results of the residential well sampling show all analyzed compounds to be undetected.

The nearest ground water receptor was identified to be the cabin well (RW-3) approximately 450 feet north of the Cole residence. Analytical ground water modeling was used to develop future worst-case time versus concentration curves for TCE and 1,1,1-TCA at the receptor well. The subsequent risk analysis showed no significant risk associated with the predicted exposure to 1,1,1-TCA; however, a total cancer risk for TCE was estimated at 2.9×10^{-5}.

1.3.3 Surface Water

The nearest surface water receptor is Ischua Creek. An analytical ground water model was used to estimate times and concentrations of TCE and 1,1,1-TCA that might enter Ischua Creek under



LEGEND

200 Isoconcetration Contour (ug/l)

800 Model Estimated Isoconcentration Contour (ug/l)

0 100 ft
SCALE

Isoconcentration Contour Map of TCE

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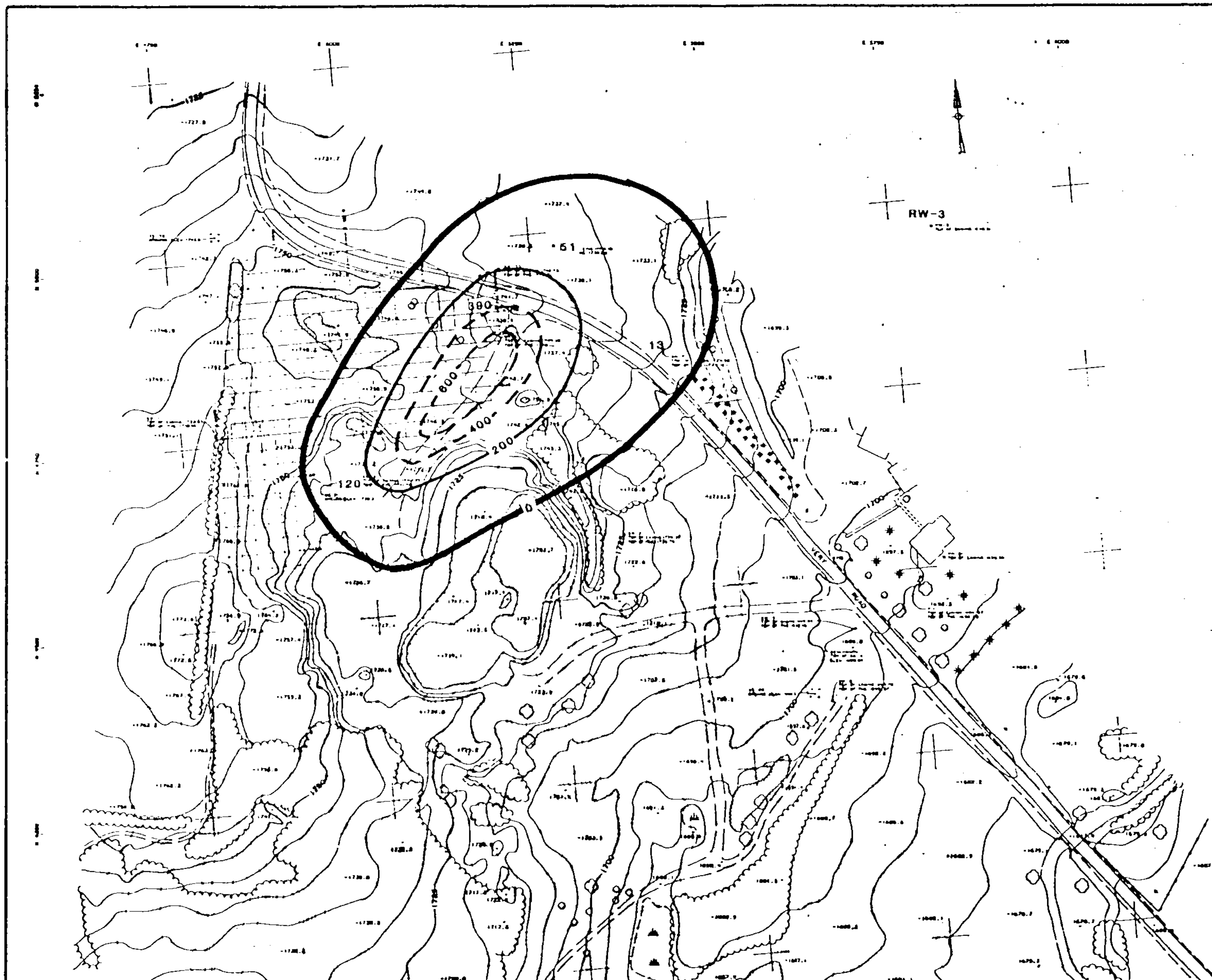
FIGURE 3



LEGEND

200 Isoconcentration Contour (ug/l)

600 Model Estimated Isoconcentration Contour (ug/l)

0 100 ft
SCALE

Isoconcentration Contour Map of 1,1,1,-TCA

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FIGURE 4

present ground water conditions. The estimated distance along the flow path from the source area to Ischua Creek was 1700 feet. The worst-case scenario assumed that all contaminant entered the stream and that stream flow was 3.4 ft^3/sec (based on measurements taken June 7, 1991 during an unusually dry month). The analytical model predicted arrival time and concentration of the contaminant plume at the creek. Results of the modeling are illustrated on Figures 5 and 6 for TCE and 1,1,1-TCA, respectively.

Model results predict the leading edge of the plume to reach the creek within eight years and peak contaminant levels in 13 years for 1,1,1-TCA and 17 years for TCE. With a stream flow of 3.4 ft^3/sec peak concentrations of contaminant in the stream are predicted to be 1.02 ug/L and 0.753 ug/L for TCE and 1,1,1-TCA, respectively. It should be noted that these estimates are believed to be worst-case as the model assumes direct discharge to Ischua Creek with no component of parallel flow allowing for additional dispersion and dilution prior to discharge, no biodegradation and extremely low flow conditions.

This worst-case scenario does not appear to pose significant impacts to the environment as the maximum concentrations predicted are less than the New York State Water Quality Guidance Values. Guidance values are 5 ug/L and 3 ug/L for 1,1,1-TCA and TCE, respectively, and maximum predicted contaminant concentration of Ischua Creek is 0.753 ug/L for 1,1,1-TCA and 1.02 ug/L for TCE. These guidance values assume that Ischua Creek is used as a drinking water source. Less conservative guidelines are established for TCE (11 ug/L) and no guideline is available for TCA if the stream use is assumed to be strictly for fishing and fish propagation.

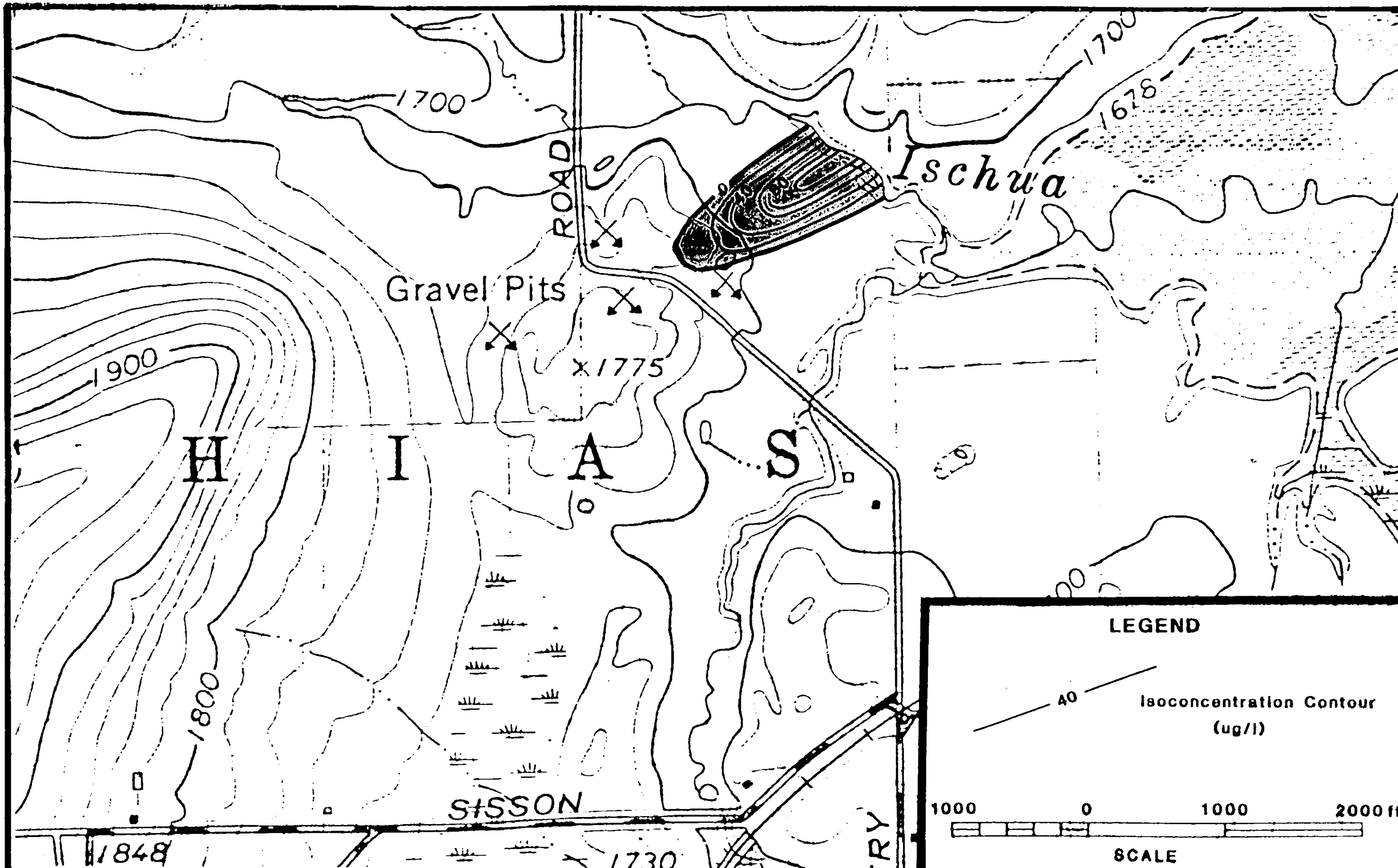

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FIGURE 5

TCE ISOCONCENTRATION CONTOUR MAP OF MODELED PLUME POTENTIALLY ENTERING ISCHUA CREEK

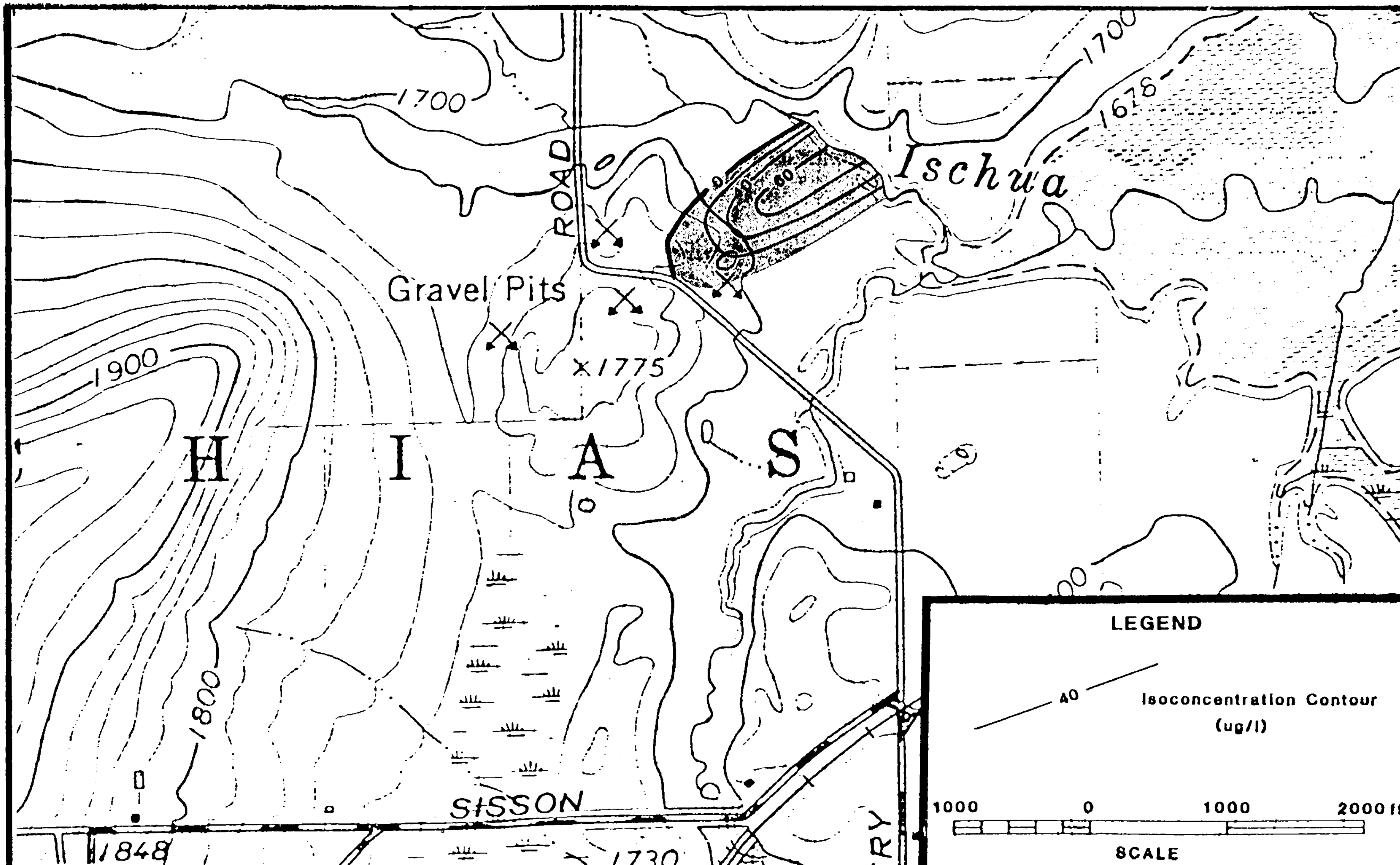

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FIGURE 6

1,1,1 TCA ISOCONCENTRATION CONTOUR MAP OF MODELED PLUME POTENTIALLY ENTERING ISCHUA CREEK

2.0 REMEDIAL ACTION OBJECTIVES

2.1 Remedial Action Scope

Remedial actions for the Machias Gravel Pit site will address VOCs (namely TCE and 1,1,1-TCA) in the ground water. As indicated in Section 1.3, soil contamination is limited to the drum disposal area (inactive gravel pit area; Figure 2) but is only present at levels that cause an unacceptable risk directly above the water table, indicating that the contamination may be the result of ground water table fluctuations. Remediation of the ground water would, therefore, also result in the eventual clean-up of the soil.

