Final Report

Feasibility Study for the General Instrument Corporation in Sherburne, New York

September 1994

FINAL REPORT
FEASIBILITY STUDY FOR THE GENERAL INSTRUMENT CORPORATION IN SHERBURNE, NEW YORK:

Prepared for

GENERAL INSTRUMENT CORPORATION

STATE OF NEW YORK
WAYNE EDWARD MC FARLAND
No. 59177
LICENSED PROFESSIONAL ENGINEER

Wayne E. Mc

Prepared by

STEARNS & WHELER
Environmental Engineers and Scientists
One Remington Park Drive
Cazenovia, NY 13035

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Project No. 1587

FINAL REPORT
FEASIBILITY STUDY FOR THE GENERAL INSTRUMENT CORPORATION IN SHERBURNE, NEW YORK: FORMAT AND PRELIMINARY SCREENING

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STEARNS & WHELER
Environmental Engineers and Scientists
One Remington Park Drive
Cazenovia, NY 13035

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CHAPTER 1

INTRODUCTION

1.1 ORGANIZATION AND PURPOSE

General Instrument Corporation owned and operated a manufacturing and metal plating facility on TACO Street in Sherburne, New York. Site-related environmental impact was discovered during plant closure and a Remedial Investigation/Feasibility Study was initiated in 1989. The RI, which characterized site conditions and extent of environmental impact, has been prepared and is approved. This report presents the results of the Feasibility Study.

In a general sense, a Feasibility Study can be viewed as occurring in three phases: (1) development of alternatives; (2) screening of alternatives; and (3) detailed analysis of alternatives. However, for practical reasons, Phases I and II are usually combined and occur concurrently.

Alternatives are developed by combining site-specific and appropriate remedial technologies. An alternative therefore is "one" option composed of one or more technologies that will satisfy remediation objectives and goals for the site. Usually, several alternatives are developed and screened before the Feasibility Study moves on to a detailed analysis of alternatives.

The process of alternative development consists of six steps, which are outlined below.

1. Develop remedial action objectives, specifying contaminants and media of interest, exposure pathways, and remediation goals. Remediation goals are derived from chemical-specific ARARs or site-specific, risk-related factors.

2. Develop general response actions for each medium of interest defining containment, treatment, excavation, pumping, or other actions that may satisfy the remedial action objectives.

3. Identify volumes or areas of media to which general response actions will be applied.

4. Identify and screen technologies applicable to each general response action to eliminate those that are not technically feasible at the site.

5. Evaluate technology process actions for each technology type being considered.

6. Assemble selected technologies into alternatives representing a range of treatment and containment combinations.

The purpose of this report is four-fold: (1) to identify operable units and media in need of remediation; (2) to define remedial objectives and develop general response actions that would satisfy the remedial objectives; (3) to develop and screen preliminary remedial alternatives for the site; and (4) to fully evaluate alternatives for the site with the goal of selecting the most appropriate and cost-effective option for remediation. The report is organized into chapters that address each one of these topics. The remainder of Chapter 1 presents background information of site characteristics and summarizes the results of the RI. Chapter 2 defines two operable units; Chapter 3 identifies remedial action objectives and Applicable and Relevant or Appropriate Requirements (ARARs); and Chapter 4 develops general response actions and identifies site-appropriate remedial alternatives. Chapter 5 describes the interim remedial measure undertaken, and Chapter 6 presents a full evaluation of remedial alternatives for the site.

1.2 BACKGROUND INFORMATION

The site was used to plate antennas and manufacture electronics parts from 1947 until 1983. When the plant shut down in 1983, closure procedures were properly followed as mandated in the Resource Conservation and Recovery Act (RCRA) of 1976. RCRA protocol required testing for potential sources of environmental contamination, and hazardous material was discovered on site. The potential for environmental release of hazardous material was also discovered. Environmental testing and remediation began immediately, culminating in the preparation of this RI/FS.

A. **Site Description.** The site is located on TACO Road in Sherburne, New York (Figure 1-1A). The Village of Sherburne is situated in the Town of Sherburne, Chenango County, approximately 28 miles south of Utica (Figure 1-1B).