Remedial actions for the ground water will address the following exposure pathways:

1) Direct contact/ingestion of contaminated ground water.
2) Inhalation of contaminated vapors.

The objectives of remedial action will be to provide a permanent remedy for the site that mitigates threats associated with ground water contamination as rapidly and cost-effectively as possible.

2.2 Applicable or Relevant and Appropriate Requirements

Implementation of remedial actions at the Machias Gravel Pit site must be consistent with the State of New York and Federal regulations and policy regarding hazardous waste. These regulations are referred to applicable or relevant and appropriate requirements (ARARs).

A preliminary list of ARARs for the site is presented in Table 1. A more extensive review of ARARs would be required during the design of a remedial alternative.

TABLE 1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Standard, Requirement, Criteria or Limitation	Citation	Description
Safe Drinking Water Act	42 U.S.C. § 300g	
National Primary Drinking Water Standards	40 CFR, Part 141	Establishes health-based standards for public water supply systems (MCLs).
National Secondary Drinking Water Standards	40 CFR, Part 143	Establishes welfare-based standards for public water supply systems (secondary MCLs).
Underground Injection Control Regulations	40 CFR, Part 144-147	Provides for protection of underground sources of drinking water through control of underground injection.
Maximum Contaminant Level Goals	Pub. L. No. 99-339, 100 Stat. 642 (1986)	Establishes drinking water quality goals set at levels of no known or anticipated adverse health effects.
New York State, Department of Health, State Sanitary Code	Pub. Health Law § 225	
Chapter I, Part 5, Drinking Water Supplies	Subpart 5-1	Provides for NYS Maximum Contaminant Level determination, monitoring requirements and variances. Establishes notification procedures in the event of violations.
New York State, Department of Environmental Conservation, Division of Water, Water Quality Standards and Guidance Values, September 25, 1990	---	Defines water classes and principal organic contaminants. Provides standards and guidance values for surface waters and ground waters.
Clean Water Act	33 U.S.C. §§ 1251-1376	
Water Quality Criteria	40 CFR, Part 131	Provides for establishment of water quality standards based on toxicity to aquatic organisms and human health.
Clean Air Act	42 U.S.C. §§ 7401-7642	
National Primary and Secondary Ambient Air Quality Standards	40 CFR, Part 50	Establishes standards for ambient air quality to protect public health and welfare.
National Emission Standards for Hazardous Air Pollutants	40 CFR, Part 61	Sets emissions standards for designated hazardous pollutants.
New York State, Environmental Conservation Law	Chapter 3, Title 6	
	Parts 256-257	Provides air quality classification system and air quality standards.
	Part 263	Provides county-specific air quality standards.
Air Clean-up Criteria	(Pages 6 & 7)-1	Provides cross media contamination standards.

2.3 Action Levels and Clean-up Goals

The New York State Department of Health (NYSDH) has promulgated standards for ground water used as drinking water. These standards are the New York State Maximum Contaminant Levels (NYS MCLs). The NYS and Federal MCLs for the contaminants of concern found in the ground water at the site are presented in Table 2. Compliance with the NYS MCLs is measured at the point of use (e.g., the faucet). The NYS MCLs will be used as action levels and clean-up goals for the ground water.

Clean-up goals for the aquifer, however, must meet the NYS ground water standard as defined by 6NYCRR Part 703.5(a)(2) which may be different from the NYS MCL (e.g., lead and benzene; see Table 2).

TABLE 2

NEW YORK STATE AND FEDERAL MAXIMUM CONTAMINANT LEVELS

Compound	NYS MCL	Federal MCL	NYS Ground Water Standards
Acetone	0.05 mg/L	N.A.	--
Benzene	0.005 mg/L	0.005 mg/L	0.7 ug/l
1,1,1-Trichloroethane	0.005 mg/L	0.20 mg/L	5 ug/l
Trichloroethene	0.005 mg/L	0.005 mg/L	5 ug/l
Total Phenols	0.001 mg/L	N.A.	1 ug/l
Chromium	0.05 mg/L	0.05 mg/L	50 ug/l
Lead	0.05 mg/L	0.05 mg/L	25 ug/l
Nickel	N.A.	0.10 mg/L*	--
Iron	0.3 mg/L	N.A.	300 ug/l**

N.A. - Not Available
-- - Standard Not Estimablished
*MCLG - Maximum Contaminant Level Goal
** - Standard for Iron and Manganese is 500 ug/l

3.0 DEVELOPMENT OF REMEDIAL ACTION ALTERNATIVES

3.1 Introduction

Remedial action alternatives are developed using a systematic approach. First, the remedial action objectives are identified. This was accomplished in Section 2.0 from which the medium of concern, action levels and clean-up levels were determined. The second step involves the identification of general response actions that meet the remedial action objectives. Examples of general response actions are treatment, disposal and containment. The third step involves the identification and screening of technologies which are defined as a subset of general response actions. Examples of technologies are thermal treatment, landfilling and capping. Technologies are screened on the basis of technical applicability (i.e., only technologies with the potential to address the media and contaminants of concern are retained). The fourth step involves the identification and screening of process options which are defined as subsets of technologies. Examples of process options are incineration, Subtitle C landfill and a RCRA cap. The process options are screened on the basis of effectiveness, implementability and cost. The fifth and final step in the development of remedial action alternatives is the combination of process options to form remedial action alternatives.

This process for developing remedial action alternatives assures that a full range of potentially feasible alternatives is developed. The remainder of this section presents the development of remedial action alternatives for the Machias Gravel Pit site.

3.2 Identification of General Response Actions

Table 3 lists the range of general response actions and identifies those appropriate for ground water.

No action may be appropriate for the ground water since contamination is localized and presently not threatening human health, however, this does not address future risks. In all probability,

TABLE 3

GENERAL RESPONSE ACTIONS IDENTIFIED FOR THE MACHIAS GRAVEL PIT SITE

General Response Action	Applicable to Ground Water
No Action	X
Institutional Controls	X
Containment	
On-site Treatment	X
Off-site Treatment	X
On-site Disposal	X
Off-site Disposal	X

the no action general response action would be combined with institutional controls which would assure that there is no future threat to human health by implementing necessary controls for the present and planning for future controls. The containment general response action is the only general response action not practical for the ground water. Containment measures for the ground water may alter hydrogeologic conditions, especially for downgradient users. In addition, containment measures for ground water are considered short-term remedies and would, therefore, not be beneficial at the Machias Gravel Pit site. On-site treatment of ground water is feasible and desirable in many cases given State and Federal regulations. On-site treatment includes both in-situ (i.e., in-place) and above-ground applications. Off-site treatment of ground water is feasible, but often less desirable when compared to on-site treatment because of state and federal regulations and cost. On-site disposal is only considered feasible for ground water treated on-site. On-site disposal, such as reinjection of ground water, may enhance the restoration of contaminated aquifers by flushing the aquifer more rapidly than under natural conditions. Off-site disposal is feasible, particularly if ground water is treated off-site.

3.3 Identification of Technologies

TCE and 1,1,1-TCA are highly volatile organic compounds which makes contaminant removal and destruction relatively easy compared to other compounds. There are basically four treatment technologies and three disposal technologies for ground water. The four treatment technologies are thermal, chemical, biological and physical treatment. The three disposal technologies are surface water discharge, ground water discharge and discharge to a public owned treatment works (POTW).

3.3.1 Treatment Technologies

Thermal treatment technologies involve heat transfer or the use of high temperatures as the principle means of destroying or detoxifying hazardous compounds. Incineration, pyrolysis and wet air oxidation are processes that fall under the thermal treatment technology category. While thermal technologies are highly capable of destroying TCE and 1,1,1-TCA, they have not been promoted for the treatment of liquids, especially those containing volatile organic compounds, because they are cost prohibitive compared to other technologies. Recent development of a few thermal process options, however, warrant further consideration of thermal treatment. Thermal treatment technologies will be retained for further consideration.

Chemical treatment technologies alter the chemical structure of the constituents to produce a residual that is less hazardous than the original constituent, or is no longer hazardous. Examples of chemical processes under the chemical treatment technology category are reduction-oxidation, neutralization, and dechlorination. Chemical treatment technologies, like thermal treatment technologies, have not been promoted for the treatment of volatile organic contaminants. While chemical treatment technologies are not cost prohibitive, they are primarily intended for organic compounds exhibiting strong molecular bonding and inorganic compounds. For these reasons, chemical treatment technologies will no longer be considered.

Biological treatment technologies involve the biological transformation (or biodegradation) of toxic organic compounds to less toxic compounds. Often times the transformation is to carbon dioxide and water. Biodegradation is an innovative technology that shows much potential for the cost-effective treatment of organic compounds. One of the primary features of biodegradation is the ability to perform remediation in-situ. A full-scale study being conducted at Moffet Naval Air Station in Mountain View, California indicates, however, that the ability to effectively use and control biodegradation for TCE and 1,1,1-TCA detoxification is still in the developmental stages. One of the by-products of degradation is vinyl chloride, which is much more toxic than TCE and 1,1,1-TCA and the production of vinyl chloride is difficult to control. Even if biodegradation was further developed, biodegradation would likely not be technically feasible for the Machias Gravel Pit site because it would likely require the injection of bacteria and primary substrates such as methane or methanol to promote biodegradation, given that biodegradation has not been observed to date. Ground water characterization would need to be conducted in further detail to assess what impacts bacteria and substrates would have on nearby Ischua Creek. For the reasons mentioned above, biological treatment will no longer be considered in the development of alternatives.

The physical treatment technology employs the separation of a contaminant from its medium through the use of physical forces or by changing the physical form of the contaminant. In both cases, the chemical form of the contaminant remains constant. Examples of physical treatment technology processes are air stripping, steam stripping and carbon adsorption. The physical treatment technology is simple, proven, relatively inexpensive and frequently used for a wide variety of contaminants, including TCE and 1,1,1-TCA. The physical treatment technology will, therefore, be retained for the development of remedial action alternatives.

3.3.2 Disposal Technologies

The surface water discharge technology involves discharge of treated water to nearby drainages including streams or creeks. Surface water discharge may be feasible at the site given that it is located in a rural area and two creeks are nearby, Ischua Creek and an unnamed creek that drains Bird Swamp. The surface water discharge technology will be retained for the development of remedial action alternatives.

The ground water discharge technology involves the re-introduction of treated ground water into the contaminated aquifer. Processes by which ground water discharge can be accomplished include injection wells and infiltration galleries. This technology would enhance ground water remediation by flushing the aquifer (and contaminated soils). The ground water discharge technology will be retained for further evaluation during the alternatives development.

Discharge to a POTW is a potentially feasible technology. This technology involves conveyance of contaminated ground water to an off-site treatment plant that would treat and dispose (or use) the water. The Town of Machias is the closest municipality to the site, however, according to the town supervisor, the town does not have waste water treatment capabilities. The closest municipality with water treatment capabilities is Yorkshire and is located approximately 5 miles north of the site. This option will be retained for further evaluation.

3.4 Identification of Process Options

The following treatment technologies and disposal technologies were retained for further evaluation:

Treatment Technologies	Disposal Technologies
Thermal Treatment	Surface Water Discharge
Physical Treatment	Ground Water Discharge
	POTW Discharge

Process options for each of the above technologies are identified and screened in this section.

3.4.1 Thermal Treatment Process Options

There are several thermal treatment process options that could be used to destroy TCE and 1,1,1-TCA, however, most are not well suited for ground water treatment. The one process option that is potentially feasible is thermal oxidation. Thermal oxidation is described below and evaluated in terms of effectiveness, implementability and cost.

Thermal Oxidation

Thermal oxidation is the oxidation of organic compounds by the introduction of heat. The process involves heating the influent stream to temperatures on the order of 1,400 to 1,600°F. During the heating process, the contaminants are thermally destroyed by oxidation yielding residuals of carbon dioxide, water vapor and hydrochloric acid (HCl). Maximum HCl production is estimated to be 4 to 5 pounds per day for an influent flow rate of 50 gallons per minute (gpm). This quantity is within ambient air quality standards.

Thermal oxidation is highly effective at destroying volatile organic compounds. The process is primarily intended for treatment of a vapor stream but can handle an influent stream of up to

90 percent water. The ideal application of the process would be as a treatment step for vapor (e.g., the contaminated water would first be run through an air stripper, then the stripped air would be treated via the thermal oxidizer).

Thermal oxidation units are readily available, vendor supplied systems that are easily set-up. The thermal oxidizers are powered by electricity and maintenance is relatively low. Operation of the system can be fully automated and include an LEL monitor (measures combustible gas) and a flame detector (shuts down system if flame is detected).

Capital costs for a 40 gpm (10,000 cfm) thermal oxidizer unit range from $300,000 to $350,000 depending on the options selected. Operating cost ranges from $175,000 to $300,000 per year.

Summary of Thermal Treatment Process Options

Thermal oxidation is a potentially feasible process option and will be retained for further evaluation.

3.4.2 Physical Treatment Process Options

Three physical treatment process options have been identified that have potential applicability at the Machias Gravel Pit site. These processes are air stripping, steam stripping and carbon adsorption. All are conventional processes that are frequently used for ground water remediation.

Air Stripping

Air stripping is a process that provides for mass transfer of volatile organic contaminants from a dilute aqueous stream (e.g., contaminated ground water) into an air stream. Air stripping has been around for several years and has undergone several modifications. Various configurations of air stripping are available including tower aeration, diffused aeration, spray aeration and air-lift pumping.

The most common configurations for the removal of organic compounds are the countercurrent packed and tray towers. In packed and tray tower aeration, mass transfer of VOCs from the water to the air is achieved by mixing contaminated water with uncontaminated ambient air in a countercurrent flow pattern. Contaminated water is pumped to the top of the column, distributed over the surface and allowed to trickle down through a bed of packing materials or trays. Simultaneously, air is blown into (or drawn into if a vacuum source is used) the bottom of the column. The packing material or trays provide a large surface area for mixing, increased contact time for the VOC molecules to transfer from the water to the air and a large void volume to reduce the energy loss of the air system. The air is then released to the atmosphere at the top of the column or treated via carbon adsorption, thermal oxidation or incineration.

Aeration can effectively remove up to 99.9 percent of VOCs from water. The degree to which a contaminant becomes involved in the mass transfer depends on a combination of physical and chemical characteristics such as the Henry's Law constant, diffusivity, molecular weight, solubility and vapor pressure. One of the more important characteristics with respect to aeration is the Henry's Law constant. The greater the Henry's Law constant, the more amenable a contaminant is to aeration. VOCs with Henry's Law constants greater than 3.0×10^{-3} atm-m^3/mole would effectively be removed with air stripping. TCE and 1,1,1-TCA have Henry's Law constants of 9.9×10^{-3} and 1.5×10^{-2} atm-m^3/mole at 68°F, respectively (Roberts and Dändliker 1983). As such, TCE and 1,1,1-TCA would readily be removed by air stripping. In addition, for air stripping to be effective, the waste stream must be low in suspended solids. It may be necessary, therefore, to incorporate a filtration process prior to aeration.

Typical design criteria for air strippers are liquid loadings between 10 and 50 gpm per square foot of tower cross-sectional area and air to water flow rates ranging from 10:1 to 100:1 by volume. The tower height primarily depends on the mass transfer properties of the contaminants removed and the tower packing characteristics, but typically heights range from 10 to 30 feet.

Vendors are marketing low-profile systems that optimize the use of trays and are able to provide systems that are 5 to 6 feet high. There are several manufacturers of air strippers and all are configurations are readily available.

Total capital cost for implementing a 10,000 cfm (40 gpm) air stripping system ranges from $60,000 to $100,000. Operation and maintenance costs are $30,000 to $40,000 per year.

Steam Stripping

Steam stripping is similar to air stripping with respect to the process, only steam is used in place of air. Direct injection of steam and multiple pass heat exchangers are the two most common methods of steam stripping. Steam stripping by steam injection, usually into a tray or packed distillation column, is most commonly used for removal of VOCs from waste streams. Steam strippers are advantageous over air strippers for removing VOCs with lower Henry's Law constants because the Henry's Law constant increases with increasing temperature and for removing higher concentrations of VOCs (e.g., 1 to 10 percent).

Waste stream characteristics that adversely affect the feasibility of steam stripping include: high solubility of organic compounds in water (generally above 1,000 ppm); organic compounds with high boiling points (greater than 300 F); VOC concentrations in excess of 10 percent; and suspended solids concentrations in excess of 2 percent. None of these characteristics are anticipated for the ground water to be treated, therefore, steam stripping would be highly effective at removing VOCs from the ground water.

With steam stripping, both the liquid effluent and vapor effluent may require additional treatment. The vapor phase would require a condensation step followed by liquid-liquid separation prior to air treatment via carbon adsorption. If thermal oxidation was used, these steps would not be necessary.

Like air strippers, steam strippers are marketed by several vendors. Both tray towers and packed towers are readily available. Tray columns have been more widely used in the past and, consequently, are more predictable in their performance. Tray columns operate over a wide range of flow rates and are generally more adaptable than packed towers. Tray columns also require less maintenance, are easier to clean and less likely to be affected should high metal concentrations be encountered. Steam strippers can be designed to handle most any flow rate but are typically available in the 10 to 20,000 gpm size.

Capital cost for a 10,000 cfm (40 gpm) steam stripper is on the order of $100,000 to $200,000. Operation and maintenance cost are estimated at $400,000 to $600,000 per year.

Carbon Adsorption

Carbon adsorption is the process by which soluble contaminants are removed from an aqueous or gaseous phase waste stream by binding the contaminants to the surface of a solid activated carbon adsorbent. The activated carbon selectively adsorbs the contaminants by a surface attraction phenomenon, whereby organic molecules are attracted to the internal pores of the carbon grains (Major and Fitchko 1990). The adsorbent is either granular or powdered carbon.

Granular activated carbon (GAC) involves contact between the adsorbent and waste stream within a moving bed reactor or through a series of fixed bed reactors. When the carbon has reached its adsorbent capacity, the carbon is replaced or regenerated and reused. Regeneration is achieved by heating, steam stripping or solvent extraction.

Powdered activated carbon (PAC) also involves contact between the adsorbent and waste stream, however, finely ground carbon is added to the aqueous stream and thoroughly mixed to provide sufficient contact time. After sufficient contact time the carbon is settled or filtered out and disposed of. The PAC process does not readily lend itself to regeneration. PAC is commonly used in conjunction with the activated sludge process and is not readily adaptable for ground water treatment at the site.

Activated carbon will adsorb most metals chelated with organic compounds, halogenated organic compounds and volatile organic compounds. Factors that affect the adsorption process include the carbon pore structure, contact times, temperature and pH. Multiple organic constituents may reduce the adsorptive capacity for certain compounds because compounds are adsorbed preferentially. Carbon adsorption is not appropriate for waste streams with high solids content or unassociated metals. For contaminants having high molecular weights, low polarities and/or low solubility concentrations, carbon adsorption has a demonstrated removal efficiency of over 99 percent. Therefore, activated carbon (particularly granular activated carbon systems) would be highly effective for treating contaminated ground water at the site.

Several vendors market carbon adsorption units, many of which are mobile systems. The units are readily available and can be fully automated. The systems have capacities ranging from 1 gpm to several thousand gpm. The units are low maintenance systems with the exception of the carbon supply. Carbon usage varies from 1 to 7 pounds per 1,000 gallons of water treated. Carbon usage is affected by influent concentrations, suspended solids levels and oil and grease levels. Biodegradation can also occur in the reactors and cause clogging of the carbon. Carbon reactors are available in sizes ranging from 150 pounds to 40,000 pounds or more.

Capital cost for a 40 gpm carbon adsorption system is approximately $20,000 to 50,000. Operation and maintenance costs based on a carbon usage rate range of 1 to 7 pounds per 1,000 gallons is estimated to be $45,000 to $300,000 per year. These cost are based on liquid treatment. Vapor phase treatment (e.g., treatment of the vapor phase from an air stripper) would have lower operation and maintenance costs of approximately $10,000 to $20,000 per year because carbon usage would be significantly reduced.

Physical Treatment Process Option Summary

All three process options evaluated are feasible for treating the contaminated ground water at the site. All have similar removal efficiencies, however, the costs vary considerably. The capital and operation and maintenance (O&M) cost for each option is summarized below:

Process Option	Capital Cost	O&M Cost
Air Stripping	$60,000 - $100,000	$30,000 - $40,000
Steam Stripping	$100,000 - $200,000	$400,000 - $600,000
Liquid Phase GAC	$20,000 - $50,000	$45,000 - $300,000
Vapor Phase GAC	$20,000 - $50,000	$10,000 - $20,000

Because steam stripping is considerably more costly than the other two processes and does not yield any significant benefit, it will be eliminated from further evaluation. The present worth of the remaining ground water treatment processes are $263,000 to $371,000 for air stripping and $325,000 to $2,084,000 for liquid phase granular activated carbon. The present worth calculations are based on a 7 percent rate of return, a 4 percent inflation rate and an 8-year life. Because liquid phase granular activated carbon is considerably more costly than air stripping over the design life of the remediation and there are no apparent benefits, liquid phase granular activated carbon will no longer be considered in the evaluation. Air stripping will be retained as the representative physical treatment process. Vapor phase GAC will also be retained in case air effluent from the stripper requires treatment prior to discharge to the atmosphere.

3.4.3 Surface Water Discharge Options

A few drainages exist on the site that could be used for discharge of treated ground water. These drainages would ultimately end up in either in Ischua Creek or the Bird Swamp drainage. Because treated water discharge would be on the order of 40 gpm, discharge to the on-site drainages may overload the drainage and result in significant erosion and sediment discharge to the creeks. The most feasible surface water discharge options, therefore, are to either construct a concrete-lined drainage channel or a pipeline for direct discharge to the creeks. The concrete drainage channel (or any type of channel) has a major disadvantage in that it is susceptible to freezing. The pipeline, however, would be installed below the frost line to avoid freezing.

Surface water discharge would be subject to State and Federal approval in the form of a Pollution Discharge and Elimination System permit (SPDES and NPDES, respectively) and would require routine monitoring. Construction of a drainage ditch or pipeline would be accomplished using conventional construction techniques. Approximately 1,500 lineal feet of either drainage channel or pipeline would be required to convey the treated water to either of the two creeks.

Capital cost for constructing the surface water discharge options would range from $19,000 for a pipeline to $45,000 for a concrete lined channel. Maintenance costs would be minimal and on the order of $300 per year for inspection and periodic repairs.

Surface Water Discharge Options Summary

Because of the problems associated with freezing and the considerably higher cost, the drainage channel option will be deleted from further consideration. Surface water discharge to one of the two creeks via a buried pipeline will be retained as the representative option.

3.4.4 Ground Water Discharge Options

Three ground water discharge options exist for disposal of treated ground water. These options are: (1) infiltration pond, (2) injection wells and (3) infiltration gallery. Ground water injection would require State and Federal approval in the form of underground injection permits. Ground water injection is an effective method for disposing of ground water that can also aid in expediting remediation through aquifer flushing, assuming ground water discharge occurs upgradient of the contaminant plume.

Infiltration Pond

An infiltration pond is a simple structure that consists of a berm placed around the perimeter of the area to be filled with water. The berm would be constructed of concrete or other low permeability material to reduce lateral leakage. A pond could also be excavated under this option. Water from the treatment plant would be pumped into the pond and hydrostatic pressure (i.e., the pressure exerted by the water itself) would drive the water into the ground since it would be the path of least resistance. An infiltration pond would only be effective during warmer months since the pond would be subject to freezing during colder weather. For this reason, an infiltration pond will no longer be considered.

Injection Wells

Injection wells are conduits that allow for deep injection directly into the water bearing zone. The wells would be slotted in the lower portion of the well to enhance discharge to the aquifer. Water would be pumped from the treatment plant and discharged to the well. Gravity would draw the water into the well. Injection wells could be operated year-round. Freezing would not be a problem because continuous pumping would not allow the pipes to freeze. The pipeline to the well would be placed in a trench located below the frost line. The aquifer porosity and subsurface permeability at the site is ideally suited for injection wells.

The capital cost for constructing an injection well system is approximately $16,000 assuming two wells would be drilled to a depth of 20 feet. Operation and maintenance cost would be minimal. It has been assumed that the transfer pump would be part of the treatment plant cost.

Infiltration Gallery

An infiltration gallery is a gravel-packed trench (other porous material will work) that provides a large surface area for reinjection of ground water. Infiltration galleries are constructed in a variety of subsurface conditions ranging from highly permeable materials such as sand and gravel to less permeable materials such as clay. There are several methods for constructing infiltration galleries. The basic method involves a trench excavation with a backhoe and backfill with gravel. The more advanced method is referred to as biopolymer drain technology. This method involves trench excavation with a backhoe followed simultaneously with injection of a biodegradable slurry that supports the trench walls until gravel or other porous medium can be backfilled into the trench. The gravel displaces the slurry which begins to biodegrade within 48 hours. The latter method would be best suited for the Machias Gravel Pit site due to the lack of cohesiveness of site deposits (i.e., low clay content). Like the injection well option, treated water would need to be pumped to the trench below the frost level and discharged below the frost line to prevent freezing. The discharge would be via a horizontal slotted pipe placed in the trench. The top of the trench would be covered with a low permeability material to reduce additional infiltration into the trench.

The capital cost for constructing an infiltration gallery is estimated to be approximately $20,000, assuming a trench depth of 15 feet and a trench length of 50 feet using the biopolymer drain method. As with the injection wells, operation and maintenance costs would be minimal.

Ground Water Discharge Options Summary

The infiltration pond option was screened out earlier in this section due to concerns over freezing and the inability to function properly. Of the two remaining options, injection wells and infiltration galleries both would function equivalently and be similar in costs. Permitting issues would also be identical. For the purposes of the remainder of this evaluation, only injection wells will be discussed; however, infiltration galleries may be substituted in place of injection wells with the same results/benefits/costs.

3.4.5 POTW Discharge Options

POTW discharge is a commonly selected option because treatment plants are readily able to accept and treat low concentration waste streams such as the contaminated ground water at the Machias Gravel Pit site. Unfortunately, the nearest municipalities with any waste water treatment capabilities are Yorkshire and Frankenville and are 5 miles and 7 miles from the site, respectively, according to the town supervisor in Machias. At these distances, constructing a pipeline is not feasible. Assuming that actual pipe length would be 7 miles to 10 miles (accounting for the likely inability to lay a straight pipe) depending on the municipality, the cost to construct a pipeline would range from $400,000 to $530,000 at a minimum. This cost includes only pipe and pipe placement. Costs for pump stations, highway, railroad, and water crossings and easements could easily bring the cost over $1,000,000. In addition, disposal cost would be incurred as well as operation and maintenance costs. POTW discharge options will, therefore, no longer be considered in this evaluation.

3.5 Development of Alternatives

3.5.1 Overview

The following process options were retained for further evaluation:

Treatment	Disposal
Thermal Oxidation	Pipeline Discharge to Creek
Air Stripping	Injection Well Discharge to Ground Water
Vapor Phase GAC	

The systematic development of alternatives would yield the following four alternatives:

- Thermal Oxidation/Vapor Phase GAC/Pipeline Discharge to Creek.
- Thermal Oxidation/Vapor Phase GAC/Injection Well Discharge to Ground Water.
- Air Stripping/Vapor Phase GAC/Pipeline Discharge to Creek.
- Air Stripping/Vapor Phase GAC/Injection Well Discharge to Ground Water.

Because thermal oxidation and air stripping would serve the same purpose and do it equally as effective, it is redundant to consider four alternatives. An evaluation of the present worth cost of air stripping at $263,000 to $371,000 compared to the present worth cost of thermal oxidation at $1,487,000 to $2,384,000 indicates that air stripping is the most cost-effective of the two processes and, therefore, only the two alternatives employing air stripping need to be considered.

In addition, as discussed in Section 3.2, the no action alternative is a third alternative that should be considered. No action is defined as no action taken on the contaminant plume to restrict movement or to reduce contaminant levels. Variations of no action in combination with institutional controls were also identified in Section 3.2. The following variations of the no action alternative are presented for consideration.

- Point-of-Use Treatment
- Alternate Water Supply
- Replacement of Existing Wells

Each alternative is defined in the following section.

3.5.2 No Action Alternatives

No Action

The basic no action alternative involves continued site monitoring to track the contaminated plume migration and restrictions on future ground water well installations that are in the path of the contaminant plume.

Point-of-Use Treatment

This alternative involves the installation of point-of-use treatment systems at each residential well or household in the path of the contaminant plume, provided that unacceptable contaminant levels are present. The point-of-use treatment systems would be granular activated carbon units with replaceable carbon filters. Small scale air strippers or thermal oxidizers are not available for this type of application. The point-of-use treatment systems would be installed immediately at any wells within 1,000 feet of the contaminant plume (downgradient of the contaminant plume) or when ground water monitoring at other residential wells indicates that concentrations of contaminants are increasing and when the concentration for any given contaminant is one-half its MCL. The point-of-use treatment system has an estimated capital cost of $1,000 per well and an operation and maintenance cost of $300 per year.