The 5.5-acre site is located approximately 250 feet west of Route 12 and 1,300 feet north of Route 80. The site borders agricultural fields on the west, residential and light commercial property on the east and south, and a bulk petroleum storage facility on the north. Property boundaries are delineated by a chain link fence around the main plant. There is a small parcel of property which borders Route 12 that is not fenced.

The facility consists of the following buildings: a 75,000 square foot main building previously used for manufacturing, warehousing and administration; a 4,900 square foot plating building used for applying metal plating material and for degreasing; a 1,600 square foot garage used as a maintenance shop; and a 2,800 square foot wooden shed used to store machinery and material (Figure 1-2). There is a paved parking lot on the eastern side of the main building, and a concrete pad south of the wooden shed. The remainder of the site (and the majority of ground surface) is open, grass-covered space. A two-acre field at the south side of the property (South Field) is predominantly grass covered, with some open patches in the grass where coarse gravel fill can be seen. Additionally, there are old concrete slabs and shallow foundations in the South Field, probably the foundations of sheds and outbuildings that have been removed.

In historic times, the Chenango Canal crossed the site along the eastern property boundary. Today, Potash Creek roughly follows the route of the abandoned Chenango Canal along the eastern side of the property (Figure 1-3). The portion of the creek which crosses the northern half of the property was enclosed in an underground culvert, presumably during site development. During closure, the remaining portion of the creek was also enclosed in an underground culvert. The section of the creek enclosed during closure extends approximately from the south of the main building, across the South Field, to the extreme southwest corner of the site. The underground culvert empties into a drainage ditch adjacent to the railroad tracks.

B. **Site History.** Site development began in 1947, when the property was improved for manufacturing by the Technical Appliance Corporation of America (TACO). TACO initially manufactured kitchen equipment, but soon began to manufacture antennas. In 1962, Jerrold Electronic Corporation purchased the plant and renamed it R.F. Systems. General Instrument purchased the facility in 1968, and at first operated the site as R.F. Systems, a Division of General Instrument Corporation. Later, they operated the facility under the name "General Instrument".

From 1947 until plant operations ended in 1983, the plant was involved with developing, designing, manufacturing and testing aluminum antennas, remote control devices for televisions, and other types of electronic equipment. Production activities were supported by a fabrication shop, a paint shop, and a metals plating facility (which included an analytical laboratory).

The facility used a process that cleans antennas and other aluminum products and adds a protective coating to their surface; this trademarked process is called the Alodine™ process. The Alodine equipment was located along the west wall of the main building.

Other processes employed at the plant included metal etching with chromic acid, cleaning with halogenated solvents, and vapor degreasing.

In 1983, General Instrument Corporation implemented a plan to close the Sherburne facility. A closure plan for decommissioning the plant, consistent with RCRA guidelines, was submitted to the NYSDEC in September 1984 and approved in October 1984.

Between 1984 and 1989, the plant was decommissioned. Production equipment was cleaned and relocated. All building surfaces were cleaned and structurally repaired. The closure plan identified eight areas that required decontamination because of the presence of hazardous materials:

- The plating room.
- The vapor degreasing room.
- A chemical laboratory.
- A 5,000-gallon underground settling tank.
- A paint shop.
- The Alodine™ booth.
- The hazardous material storage shed.
- The exterior faces of building walls.

Based on the "Engineering Report for Plant Closure," hazardous compounds suspected to be present in these areas were:

Plating Process

Ammonium chloride
Zinc chloride
Chromic acid
Phosphoric acid
Sulfuric acid
Hydrogen fluoride
Nitric acid
Caustic soda
Muriatic acid
Smut remover
1,1,1-trichloroethane (TCA)
Miscellaneous chlorinated hydrocarbons
Cyanide

Heavy metals:
Manganese
Iron
Silver
Titanium
Cadmium
Chromium
Copper
Lead
Mercury
Zinc
Aluminum

Painting Shop

Paint thinners
Toluene diisocyanate
Naptha
Xylol
Red lead
Lead chromate
Toluol
Methyl isobutyl ketone

Alkylamine
Formaldehyde
Lactol spirits
Ether ester
Aliphatic petroleum distillates
Acetyl acetone
Ethyl acetate
Methyl ethyl ketone

Alodine Process
- Hydrofluoric acid
- Potassium ferricyanide
- Caustic potash
- Alkali pyrophosphate
- Sodium gluconate
- Isopropanol
- Glycol solvent
- Organic dye
- Bisulfite

Vapor Degreasing Process
- 1,1,1-trichloroethane (TCA)
- Chlorinated solvents

Environmental sampling revealed the presence of inorganics in the soil, and inorganic and organic compounds in the groundwater beneath the site.