Alternate Water Supply

This alternative would involve the installation of a water tank at each impacted residence and import of water on a regular basis or a supply of bottled water. This alternative is not considered feasible, primarily because of the cost but also because of the inconvenience to the residents. It is presented for informational purposes only. Capital costs would be on the order of $10,000 to $15,000 dollars per residence with yearly costs estimated at $15,000 per residence.

Replacement of Existing Wells

This alternative would involve the replacement of any existing well in the flow path of the contaminant plume with a new well constructed in a non-impacted area of the aquifer. This would be implemented under the conditions identified for the point-of-use treatment alternative.

3.5.3 Summary of the Development of Alternatives

The following alternatives will be evaluated in the following section:

- No Action
- Point-of-Use Treatment
- Replacement of Existing Wells
- Air Stripping/Vapor Phase GAC/Pipeline Discharge to Creek
- Air Stripping/Vapor Phase GAC/Injection Well Discharge to Ground Water

Each of the alternatives will be evaluated in terms of the following criteria:

- Effectiveness
    - Protection of Human Health
    - Protection of the Environment

- Implementability
    - Technical Feasibility
    - Availability
    - Administrative Feasibility

- Cost
  - Capital Cost
  - O&M Cost
  - Present Worth Cost

Present worth costs will be calculated assuming a 4 percent inflation rate and 7 percent rate of return. A design life of 20 years will be used for the no action alternatives. This design life is based on the calculated time required for the plume to migrate past the cabin well. The design life of the two pump and treat alternatives is eight years and based on the calculated time required to remediate the contaminant plume.

4.0 ANALYSIS OF ALTERNATIVES

4.1 No Action

4.1.1 Effectiveness

Under present conditions, the no action alternative is not impacting human health since the contaminant plume has not reached any residential wells. Analytical modeling of contaminant migration indicates that contaminant levels above MCLs may reach the Cabin well within 3 years. Until then, no impacts to human health would be encountered. Natural attenuation processes are not expected to be significant with time based on past and present data that indicate little, if any, biodegradation is occurring. Dilution of the contaminant plume will occur, but based on the analytical model, by the time the plume reaches the Cabin well, the contaminant concentrations will still be above MCLs.

Environmental impacts have been minimal to this point and are not anticipated to be significant. The only concern would be when the contaminant plume reaches and discharges to Ischua Creek. Analytical modeling, however, indicates that the plume would be diluted considerably by the time it discharges to the creek but, ground water concentrations would still be above the water quality standards. However, once the plume enters the creek, a significant dilution would occur resulting in predicted levels of TCE and 1,1,1-TCA less than water quality guidance values (refer to Section 1.3.3 for detailed discussion).

Since the source of the ground water contamination has been removed, the present conditions being experienced represent the "worst case" scenario.

4.1.2 Implementability

Implementation of the no action alternative is straightforward. A monitoring plan would need to be implemented and a contingency plan would need to be identified should unacceptable contaminant levels be encountered either in residential wells or in Ischua Creek. This contingency may involve one of the alternatives presented in this document for residential well contamination.

4.1.3 Cost

Capital cost for the no action alternative are considered to be minimal. Monitoring cost would be approximately $15,000 per year assuming three ground water samples and one surface water sample per quarter. The present worth cost of this alternative is estimated to be $215,000 based on a rate of return of 7 percent, an annual inflation rate of 4 percent and monitoring for 20 years.

4.2 Point-of-Use Treatment

4.2.1 Effectiveness

Point-of-use treatment is highly effective at protecting human health by assuring that contaminants are removed from the water supply before human consumption or other use. The carbon adsorption units proposed as part of this alternative are effective at removing over 99 percent of the contaminants. In the case of TCE and 1,1,1-TCA, removal efficiencies of 99.9 percent can be expected. For the maximum concentrations observed to date (720 ug/L for TCE and 390 ug/L for 1,1,1-TCA), concentrations at the tap after treatment would be less than 1 ug/L for each contaminant. If metals concentrations are of concern, a filtration system such as reverse osmosis could be added.

Like the no action alternative, the point-of-use treatment alternative does not change the environmental impacts caused by the contaminant plume. As indicated, though, the environmental impacts to date have been minimal and are anticipated to remain so based on analytical modeling results and surface water quality guidance values.

4.2.2 Implementability

This alternative could be easily implemented in a short time (e.g., within 1 month). It is anticipated that the Cabin well will be the only well requiring point-of-use treatment. The treatment unit would be installed either below ground in a small vault near the residence or within the residence itself. Plumbing, electrical and concrete work (vault only) would be required to install the system.

4.2.3 Cost

The capital cost for the point-of-use treatment alternative has been estimated to be approximately $3,000 ($1,000 for the treatment unit and $2,000 for the vault construction, electrical wiring and plumbing). O&M cost would be approximately $300 per year for the system plus $15,000 per year for the site-wide monitoring described for the no action alternative. The present worth cost of this alternative is estimated to be $224,000 assuming a 20 year life.

4.3 Replacement of Existing Well

4.3.1 Effectiveness

This alternative would involve construction of a new well to replace the Cabin well (or use of the existing well located approximately 700 feet northwest of the Cabin well) and closure of the Cabin well. Analytical modeling indicates that no other wells are in the impacted area. The new well would be constructed in a non-impacted area of the aquifer (assumed to be 500 feet northwest of the existing Cabin well).

This alternative would provide considerable protection to human health by assuring that the residents are not exposed to contaminants. It has been assumed that no water treatment would be required for this alternative as water quality standards in the new well (or existing well) would be met.

Like the two previous alternatives, this alternative does not improve present environmental impacts. Present impacts to the environment, however, are insignificant.

4.3.2 Implementability

Implementation of this alternative would depend on the ability to either permit the new well or use the existing well located on the west end of the Cole property. In either case, a pipeline would be required from the well to the residence. The pipeline would be installed below ground (approximately 6 feet) below the frost line. Each option would also require a pump and electrical controls. The new well construction would, of course, require the drilling and casing of the well. Each option would also include well development. All materials and equipment necessary to implement this alternative would be readily available. This alternative could be implemented within 1 month, excluding the time necessary to obtain a new well permit.

4.3.3 Cost

The capital cost for this alternative is estimated to be $17,000 for a new well and $18,000 for the existing well. These costs are based on a piping distance of 500 feet for a new well and 700 feet for the existing well and do not include any cost for permit acquisition. These costs are therefore subject to change when more specific information is available. The only annual costs incurred would be for operation and maintenance at $600 per year and for monitoring at approximately $15,000 per year. The present worth cost of this alternative is $241,000 for a new well or $242,000 for use of the existing well based on the design life of 20 years.

4.4 Air Stripping/Vapor Phase GAC/Pipeline Discharge to Creek

4.4.1 Effectiveness

This alternative involves active remediation of the contaminated aquifer by pumping and treating the contaminated plume. The alternative has been designed such that it captures the contaminant plume and significantly reduces the potential for contaminant migration. The time required to actively remediate the ground water was modeled and found to be approximately eight years based on an optimal extraction rate of 40 gpm. This assumes that five volumes of ground water would be extracted and treated.

The treatment process selected for treating the ground water is a proven, cost-effective technology that requires very little maintenance. As a conservative measure, vapor phase carbon adsorption has been included to treat the off-gases (or vapor) from the air stripper to assure that ambient air quality standards are not exceeded. Water would be treated to levels below MCLs (e.g., less than 1 ug/L for TCE and 1,1,1-TCA), therefore, human health and environmental impacts would be mitigated.

A review of the NYS Water Quality Standards and Guidance Values indicates that surface water discharge standards for both organic and inorganic contaminants will be met with this alternative. The only dissolved metal detected in the ground water was iron at concentrations of 23.3 to 86.2 ug/L. The standard is 300 ug/L. Appendix A contains a summary table of the existing ground water quality.

4.4.2 Implementability

This alternative consists of (1) installing two pumping wells at the downgradient end of the contaminant plume, (2) circulating the water through an air stripper, (3) treating off-gases through a vapor phase GAC treatment system and (4) discharging the treated effluent into either Ischua Creek or the Bird Swamp drainage via a pipeline. Each of the pumping wells would produce 20 gpm from electric submersible pumps and discharge into a single mixing tank. Water from the mixing tank would be sent through a filter to remove suspended solids and then into an air stripper. Stripped vapors would be processed through the vapor phase GAC treatment system prior to discharge to the atmosphere. The treatment system itself would be housed in a heated building. A schematic of the proposed process is shown in Figure 7.

Implementation of this alternative would be accomplished using conventional construction techniques and readily available materials and equipment. The construction sequence would be similar to that described in Section 4.5.2. The alternative could be implemented within 3 months.

Because the system will be operated continuously for eight years, it will be important to design the system to be "freeze-proof". This would be accomplished by burying all pipelines below the frost level (assumed to be 6 feet below ground surface) and keeping the building that houses the treatment system heated.

Maintenance will involve cleaning filters; removing sediments from pipe lines, the mixing tank and sumps; periodic repair or rebuilding of pumps (i.e., every 5 years); and replacement of carbon canisters (assumed to be required monthly).

4.4.3 Cost

The capital cost for this alternative is estimated to be $197,000. The O&M cost is estimated to be $75,000 to $85,000 per year, including site-wide monitoring. The present worth cost is $706,000 to $773,000 assuming a life of eight years. The capital cost for this alternative without vapor phase GAC is $162,000, the O&M cost is $65,000 to $75,000 per year and the present worth cost is $603,000 to $671,000.

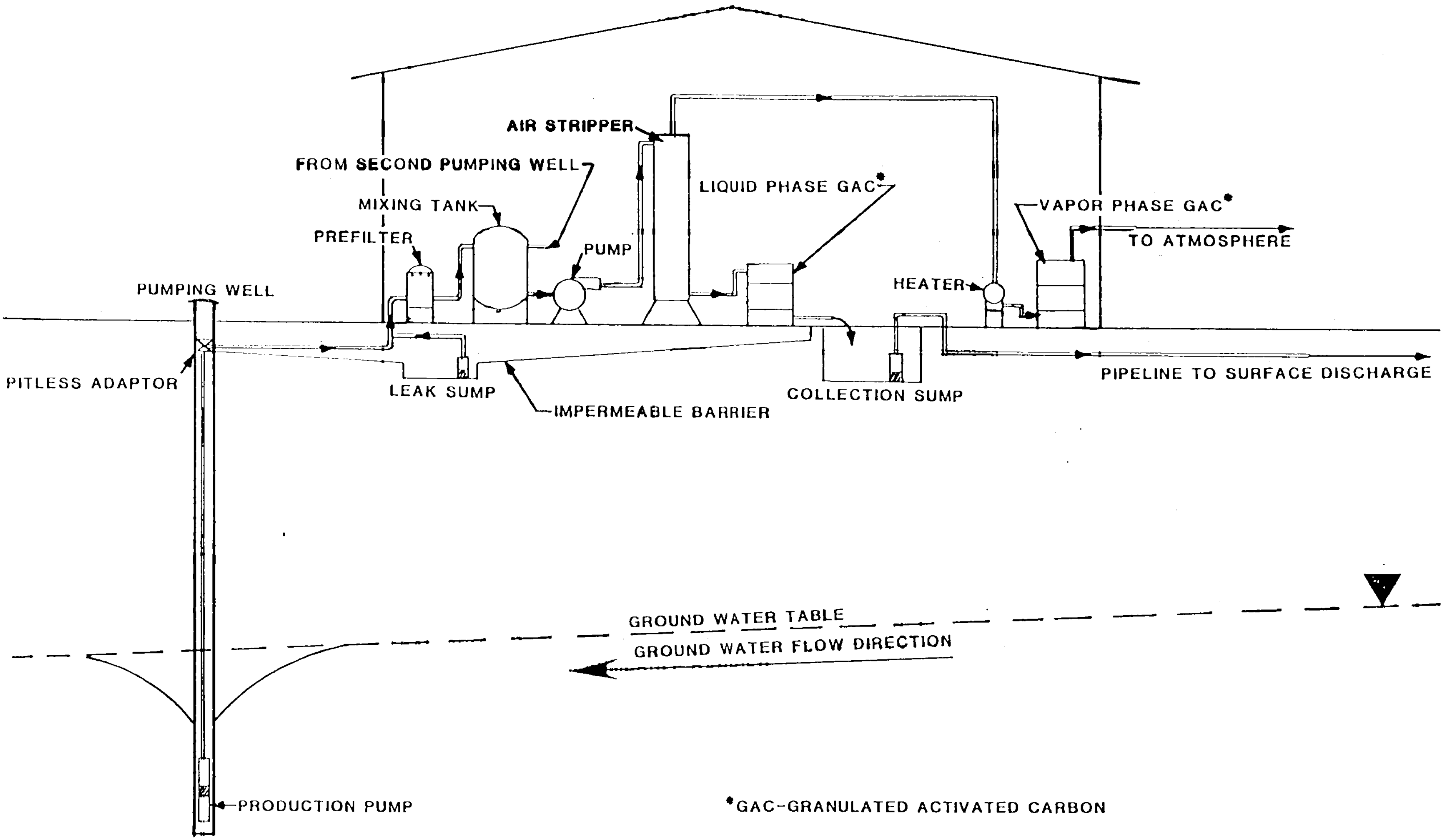

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FIGURE 7

SCHEMATIC DIAGRAM OF GROUND WATER WITHDRAWL, ON-SITE TREATMENT AND OFF-SITE DISCHARGE

4.5 Air Stripping/Vapor Phase GAC/Injection Well Discharge to Ground Water

4.5.1 Effectiveness

This alternative involves active remediation of the contaminated aquifer by pumping and treating the contaminated plume. The alternative has been designed such that it captures the contaminant plume and significantly reduces the potential for contaminant migration. The treatment process selected for treating the ground water is a proven, cost-effective technology that requires very little maintenance. As a conservative measure, vapor phase carbon adsorption has been included to treat the off-gases (or vapor) from the air stripper to assure that ambient air quality standards are not exceeded. Water would be treated to levels below MCLs (e.g., less than 1 ug/L for TCE and 1,1,1-TCA), therefore, human health and environmental impacts would be mitigated.

It is anticipated that this alternative will meet all requirements of the underground injection permit that will need to be obtained. TCE and 1,1,1-TCA contaminant levels in the ground water will be reduced to less than 1 ug/L. Ambient air discharge concentration levels will also comply with ambient air quality standards.

4.5.2 Implementability

This alternative consists of (1) installing two pumping wells at the downgradient end of the contaminant plume, (2) circulating the water through an air stripper, (3) treating off-gases through a vapor phase GAC treatment system, and (4) injecting the treated effluent back into the aquifer, upgradient of the contaminant plume. Each of the pumping wells would produce 20 gpm from electric submersible pumps and discharge into a single mixing tank. Water from the mixing tank would be sent through a filter to remove suspended solids and then into an air stripper. Stripped vapors would be processed through the vapor phase GAC system prior to discharge to the atmosphere. The liquid effluent would then be pumped from a collection sump to the injection wells. The entire treatment process would be housed in a heated building. A schematic of the proposed process is shown in Figure 8. It should be noted that the schematic includes a liquid phase GAC unit that could be used in conjunction with or in place of the air stripper. Present indications are, however, that the air stripper alone would be sufficient and the most cost-effective.

Like the previous alternative, the construction of this alternative would be achieved using conventional construction techniques and equipment. The construction sequence would begin with site preparations for the placement of insulated buildings to house the mixing tank, filter, treatment equipment (air stripper and GAC canister) and effluent collection sump. The pumping and injection wells would be sited and drilling would commence with the injection wells first. After the injection wells have been installed, the pumping wells would be drilled and completed. All water lines would be laid below the frost line in trenches.

This alternative would be implemented within 3 months, excluding the time required to obtain the underground injection permit. It has been estimated that this permit would take 6 months to obtain.

4.5.3 Cost

The capital cost of this alternative is estimated to be $196,000. The O&M cost is estimated to be $75,000 to $85,000 per year, including monitoring. The present worth cost is estimated to be $705,000 to $772,000 assuming a life of eight years. The capital cost for this alternative without vapor phase GAC is $161,000, the O&M cost is $65,000 to $75,000 per year and the present worth cost is $602,000 to $670,000.

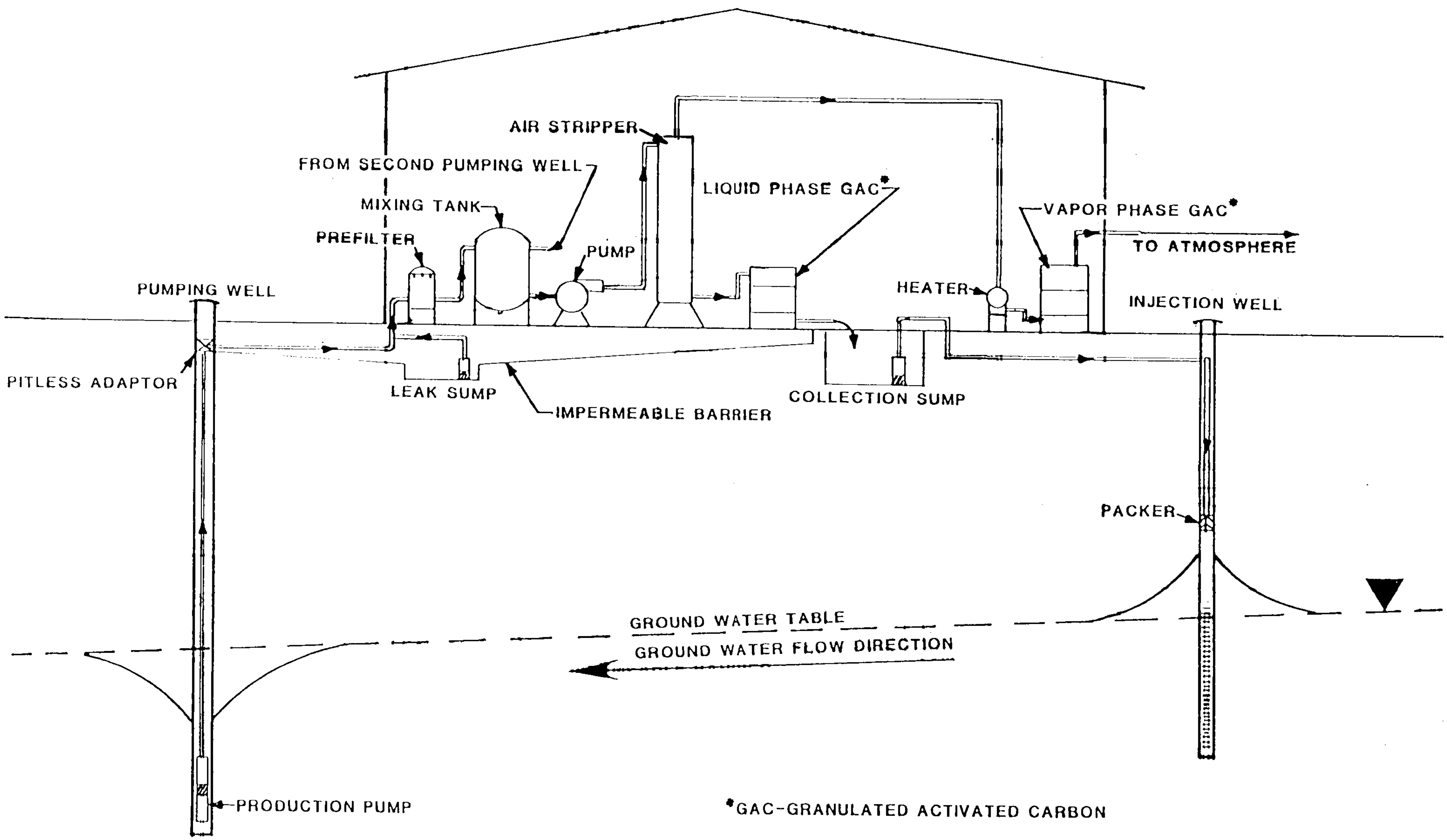

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FIGURE 8

SCHEMATIC DIAGRAM OF GROUND WATER WITHDRAWL, ON-SITE TREATMENT AND ON-SITE INJECTION

5.0 SUMMARY

A range of alternatives has been developed and analyzed in this engineering evaluation and cost analyses. All the alternatives, excluding no action, are protective of human health. The two ground water extraction/treatment/discharge alternatives are protective of both human health and the environment. Any of the alternatives are feasible, however, depending on the objectives for the site.

Each alternative is easily implementable and reliable. The two extraction/treatment/discharge alternatives require more maintenance than the other alternatives, but the maintenance requirements are considered reasonable.

The cost for each of the alternatives is summarized below:

Alternative	Capital Cost	O&M Cost	Present Worth
No Action	$ 0	$15,000/yr	$215,000 (20 year life)
Point-of-Use Treatment	$3,000	$15,300/yr	$224,000 (20 year life)
Replacement of Existing Well	$17,000 - $18,000	$15,000/yr	$241,000 - $242,000 (20 year life)
Air Stripping/ Vapor Phase GAC/ Pipeline Discharge (without Vapor Phase GAC)	$197,000 ($162,000)	$75,000 - $85,000 ($65,000 - $75,000)	$706,000 - $773,000 ($603,000 - $671,000) (8 year life)
Air Stripping/ Vapor Phase GAC/ Injection Well Discharge (without Vapor Phase GAC)	$196,000 ($161,000)	$75,000 - $85,000 ($65,000 - $75,000)	$705,000 - $772,000 ($602,000 - $670,000) (8 year life)

As requested by the NYSDEC, each of the above alternatives was also evaluated using the Technical and Administrative Guidance Memorandum (TAGM) on the Selection of Remedial Actions at Inactive Hazardous Waste Sites dated May 15, 1990. The scoring sheets for each alternative are provided in Appendix B. As expected, the two pump and treat alternatives and the point-of-use treatment alternative are found to be the most protective of human health and the environment, all scoring in a similar range. The no action alternative and replacement of the existing well alternative score the lowest and are the least desirable based on the TAGM evaluations.

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Means, R.S., Company. "Means Site Work Cost Data 1991", 1990.

TABLE 1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Standard, Requirement, Criteria or Limitation	Citation	Description
Safe Drinking Water Act	42 U.S.C. § 300g	
National Primary Drinking Water Standards	40 CFR, Part 141	Establishes health-based standards for public water supply systems (MCLs).
National Secondary Drinking Water Standards	40 CFR, Part 143	Establishes welfare-based standards for public water supply systems (secondary MCLs).
Underground Injection Control Regulations	40 CFR, Part 144-147	Provides for protection of underground sources of drinking water through control of underground injection.
Maximum Contaminant Level Goals	Pub. L. No. 99-339, 100 Stat. 642 (1986)	Establishes drinking water quality goals set at levels of no known or anticipated adverse health effects.
New York State, Department of Health, State Sanitary Code	Pub. Health Law § 225	
Chapter I, Part 5, Drinking Water Supplies	Subpart 5-1	Provides for NYS Maximum Contaminant Level determination, monitoring requirements and variances. Establishes notification procedures in the event of violations.
New York State, Department of Environmental Conservation, Division of Water, Water Quality Standards and Guidance Values, September 25, 1990	---	Defines water classes and principal organic contaminants. Provides standards and guidance values for surface waters and ground waters.
Clean Water Act	33 U.S.C. §§ 1251-1376	
Water Quality Criteria	40 CFR, Part 131	Provides for establishment of water quality standards based on toxicity to aquatic organisms and human health.
Clean Air Act	42 U.S.C. §§ 7401-7642	
National Primary and Secondary Ambient Air Quality Standards	40 CFR, Part 50	Establishes standards for ambient air quality to protect public health and welfare.
National Emission Standards for Hazardous Air Pollutants	40 CFR, Part 61	Sets emissions standards for designated hazardous pollutants.
New York State, Environmental Conservation Law	Chapter 3, Title 6	
	Parts 256-257	Provides air quality classification system and air quality standards.
	Part 263	Provides county-specific air quality standards.
Air Clean-up Criteria	(Pages 6 & 7)-1	Provides cross media contamination standards.

TABLE 3

GENERAL RESPONSE ACTIONS IDENTIFIED FOR THE MACHIAS GRAVEL PIT SITE

General Response Action	Applicable to Ground Water
No Action	X
Institutional Controls	X
Containment	
On-site Treatment	X
Off-site Treatment	X
On-site Disposal	X
Off-site Disposal	X

TABLE 2

NEW YORK STATE AND FEDERAL MAXIMUM CONTAMINANT LEVELS

Compound	NYS MCL	Federal MCL	NYS Ground Water Standards
Acetone	0.05 mg/L	N.A.	--
Benzene	0.005 mg/L	0.005 mg/L	0.7 ug/l
1,1,1-Trichloroethane	0.005 mg/L	0.20 mg/L	5 ug/l
Trichloroethene	0.005 mg/L	0.005 mg/L	5 ug/l
Total Phenols	0.001 mg/L	N.A.	1 ug/l
Chromium	0.05 mg/L	0.05 mg/L	50 ug/l
Lead	0.05 mg/L	0.05 mg/L	25 ug/l
Nickel	N.A.	0.10 mg/L*	--
Iron	0.3 mg/L	N.A.	300 ug/l**

N.A. - Not Available
-- - Standard Not Estimablished
*MCLG - Maximum Contaminant Level Goal
** - Standard for Iron and Manganese is 500 ug/l

Appendix A

Analytical Results

SIMON HYDRO-SEARCH

TABLE A.1 – SUMMARY OF SOIL SAMPLE VOLATILE ORGANIC COMPOUND ANALYSES

Machias, New York

SAMPLE DESIGNATION	TP01-01	TP02-01	TP02-01-DP	TP03-01	TP04-01	TP05-01
MATRIX	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
VOLATILE ORGANIC COMPOUNDS	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND	ND	ND

SAMPLE DESIGNATION	SS01-01	SS02-01	SS03-01	SB01-01	SB02-01
MATRIX	SOIL	SOIL	SOIL	SOIL	SOIL
VOLATILE ORGANIC COMPOUNDS	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
1,1,1-Trichloroethane	ND	ND	ND	27	ND
Trichloroethene	ND	ND	ND	291	ND

Notes:
ND – Not detected.
TP – Test pit.
SB – Soil boring.
SS – Surface soil.
DP – Duplicate.

TABLE A.2 – SUMMARY OF POLYAROMATIC HYDROCARBON ANALYSES

Machias, New York

SAMPLE DESIGNATION	TP01-01		TP02-01		TP02-01DP		TP03-01		TP04-01		TP05-01	
MATRIX	SOIL		SOIL		SOIL		SOIL		SOIL		SOIL	
SEMI-VOLATILE ORGANIC COMPOUNDS	ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg	
Acenaphthylene	ND		ND		ND		ND		ND		280	J
Fluorene	ND		ND		ND		ND		ND		220	J
Phenanthrene	ND		ND		ND		ND		ND		1900	
Anthracene	ND		ND		ND		ND		ND		220	JX
Fluoranthene	ND		ND		ND		340	J	ND		1500	
Pyrene	ND		ND		ND		260	J	ND		1100	
Benzo(a)anthracene	ND		ND		ND		ND		ND		490	J
Benzo(b)fluoranthene	ND		ND		ND		ND		ND		570	
Benzo(k)fluoranthene	ND		ND		ND		ND		ND		410	J
Benzo(a)pyrene	ND		ND		ND		ND		ND		470	J
Indeno(1,2,3-cd)pyrene	ND		ND		ND		ND		ND		400	J
Benzo(g,h,i)perylene	ND		ND		ND		ND		ND		250	JX

SAMPLE DESIGNATION	SB01-01		SB02-01		SS01-01		SS02-01		SS03-01	
MATRIX	SOIL		SOIL		SOIL		SOIL		SOIL	
SEMI-VOLATILE ORGANIC COMPOUNDS	ug/kg		ug/kg		ug/kg		ug/kg		ug/kg	
Acenaphthylene	ND		ND		ND		ND		ND	
Fluorene	ND		ND		ND		ND		ND	
Phenanthrene	ND		ND		ND		ND		ND	
Anthracene	ND		ND		ND		ND		ND	
Fluoranthene	ND		ND		ND		ND		ND	
Pyrene	ND		ND		ND		ND		ND	
Benzo(a)anthracene	ND		ND		ND		ND		ND	
Benzo(b)fluoranthene	ND		ND		ND		ND		ND	
Benzo(k)fluoranthene	ND		ND		ND		ND		ND	
Benzo(a)pyrene	ND		ND		ND		ND		ND	
Indeno(1,2,3-cd)pyrene	ND		ND		ND		ND		ND	
Benzo(g,h,i)perylene	ND		ND		ND		ND		ND	

Notes:
- ND – Not detected.
- TP – Test pit.
- SB – Soil boring.
- SS – Surface soil.
- DP – Duplicate.
- J – Estimated value.
- X – Mass spectrometer does not meet EPA CLP criteria for confirmation, but compound presence is strongly suspected.

TABLE A.3 – SUMMARY OF SOIL SAMPLE INORGANIC ANALYSES

Machias, New York

SAMPLE DESIGNATION	TP01-01	TP02-01	TP02-01DP	TP03-01	TP04-01	TP05-01
MATRIX	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
METALS	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
Chromium	3.7	5.0	4.8	6.5	8.2	5.5
Lead	*	*	*	*	*	*
Nickel	11.0	13.2	13.3	14.0	23.0	17.3

SAMPLE DESIGNATION	SB01-01	SB02-01	SS01-01	SS02-01	SS03-01
MATRIX	SOIL	SOIL	SOIL	SOIL	SOIL
METALS	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
Chromium	ND	3.1	2.5	4.6	6.0
Lead	5.5	*	608	19.7	13.6
Nickel	9.6	13.3	11.7	10.2	13.3

Notes:
- ND – Not detected.
- TP – Test pit.
- SB – Soil boring.
- SS – Surface soil.
- DP – Duplicate.
- * – Analyzed but results rejected by third party data validation.

TABLE A.4 – SUMMARY OF GROUND WATER VOLATILE ORGANIC COMPOUNDS AND PHENOL ANALYSES
Machias, New York

SAMPLE DESIGNATION MATRIX	GW01-01 WATER	GW02-01 WATER	GW02-01-DP WATER	GW03-01 WATER	GW03D-01 WATER	GW04-01 WATER	GW05-01 WATER
VOLATILE ORGANIC COMPOUNDS	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
Acetone	ND	ND	ND	ND	13	ND	ND
Benzene	ND	ND	ND	9 J	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	390	160	ND	120
Trichloroethene	ND	ND	ND	44	7	ND	720 J
Total Phenols	ND	ND	ND	60	ND	ND	ND

SAMPLE DESIGNATION MATRIX	GW06-01 WATER	GW07-01 WATER	GW08-01 WATER	FIELD BLANK WATER	TRIP BLANK #1 WATER	TRIP BLANK #2 WATER
VOLATILE ORGANIC COMPOUNDS	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
Acetone	ND	ND	ND	ND	ND	ND
Benzene	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	51	13	ND	ND	ND	ND
Trichloroethene	ND	33	ND	ND	ND	ND
Total Phenols	ND	ND	ND	ND	ND	ND

Notes:
ND – Not detected.
GW – Ground water.
DP – Duplicate.
J – Estimated value.

TABLE A.5 – SUMMARY OF GROUND WATER INORGANIC RESULTS (TOTAL AND DISSOLVED)

Machias, New York

SAMPLE DESIGNATION	GW01-01				GW02-01				GW02-01DP				GW03-01			
MATRIX	TOTAL WATER		DISSOLVED WATER		TOTAL WATER		DISSOLVED WATER		TOTAL WATER		DISSOLVED WATER		TOTAL WATER		DISSOLVED WATER	
METALS	ug/l		ug/l		ug/l		ug/l		ug/l		ug/l		ug/l		ug/l	
Chromium	54.4	J	ND		53.5		ND		47.4		ND		ND		ND	
Lead	69.0		ND		131.0		ND		154.0		ND		21.3		ND	
Nickel	41.3		ND		155.0		ND		161.0		ND		ND		ND	
Iron	53700.0	J	23.3	J	120000.0		N/A		125000.0		N/A		16500.0		N/A	
* Hardness	546.0		N/A		680.0		N/A		730.0		N/A		399.0		N/A	

SAMPLE DESIGNATION	GW03D-01				GW04-01				GW05-01				GW06-01			
MATRIX	TOTAL WATER		DISSOLVED WATER		TOTAL WATER		DISSOLVED WATER		TOTAL WATER		DISSOLVED WATER		TOTAL WATER		DISSOLVED WATER	
METALS	ug/l		ug/l		ug/l		ug/l		ug/l		ug/l		ug/l		ug/l	
Chromium	37.6	J	7.3	J	50.0		ND		37.8	J	ND		51.2	J	ND	
Lead	124.0		ND		16.4	S	ND		75.7		ND		54.9		ND	
Nickel	133.0		ND		96.8		ND		120.0		ND		83.9		ND	
Iron	150000.0	J	41.3	J	120000.0		N/A		137000.0	J	86.2	J	85400.0	J	83.1	J
* Hardness	913.0		N/A		635.0		N/A		643.0		N/A		682.0		N/A	

SAMPLE DESIGNATION	GW07-01				GW08-01				FIELD BLANK			
MATRIX	TOTAL WATER		DISSOLVED WATER		TOTAL WATER		DISSOLVED WATER		TOTAL WATER		DISSOLVED WATER	
METALS	ug/l		ug/l		ug/l		ug/l		ug/l		ug/l	
Chromium	31.3	J	ND		7.2	J	ND		ND		ND	
Lead	82.9		ND		29.0		ND		ND		ND	
Nickel	90.5		ND		ND		ND		ND		ND	
Iron	106000.0	J	27.2	J	61700.0	J	68.5	J	36.7	J	26.4	J
* Hardness	616.0		N/A		569.0		N/A		0.78		N/A	

Notes:
- * – Hardness = mg equivalent CaCO3/L
- ND – Not detected.
- DP – Duplicate.
- GW – Ground water.
- S – Value presented was calculated using method of standard addition.
- J – Estimated value.
- N/A – Not applicable.

APPENDIX B

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Revised Technical and Administrative Guidance Memorandum
Selection of Remedial Actions at Inactive Hazardous Waste Sites

ALTERNATIVE SCORING SHEETS

Introduction

The Alternative Scoring Sheets have been prepared in accordance with the New York State Department of Environmental Conservation "Revised Technical and Administrative Guidance Memorandum, Selection of Remedial Actions at Inactive Hazardous Waste Sites". The scoring sheets are oriented toward site-wide remediation. In the case of the Machias Gravel Pit site, however, three of the five alternatives developed and evaluated are not site-wide remediation alternatives. In order to provide equal comparisons, the following assumptions have been made:

- For alternatives involving treatment, the point of compliance is measured at the point-of-use (i.e., the faucet or Ischua Creek).

- "Complete remediation" or "remediation" is defined as that point in time when SCGs at the point(s) of compliance have been met and/or the design life has been met.

NYS ALTERNATIVE RANKING SYSTEM
SCORING SUMMARY TABLE

Ranking Criteria	Maximum Score	No Action	Point-of-Use Treatment	Replacement of Existing Well	Air Stripping/Vapor Phase GAC/Pipeline Discharge to Creek	Air Stripping/Vapor Phase GAC/Injection Well Discharge to Ground Water
Short-Term/Long-Term Effectiveness (Table 4.1)	25	10	20	14	22	22
Implementability (Table 4.2)	15	9	14	13	14	14
Compliance With NYS SCGs (Table 5.2)	10	3	10	7	10	10
Protection of Human Health and the Environment (Table 5.3)	20	9	20	14	20	20
Short-Term Effectiveness (Table 5.4)	10	10	10	10	10	10
Long-Term Effectiveness and Permanence (Table 5.5)	15	0	10	4	12	12
Reduction of Toxicity, Mobility or Volume (Table 5.6)	15	2	7	0	13	13
Implementability (Table 5.7)	15	9	13	13	14	14

ALTERNATIVE: No Action

SITE NAME: Machias Gravel Pit
SITE NUMBER: 905013

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.	• Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes No	___ _X_	0 4
	• Can the short-term risk be easily controlled?	Yes No	___ ___	1 0
	• Does the mitigative effort to control short-term risk impact the community life-style?	Yes No	___ ___	0 2
	Subtotal (maximum = 4)			4
2. Environmental Impacts	• Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes No	___ _X_	0 4
	• Are the available mitigative measures reliable to minimize potential impacts?	Yes No	___ ___	3 0
	Subtotal (maximum = 4)			4
3. Time to implement the remedy.	• What is the required time to implement the remedy?	≤ 2yr. > 2yr.	_X_ ___	1 0
	• Required duration of the mitigative effort to control short-term risk.	≤ 2yr. > 2yr.	_X_ ___	1 0
	Subtotal (maximum = 2)			2
4. On-site or off-site treatment or land disposal.	• On-site treatment*		___	3
	• Off-site treatment*		___	1
	• On-site or off-site land disposal		___	0
* treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes.	Subtotal (maximum = 3)			0

Table 4.1
(continued)
SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening			Score
5. Permanence of the remedial alternative.	• 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**
6. Lifetime of remedial actions.	• 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	___	2
	iii) Is the treated residual toxic?	Yes	___	0
		No	___	1
	iv) Is the treated residual mobile?	Yes	___	0
		No	___	1
	Subtotal (maximum = 5)			**0**

Table 4.1
(continued)
SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor		Basis for Evaluation During Preliminary Screening			Score
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.

ALTERNATIVE: No Action

SITE NAME: Machias Gravel Pit
SITE NUMBER: 905013

Table 4.2

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. No uncertainties in construction.	X	3
	ii)	Somewhat difficult to construct. No uncertainties in construction.		2
	iii)	Very difficult to construct and/or significant uncertainties 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 unlikely.		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

Table 4.2
(continued)
IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening		Score
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 ____ No ____	1 0
	ii)	Will more than one vendor be available to provide a competitive bid?	Yes ____ No ____	1 0
b. Availability	i)	Additional equipment and specialists may be available without significant delay.	Yes ____ No ____	1 0
		Subtotal (maximum = 3)		0
		TOTAL (maximum = 15)		9

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

Table 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)

(Maximum Score = 10)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
1. Compliance with chemical-specific SCGs	Meets chemical specific SCGs such as ground water standards	Yes ____ No __X__	4 0
2. Compliance with action-specific SCGs	Meets SCGs such as technology standards for incineration or landfill	Yes ____ No __X__	3 0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act	Yes __X__ No ____	3 0
	TOTAL (maximum = 10)		3

ALTERNATIVE: No Action

SITE NAME: Machias Gravel Pit
SITE NUMBER: 905013

Table 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Maximum Score = 20)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table).	Yes ___ No _X_	20 0
	TOTAL (Maximum = 20)		0
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes _X_ No ___	3 0
	ii) Is the exposure to contaminants via ground water/surface water acceptable?	Yes ___ No _X_	4 0
	iii) Is the exposure to contaminants via sediments/soils acceptable?	Yes _X_ No ___	3 0
	Subtotal (maximum = 10)		6
3. Magnitude of residual public health risks after the remediation.	i) Health risk ≤ 1 in 1,000,000	___	5
	ii) Health risk ≤ 1 in 100,000	___	2
	Subtotal (maximum = 5)		0
4. Magnitude of residual environmental risks after the remediation.	i) Less than acceptable	___	5
	ii) Slightly greater than acceptable	_X_	3
	iii) Significant risk still exists	___	0
	Subtotal (maximum = 5)		3
	TOTAL (maximum = 20)		9

Table 5.4

SHORT-TERM EFFECTIVENESS
(Maximum Score = 10)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
1. Protection of community during remedial actions.	• Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2).	Yes ____ No __X__	0 4
	• Can the risk be easily controlled?	Yes ____ No ____	1 0
	• Does the mitigative effort to control risk impact the community life-style?	Yes ____ No ____	0 2
	Subtotal (maximum = 4)		4
2. Environmental Impacts	• Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3).	Yes ____ No __X__	0 4
	• Are the available mitigative measures reliable to minimize potential impacts?	Yes ____ No ____	3 0
	Subtotal (maximum = 4)		4
3. Time to implement the remedy.	• What is the required time to implement the remedy?	≤ 2yr. __X__ > 2yr. ____	1 0
	• Required duration of the mitigative effort to control short-term risk.	≤ 2yr. __X__ > 2yr. ____	1 0
	Subtotal (maximum = 2)		2
	TOTAL (maximum = 10)		10

ALTERNATIVE: No Action

SITE NAME: Machias Gravel Pit
SITE NUMBER: 905013

Table 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening			Score
1. On-site or off-site treatment or land disposal.	• On-site treatment*		______	3
	• Off-site treatment*		______	1
	• On-site or off-site land disposal		______	0
* treatment is defines as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes.	Subtotal (maximum = 3)			0
2. Permanence of the remedial alternative.	• Will the remedy be classified as permanent in accordance with Section 2.1(a), (b) or (c). (If answer is yes, go to Factor 4.)	Yes	______	3
		No	X	0
	Subtotal (maximum = 3)			0
3. Lifetime of remedial actions.	• 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
4. 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 5.)	Yes	______	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)			0

Table 5.5
(continued)
LONG-TERM EFFECTIVENESS AND PERMANENCE
(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening			Score
5. 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 = 15)			0

Table 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME

(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening			Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable go to Factor 2.	i)	Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100%	______	8
			90-99%	______	7
			80-90%	______	6
			60-80%	______	4
			40-60%	______	2
			20-40%	______	1
			< 20%	X	0
	ii)	Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes	______	0
			No	X	2
	iii)	After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal	______	0
			On-site land disposal	______	1
			Off-site destruction or treatment	______	2
		If subtotal = 10, go to Factor 3. Subtotal (maximum = 10)			2
2. Reduction in mobility of hazardous waste. If Factor 2 is not applicable, go to Factor 3.	i)	Quality of Available Wastes Immobilized After Destruction/ Treatment	90-100%	______	2
			60-90%	______	1
			< 60%	______	0
	ii)	Method of Immobilization			
		• Reduced mobility by containment.		______	0
		• Reduced mobility by alternative treatment technologies.		______	0
		Subtotal (maximum = 5)			0

Table 5.6
(continued)
REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste	Completely irreversible	____	5
	Irreversible for most of the hazardous waste constituents.	____	3
	Irreversible for only some of the hazardous waste constituents.	____	2
	Reversible for most of the hazardous waste constituents.	____	0
	Subtotal (maximum = 5)		0
	TOTAL (maximum = 15)		2

Table 5.7

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. No uncertaintied in construction.	X	3
		ii)	Somewhat difficult to construct. No uncertainties in construction.		2
		iii)	Very difficult to construct and/or significant uncertainties 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 unlikely.		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

Table 5.7
(continued)
IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening		Score
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 ______ No ______	1 0
	ii)	Will more than one vendor be available to provide a competitive bid?	Yes ______ No ______	1 0
b. Availability	i)	Additional equipment and specialists may be available without significant delay.	Yes ______ No ______	1 0
		Subtotal (maximum = 3)		0
		TOTAL (maximum = 15)		9

ALTERNATIVE: Point-of-Use Treatment

SITE NAME: Machias Gravel Pit
SITE NUMBER: 905013

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.	• 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
	• Can the short-term risk be easily controlled?	Yes	___	1
		No	___	0
	• 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	• 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
	• Are the available mitigative measures reliable to minimize potential impacts?	Yes	___	3
		No	___	0
	Subtotal (maximum = 4)			4
3. Time to implement the remedy.	• What is the required time to implement the remedy?	≤ 2yr.	X	1
		> 2yr.	___	0
	• 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.	• On-site treatment*		X	3
	• Off-site treatment*		___	1
	• On-site or off-site land disposal		___	0
* treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes.	Subtotal (maximum = 3)			3

Table 4.1
(continued)
SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening			Score
5. Permanence of the remedial alternative.	• 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
6. Lifetime of remedial actions.	• 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		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

Table 4.1
(continued)
SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor		Basis for Evaluation During Preliminary Screening			Score
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.

Table 4.2

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. No uncertainties in construction.	X	3
	ii)	Somewhat difficult to construct. No uncertainties in construction.		2
	iii)	Very difficult to construct and/or significant uncertainties 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 unlikely.		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

Table 4.2
(continued)
IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening			Score
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	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.

ALTERNATIVE: Point-of-Use Treatment

SITE NAME: Machias Gravel Pit
SITE NUMBER: 905013

Table 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Maximum Score = 10)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
1. Compliance with chemical-specific SCGs	Meets chemical specific SCGs such as ground water standards	Yes __X__ No _____	4 0
2. Compliance with action-specific SCGs	Meets SCGs such as technology standards for incineration or landfill	Yes __X__ No _____	3 0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act	Yes __X__ No _____	3 0
	TOTAL (maximum = 10)		10

Table 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Maximum Score = 20)

Analysis Factor	Basis for Evaluation During Preliminary Screening			Score
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table).		Yes __X__	20
			No ____	0
	TOTAL (Maximum = 20)			20
2. Human health and the environment exposure after the remediation.	i)	Is the exposure to contaminants via air route acceptable?	Yes ____	3
			No ____	0
	ii)	Is the exposure to contaminants via ground water/surface water acceptable?	Yes ____	4
			No ____	0
	iii)	Is the exposure to contaminants via sediments/soils acceptable?	Yes ____	3
			No ____	0
	Subtotal (maximum = 10)			0
3. Magnitude of residual public health risks after the remediation.	i)	Health risk ≤ 1 in 1,000,000	____	5
	ii)	Health risk ≤ 1 in 100,000	____	2
	Subtotal (maximum = 5)			0
4. Magnitude of residual environmental risks after the remediation.	i)	Less than acceptable	____	5
	ii)	Slightly greater than acceptable	____	3
	iii)	Significant risk still exists	____	0
	Subtotal (maximum = 5)			0
	TOTAL (maximum = 20)			0

Table 5.4

SHORT-TERM EFFECTIVENESS
(Maximum Score = 10)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
1. Protection of community during remedial actions.	• Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2).	Yes ____ No __X__	0 4
	• Can the risk be easily controlled?	Yes ____ No ____	1 0
	• Does the mitigative effort to control risk impact the community life-style?	Yes ____ No ____	0 2
	Subtotal (maximum = 4)		4
2. Environmental Impacts	• Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3).	Yes ____ No __X__	0 4
	• Are the available mitigative measures reliable to minimize potential impacts?	Yes ____ No ____	3 0
	Subtotal (maximum = 4)		4
3. Time to implement the remedy.	• What is the required time to implement the remedy?	≤ 2yr. __X__ > 2yr. ____	1 0
	• Required duration of the mitigative effort to control short-term risk.	≤ 2yr. __X__ > 2yr. ____	1 0
	Subtotal (maximum = 2)		2
	TOTAL (maximum = 10)		10

Table 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening			Score
1. On-site or off-site treatment or land disposal.	• On-site treatment*		X	3
	• Off-site treatment*			1
	• On-site or off-site land disposal			0
* treatment is defines as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes.	Subtotal (maximum = 3)			3
2. Permanence of the remedial alternative.	• Will the remedy be classified as permanent in accordance with Section 2.1(a), (b) or (c). (If answer is yes, go to Factor 4.)	Yes	X	3
		No		0
	Subtotal (maximum = 3)			3
3. Lifetime of remedial actions.	• Expected lifetime or duration of effectiveness of the remedy.	25-30yr.		3
		20-25yr.		2
		15-20yr.		1
		< 15yr.		0
	Subtotal (maximum = 3)			0
4. 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 5.)	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

Table 5.5
(continued)
LONG-TERM EFFECTIVENESS AND PERMANENCE
(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening			Score
5. 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 = 15)			10

Table 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME

(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening			Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable go to Factor 2.	i)	Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100%	______	8
			90-99%	______	7
			80-90%	______	6
			60-80%	______	4
			40-60%	______	2
			20-40%	______	1
			< 20%	X	0
	ii)	Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes	______	0
			No	X	2
	iii)	After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal	______	0
			On-site land disposal	______	1
			Off-site destruction or treatment	______	2
		If subtotal = 10, go to Factor 3. Subtotal (maximum = 10)			2
2. Reduction in mobility of hazardous waste. If Factor 2 is not applicable, go to Factor 3.	i)	Quality of Available Wastes Immobilized After Destruction/ Treatment	90-100%	______	2
			60-90%	______	1
			< 60%	______	0
	ii)	Method of Immobilization			
		• Reduced mobility by containment.		______	0
		• Reduced mobility by alternative treatment technologies.		______	0
		Subtotal (maximum = 5)			0

Table 5.6
(continued)
REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste	Completely irreversible	X	5
	Irreversible for most of the hazardous waste constituents.		3
	Irreversible for only some of the hazardous waste constituents.		2
	Reversible for most of the hazardous waste constituents.		0
	Subtotal (maximum = 5)		5
	TOTAL (maximum = 15)		7

Table 5.7

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. No uncertaintied in construction.	X	3
	ii)	Somewhat difficult to construct. No uncertainties in construction.		2
	iii)	Very difficult to construct and/or significant uncertainties 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 unlikely.		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

ALTERNATIVE: Point-of-Use Treatment

SITE NAME: Machias Gravel Pit
SITE NUMBER: 905013

Table 5.7
(continued)
IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening		Score
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__ No _____	1 0
	ii)	Will more than one vendor be available to provide a competitive bid?	Yes __X__ No _____	1 0
b. Availability	i)	Additional equipment and specialists may be available without significant delay.	Yes __X__ No _____	1 0
		Subtotal (maximum = 3)		3
		TOTAL (maximum = 15)		13

ALTERNATIVE: Replacement of Existing Well

SITE NAME: Machias Gravel Pit
SITE NUMBER: 905013

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.	• Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes No	 X	0 4
	• Can the short-term risk be easily controlled?	Yes No		1 0
	• Does the mitigative effort to control short-term risk impact the community life-style?	Yes No		0 2
	Subtotal (maximum = 4)			4
2. Environmental Impacts	• Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes No	 X	0 4
	• Are the available mitigative measures reliable to minimize potential impacts?	Yes No		3 0
	Subtotal (maximum = 4)			4
3. Time to implement the remedy.	• What is the required time to implement the remedy?	≤ 2yr. > 2yr.	X 	1 0
	• Required duration of the mitigative effort to control short-term risk.	≤ 2yr. > 2yr.	X 	1 0
	Subtotal (maximum = 2)			2
4. On-site or off-site treatment or land disposal.	• On-site treatment*			3
	• Off-site treatment*			1
	• On-site or off-site land disposal			0
* treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes.	Subtotal (maximum = 3)			0

Table 4.1
(continued)
SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening			Score
5. Permanence of the remedial alternative.	• 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
6. Lifetime of remedial actions.	• 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		2
	iii) Is the treated residual toxic?	Yes		0
		No		1
	iv) Is the treated residual mobile?	Yes		0
		No		1
	Subtotal (maximum = 5)			0

Table 4.1
(continued)
SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor		Basis for Evaluation During Preliminary Screening			Score
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)			14

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

Table 4.2

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. No uncertainties in construction.	X	3
	ii)	Somewhat difficult to construct. No uncertainties in construction.		2
	iii)	Very difficult to construct and/or significant uncertainties 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 unlikely.		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

Table 4.2
(continued)
IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening		Score
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__ No ____	1 0
	ii)	Will more than one vendor be available to provide a competitive bid?	Yes __X__ No ____	1 0
b. Availability	i)	Additional equipment and specialists may be available without significant delay.	Yes __X__ No ____	1 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 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)

(Maximum Score = 10)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
1. Compliance with chemical-specific SCGs	Meets chemical specific SCGs such as ground water standards	Yes __X__ No _____	4 0
2. Compliance with action-specific SCGs	Meets SCGs such as technology standards for incineration or landfill	Yes _____ No __X__	3 0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act	Yes __X__ No _____	3 0
	TOTAL (maximum = 10)		7

Table 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Maximum Score = 20)

Analysis Factor		Basis for Evaluation During Preliminary Screening			Score
1. Use of the site after remediation.		Unrestricted use of the land and water. (If answer is yes, go to the end of the Table).		Yes ___ No _X_	20 0
		TOTAL (Maximum = 20)			0
2. Human health and the environment exposure after the remediation.	i)	Is the exposure to contaminants via air route acceptable?		Yes _X_ No ___	3 0
	ii)	Is the exposure to contaminants via ground water/surface water acceptable?		Yes ___ No _X_	4 0
	iii)	Is the exposure to contaminants via sediments/soils acceptable?		Yes _X_ No ___	3 0
		Subtotal (maximum = 10)			6
3. Magnitude of residual public health risks after the remediation.	i)	Health risk	≤ 1 in 1,000,000	_X_	5
	ii)	Health risk	≤ 1 in 100,000	___	2
		Subtotal (maximum = 5)			5
4. Magnitude of residual environmental risks after the remediation.	i)	Less than acceptable		___	5
	ii)	Slightly greater than acceptable		_X_	3
	iii)	Significant risk still exists		___	0
		Subtotal (maximum = 5)			3
		TOTAL (maximum = 20)			14

Table 5.4

SHORT-TERM EFFECTIVENESS
(Maximum Score = 10)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
1. Protection of community during remedial actions.	• Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2).	Yes ____ No __X__	0 4
	• Can the risk be easily controlled?	Yes ____ No ____	1 0
	• Does the mitigative effort to control risk impact the community life-style?	Yes ____ No ____	0 2
	Subtotal (maximum = 4)		4
2. Environmental Impacts	• Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3).	Yes ____ No __X__	0 4
	• Are the available mitigative measures reliable to minimize potential impacts?	Yes ____ No ____	3 0
	Subtotal (maximum = 4)		4
3. Time to implement the remedy.	• What is the required time to implement the remedy?	≤ 2yr. __X__ > 2yr. ____	1 0
	• Required duration of the mitigative effort to control short-term risk.	≤ 2yr. __X__ > 2yr. ____	1 0
	Subtotal (maximum = 2)		2
	TOTAL (maximum = 10)		10

Table 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening			Score
1. On-site or off-site treatment or land disposal.	• On-site treatment*		______	3
	• Off-site treatment*		______	1
	• On-site or off-site land disposal		______	0
* treatment is defines as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes.	Subtotal (maximum = 3)			0
2. Permanence of the remedial alternative.	• Will the remedy be classified as permanent in accordance with Section 2.1(a), (b) or (c). (If answer is yes, go to Factor 4.)	Yes	______	3
		No	X	0
	Subtotal (maximum = 3)			0
3. Lifetime of remedial actions.	• 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
4. 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 5.)	Yes	______	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)			0

Table 5.5
(continued)
LONG-TERM EFFECTIVENESS AND PERMANENCE
(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening			Score
5. 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 = 15)			4

Table 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME

(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening			Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable go to Factor 2.	i)	Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100%	______	8
			90-99%	______	7
			80-90%	______	6
			60-80%	______	4
			40-60%	______	2
			20-40%	______	1
			< 20%	______	0
	ii)	Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes	______	0
			No	______	2
	iii)	After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal	______	0
			On-site land disposal	______	1
			Off-site destruction or treatment	______	2
		If subtotal = 10, go to Factor 3. Subtotal (maximum = 10)			0
2. Reduction in mobility of hazardous waste. If Factor 2 is not applicable, go to Factor 3.	i)	Quality of Available Wastes Immobilized After Destruction/ Treatment	90-100%	______	2
			60-90%	______	1
			< 60%	______	0
	ii)	Method of Immobilization			
		• Reduced mobility by containment.		______	0
		• Reduced mobility by alternative treatment technologies.		______	0
		Subtotal (maximum = 5)			0

Table 5.6
(continued)
REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste	Completely irreversible	______	5
	Irreversible for most of the hazardous waste constituents.	______	3
	Irreversible for only some of the hazardous waste constituents.	______	2
	Reversible for most of the hazardous waste constituents.	______	0
	Subtotal (maximum = 5)		0
	TOTAL (maximum = 15)		0

Table 5.7

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. No uncertaintied in construction.	X	3
	ii)	Somewhat difficult to construct. No uncertainties in construction.		2
	iii)	Very difficult to construct and/or significant uncertainties 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 unlikely.		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

Table 5.7
(continued)
IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening		Score
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__ No _____	1 0
	ii)	Will more than one vendor be available to provide a competitive bid?	Yes __X__ No _____	1 0
b. Availability	i)	Additional equipment and specialists may be available without significant delay.	Yes __X__ No _____	1 0
		Subtotal (maximum = 3)		3
		TOTAL (maximum = 15)		13

ALTERNATIVE: Air Stripping/Vapor Phase GAC/ Pipeline Discharge to Creek

SITE NAME: Machias Gravel Pit
SITE NUMBER: 905013

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.	• Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes No	____ X	0 4
	• Can the short-term risk be easily controlled?	Yes No	____ ____	1 0
	• Does the mitigative effort to control short-term risk impact the community life-style?	Yes No	____ ____	0 2
	Subtotal (maximum = 4)			4
2. Environmental Impacts	• Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes No	____ X	0 4
	• Are the available mitigative measures reliable to minimize potential impacts?	Yes No	____ ____	3 0
	Subtotal (maximum = 4)			4
3. Time to implement the remedy.	• What is the required time to implement the remedy?	≤ 2yr. > 2yr.	X ____	1 0
	• Required duration of the mitigative effort to control short-term risk.	≤ 2yr. > 2yr.	X ____	1 0
	Subtotal (maximum = 2)			2
4. On-site or off-site treatment or land disposal.	• On-site treatment*		X	3
	• Off-site treatment*		____	1
	• On-site or off-site land disposal		____	0
* treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes.	Subtotal (maximum = 3)			3

Table 4.1
(continued)
SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening			Score
5. Permanence of the remedial alternative.	• 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
6. Lifetime of remedial actions.	• 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		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		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)			4

Table 4.1
(continued)
SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor		Basis for Evaluation During Preliminary Screening			Score
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.

Table 4.2

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. No uncertainties in construction.	X	3
	ii)	Somewhat difficult to construct. No uncertainties in construction.		2
	iii)	Very difficult to construct and/or significant uncertainties 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 unlikely.		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

ALTERNATIVE: Air Stripping/Vapor Phase GAC/ Pipeline Discharge to Creek

SITE NAME: Machias Gravel Pit
SITE NUMBER: 905013

Table 4.2
(continued)
IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening		Score
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__ No _____	1 0
	ii)	Will more than one vendor be available to provide a competitive bid?	Yes __X__ No _____	1 0
b. Availability	i)	Additional equipment and specialists may be available without significant delay.	Yes __X__ No _____	1 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.

ALTERNATIVE: Air Stripping/Vapor Phase GAC/ Pipeline Discharge to Creek

SITE NAME: Machias Gravel Pit
SITE NUMBER: 905013

Table 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)

(Maximum Score = 10)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
1. Compliance with chemical-specific SCGs	Meets chemical specific SCGs such as ground water standards	Yes X No ___	4 0
2. Compliance with action-specific SCGs	Meets SCGs such as technology standards for incineration or landfill	Yes X No ___	3 0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act	Yes X No ___	3 0
	TOTAL (maximum = 10)		10

Table 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Maximum Score = 20)

Analysis Factor	Basis for Evaluation During Preliminary Screening			Score
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table).		Yes X	20
			No ____	0
	TOTAL (Maximum = 20)			20
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?		Yes ____	3
			No ____	0
	ii) Is the exposure to contaminants via ground water/surface water acceptable?		Yes ____	4
			No ____	0
	iii) Is the exposure to contaminants via sediments/soils acceptable?		Yes ____	3
			No ____	0
	Subtotal (maximum = 10)			0
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤ 1 in 1,000,000	____	5
	ii) Health risk	≤ 1 in 100,000	____	2
	Subtotal (maximum = 5)			0
4. Magnitude of residual environmental risks after the remediation.	i) Less than acceptable		____	5
	ii) Slightly greater than acceptable		____	3
	iii) Significant risk still exists		____	0
	Subtotal (maximum = 5)			0
	TOTAL (maximum = 20)			0

ALTERNATIVE: Air Stripping/Vapor Phase GAC/ Pipeline Discharge to Creek

SITE NAME: Machias Gravel Pit
SITE NUMBER: 905013

Table 5.4

SHORT-TERM EFFECTIVENESS
(Maximum Score = 10)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
1. Protection of community during remedial actions.	• Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2).	Yes ____ No __X__	0 4
	• Can the risk be easily controlled?	Yes ____ No ____	1 0
	• Does the mitigative effort to control risk impact the community life-style?	Yes ____ No ____	0 2
	Subtotal (maximum = 4)		4
2. Environmental Impacts	• Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3).	Yes ____ No __X__	0 4
	• Are the available mitigative measures reliable to minimize potential impacts?	Yes ____ No ____	3 0
	Subtotal (maximum = 4)		4
3. Time to implement the remedy.	• What is the required time to implement the remedy?	≤ 2yr. __X__ > 2yr. ____	1 0
	• Required duration of the mitigative effort to control short-term risk.	≤ 2yr. __X__ > 2yr. ____	1 0
	Subtotal (maximum = 2)		2
	TOTAL (maximum = 10)		10

Table 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE

(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening			Score
1. On-site or off-site treatment or land disposal.	• On-site treatment*		X	3
	• Off-site treatment*			1
	• On-site or off-site land disposal			0
* treatment is defines as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes.	Subtotal (maximum = 3)			3
2. Permanence of the remedial alternative.	• Will the remedy be classified as permanent in accordance with Section 2.1(a), (b) or (c). (If answer is yes, go to Factor 4.)	Yes	X	3
		No		0
	Subtotal (maximum = 3)			3
3. Lifetime of remedial actions.	• Expected lifetime or duration of effectiveness of the remedy.	25-30yr.		3
		20-25yr.		2
		15-20yr.		1
		< 15yr.		0
	Subtotal (maximum = 3)			0
4. 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 5.)	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)			4

Table 5.5
(continued)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening			Score
5. 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 = 15)			12

ALTERNATIVE: Air Stripping/Vapor Phase GAC/ Pipeline Discharge to Creek

SITE NAME: Machias Gravel Pit
SITE NUMBER: 905013

Table 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening			Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable go to Factor 2.	i)	Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100%	______	8
			90-99%	______	7
			80-90%	X	6
			60-80%	______	4
			40-60%	______	2
			20-40%	______	1
			< 20%	______	0
	ii)	Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes	______	0
			No	X	2
	iii)	After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal	______	0
			On-site land disposal	______	1
			Off-site destruction or treatment	______	2
		If subtotal = 10, go to Factor 3. Subtotal (maximum = 10)			8
2. Reduction in mobility of hazardous waste. If Factor 2 is not applicable, go to Factor 3.	i)	Quality of Available Wastes Immobilized After Destruction/ Treatment	90-100%	______	2
			60-90%	______	1
			< 60%	______	0
	ii)	Method of Immobilization			
		• Reduced mobility by containment.		______	0
		• Reduced mobility by alternative treatment technologies.		______	0
		Subtotal (maximum = 5)			0

ALTERNATIVE: Air Stripping/Vapor Phase GAC/ Pipeline Discharge to Creek

SITE NAME: Machias Gravel Pit
SITE NUMBER: 905013

Table 5.6
(continued)
REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste	Completely irreversible	X	5
	Irreversible for most of the hazardous waste constituents.		3
	Irreversible for only some of the hazardous waste constituents.		2
	Reversible for most of the hazardous waste constituents.		0
	Subtotal (maximum = 5)		5
	TOTAL (maximum = 15)		13

ALTERNATIVE: Air Stripping/Vapor Phase GAC/ Pipeline Discharge to Creek

SITE NAME: Machias Gravel Pit
SITE NUMBER: 905013

Table 5.7

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. No uncertainties in construction.	X	3
	ii)	Somewhat difficult to construct. No uncertainties in construction.		2
	iii)	Very difficult to construct and/or significant uncertainties 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 unlikely.		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

Table 5.7
(continued)
IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening		Score
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__ No _____	1 0
	ii)	Will more than one vendor be available to provide a competitive bid?	Yes __X__ No _____	1 0
b. Availability	i)	Additional equipment and specialists may be available without significant delay.	Yes __X__ No _____	1 0
		Subtotal (maximum = 3)		3
		TOTAL (maximum = 15)		14

ALTERNATIVE: Air Stripping/Vapor Phase GAC/
Injection Well Discharge to Ground Water

SITE NAME: Machias Gravel Pit
SITE NUMBER: 905013

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.	• 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
	• Can the short-term risk be easily controlled?	Yes		1
		No		0
	• 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	• 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
	• Are the available mitigative measures reliable to minimize potential impacts?	Yes		3
		No		0
	Subtotal (maximum = 4)			4
3. Time to implement the remedy.	• What is the required time to implement the remedy?	≤ 2yr.	X	1
		> 2yr.		0
	• 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.	• On-site treatment*		X	3
	• Off-site treatment*			1
	• On-site or off-site land disposal			0
* treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes.	Subtotal (maximum = 3)			3

ALTERNATIVE: Air Stripping/Vapor Phase GAC/ Injection Well Discharge to Ground Water

SITE NAME: Machias Gravel Pit
SITE NUMBER: 905013

Table 4.1
(continued)
SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening			Score
5. Permanence of the remedial alternative.	• 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
6. Lifetime of remedial actions.	• 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		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		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)			4

Table 4.1
(continued)
SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor		Basis for Evaluation During Preliminary Screening			Score
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.

ALTERNATIVE: Air Stripping/Vapor Phase GAC/ Injection Well Discharge to Ground Water

SITE NAME: Machias Gravel Pit
SITE NUMBER: 905013

Table 4.2

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. No uncertainties in construction.	X	3
		ii)	Somewhat difficult to construct. No uncertainties in construction.		2
		iii)	Very difficult to construct and/or significant uncertainties 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 unlikely.		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

Table 4.2
(continued)
IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening		Score
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__ No ____	1 0
	ii)	Will more than one vendor be available to provide a competitive bid?	Yes __X__ No ____	1 0
b. Availability	i)	Additional equipment and specialists may be available without significant delay.	Yes __X__ No ____	1 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.

ALTERNATIVE: Air Stripping/Vapor Phase GAC/ Injection Well Discharge to Ground Water

SITE NAME: Machias Gravel Pit
SITE NUMBER: 905013

Table 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)

(Maximum Score = 10)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
1. Compliance with chemical-specific SCGs	Meets chemical specific SCGs such as ground water standards	Yes X No ____	4 0
2. Compliance with action-specific SCGs	Meets SCGs such as technology standards for incineration or landfill	Yes X No ____	3 0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act	Yes X No ____	3 0
	TOTAL (maximum = 10)		10

ALTERNATIVE: Air Stripping/Vapor Phase GAC/ Injection Well Discharge to Ground Water

SITE NAME: Machias Gravel Pit
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Table 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Maximum Score = 20)

Analysis Factor		Basis for Evaluation During Preliminary Screening			Score
1. Use of the site after remediation.		Unrestricted use of the land and water. (If answer is yes, go to the end of the Table).		Yes __X__	20
				No ____	0
		TOTAL (Maximum = 20)			20
2. Human health and the environment exposure after the remediation.	i)	Is the exposure to contaminants via air route acceptable?		Yes ____	3
				No ____	0
	ii)	Is the exposure to contaminants via ground water/surface water acceptable?		Yes ____	4
				No ____	0
	iii)	Is the exposure to contaminants via sediments/soils acceptable?		Yes ____	3
				No ____	0
		Subtotal (maximum = 10)			0
3. Magnitude of residual public health risks after the remediation.	i)	Health risk	≤ 1 in 1,000,000	____	5
	ii)	Health risk	≤ 1 in 100,000	____	2
		Subtotal (maximum = 5)			0
4. Magnitude of residual environmental risks after the remediation.	i)	Less than acceptable		____	5
	ii)	Slightly greater than acceptable		____	3
	iii)	Significant risk still exists		____	0
		Subtotal (maximum = 5)			0
		TOTAL (maximum = 20)			0

ALTERNATIVE: Air Stripping/Vapor Phase GAC/ Injection Well Discharge to Ground Water

SITE NAME: Machias Gravel Pit
SITE NUMBER: 905013

Table 5.4

SHORT-TERM EFFECTIVENESS
(Maximum Score = 10)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
1. Protection of community during remedial actions.	• 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
	• Can the risk be easily controlled?	Yes ____	1
		No ____	0
	• Does the mitigative effort to control risk impact the community life-style?	Yes ____	0
		No ____	2
	Subtotal (maximum = 4)		4
2. Environmental Impacts	• 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
	• Are the available mitigative measures reliable to minimize potential impacts?	Yes ____	3
		No ____	0
	Subtotal (maximum = 4)		4
3. Time to implement the remedy.	• What is the required time to implement the remedy?	≤ 2yr. __X__	1
		> 2yr. ____	0
	• Required duration of the mitigative effort to control short-term risk.	≤ 2yr. __X__	1
		> 2yr. ____	0
	Subtotal (maximum = 2)		2
	TOTAL (maximum = 10)		10

ALTERNATIVE: Air Stripping/Vapor Phase GAC/ Injection Well Discharge to Ground Water

SITE NAME: Machias Gravel Pit
SITE NUMBER: 905013

Table 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE

(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening			Score
1. On-site or off-site treatment or land disposal.	• On-site treatment*		X	3
	• Off-site treatment*			1
	• On-site or off-site land disposal			0
* treatment is defines as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes.	Subtotal (maximum = 3)			3
2. Permanence of the remedial alternative.	• Will the remedy be classified as permanent in accordance with Section 2.1(a), (b) or (c). (If answer is yes, go to Factor 4.)	Yes	X	3
		No		0
	Subtotal (maximum = 3)			3
3. Lifetime of remedial actions.	• Expected lifetime or duration of effectiveness of the remedy.	25-30yr.		3
		20-25yr.		2
		15-20yr.		1
		< 15yr.		0
	Subtotal (maximum = 3)			0
4. 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 5.)	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)			4

Table 5.5
(continued)
LONG-TERM EFFECTIVENESS AND PERMANENCE
(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening			Score
5. 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 = 15)			12

ALTERNATIVE: Air Stripping/Vapor Phase GAC/ Injection Well Discharge to Ground Water

SITE NAME: Machias Gravel Pit
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Table 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening			Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). If Factor 1 is not applicable go to Factor 2.	i)	Quantity of hazardous waste destroyed or treated. Immobilization technologies do not score under Factor 1.	99-100%	______	8
			90-99%	______	7
			80-90%	X	6
			60-80%	______	4
			40-60%	______	2
			20-40%	______	1
			< 20%	______	0
	ii)	Are there untreated or concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.	Yes	______	0
			No	X	2
	iii)	After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal	______	0
			On-site land disposal	______	1
			Off-site destruction or treatment	______	2
		If subtotal = 10, go to Factor 3. Subtotal (maximum = 10)			8
2. Reduction in mobility of hazardous waste. If Factor 2 is not applicable, go to Factor 3.	i)	<u>Quality of Available Wastes Immobilized After Destruction/ Treatment</u>	90-100%	______	2
			60-90%	______	1
			< 60%	______	0
	ii)	Method of Immobilization			
		• Reduced mobility by containment.		______	0
		• Reduced mobility by alternative treatment technologies.		______	0
		Subtotal (maximum = 5)			0

ALTERNATIVE: Air Stripping/Vapor Phase GAC/ Injection Well Discharge to Ground Water

SITE NAME: Machias Gravel Pit
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Table 5.6
(continued)
REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste	Completely irreversible	X	5
	Irreversible for most of the hazardous waste constituents.		3
	Irreversible for only some of the hazardous waste constituents.		2
	Reversible for most of the hazardous waste constituents.		0
	Subtotal (maximum = 5)		5
	TOTAL (maximum = 15)		13

ALTERNATIVE: Air Stripping/Vapor Phase GAC/ Injection Well Discharge to Ground Water

SITE NAME: Machias Gravel Pit
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Table 5.7

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. No uncertainties in construction.	X	3
	ii)	Somewhat difficult to construct. No uncertainties in construction.		2
	iii)	Very difficult to construct and/or significant uncertainties 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 unlikely.		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

Table 5.7
(continued)
IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screening		Score
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 No ___	1 0
	ii)	Will more than one vendor be available to provide a competitive bid?	Yes X No ___	1 0
b. Availability	i)	Additional equipment and specialists may be available without significant delay.	Yes X No ___	1 0
		Subtotal (maximum = 3)		3
		TOTAL (maximum = 15)		14