In 1989, the site was classified as a "Class 2" inactive hazardous waste site (#709010), and a NYSDEC Consent Order (#A701578810) required General Instrument to conduct an RI/FS at the site. The consent order alleged that hazardous substances were discharged to soils and groundwater at the site. The hazardous substances identified in the consent order are trans-1,2-dichloroethene, 1,1,1-trichloroethane, chloroform, trichloroethene, 1,1-dichloroethane, carbon tetrachloride, methylene chloride, chlorobenzene, toluene, benzene, 1,1,2-trichloroethane, tetrachloroethene, vinyl chloride, xylene, ethyl benzene, trichlorofluoromethane, and 1,1,2,2-tetrachloroethane. All the compounds listed above are volatile organic compounds (VOCs).

In addition, the consent order required General Instrument to: (1) identify on-site and off-site contamination; (2) determine a remediation program that is technologically feasible and practical that will mitigate and eliminate to the maximum extent possible any present or potential threat to the environment and to human health; (3) submit to the Department all data within its provision; and (4) solicit public comment.

C. **Nature and Extent of Contamination.** During the Remedial Investigation, three sources of contamination and areas of concern were identified: (1) the soil in the vicinity of the plating building was identified as a source of chlorinated hydrocarbons and xylene; (2) the soil at the north end of the main building was identified as a source of volatile and semi-volatile organic compounds; and (3) the soil north of the wooden shed at the property boundary with Wescar bulk storage facility is a source of volatile and semi-volatile hydrocarbons.

Low level residual volatile organics were recognized in the South Field. However, the origin of VOCs in wells of the South Field was problematic, as no direct source was discovered. It was determined that the source was probably low level residual concentrations in the deep soil and aquifer associated with the demolished storage sheds and drums that were once stored in the South Field. Large quantities of soil were removed during earlier remediation in the South Field, and these low levels did not pose a significant threat to human health or the environment.

It was also determined that low levels of cyanide persist in groundwater along the western site boundary. The source of this cyanide was probably leaks or spills to the soil behind the main building. These soils were removed and replaced with clean fill during the facility closure. No current or persistent source is believed to exist. The MCL (100 µg/l) for cyanide was exceeded in samples from MW-5 and MW-6; however, low levels do not pose a significant threat to human health or the environment.

Polynuclear aromatic hydrocarbons were present, both on site and off site. The PNAs are attributed to background fossil fuel combustion and not a product of site activity.

Low levels of pesticides were also identified in soil samples on site and off site. It was determined that their presence is associated with the agricultural land use practices of the area and not a product of site activity.

D. **Contaminant Fate and Migration.** Contaminants were identified in the soil (within 4 feet of surface) and in the groundwater beneath the site. Advective and dispersive processes are believed to be transporting the contaminants to the west along groundwater flow paths. Migration via surface water, although possible, has not been documented, as there are no surface water conduits at the site. Atmospheric monitoring with a PID discovered no open atmospheric excursions of VOCs, and samples designed to measure atmospheric fallout downgradient did not detect atmospherically-derived contamination.

1. **Fate of Organics Beneath and Adjacent to the Plating Building.** The source of volatile organic compounds (including chlorinated solvents and xylene) in the vicinity of the plating building, is the result of the industrial activity during plant operation. Some of the contaminants probably entered the soil via the building's floor drain system. The plating room contains a 24-inch clay-tile vertical floor drain that was used to collect rinse water from the cleaning of aluminum antennas and associated parts (Figure 1-4). Solvents, including but not limited to chlorinated compounds, were used to clean aluminum parts. The cleaned parts were then rinsed with large quantities of water. The rinse water was collected in the floor drain. The organic compounds found beneath the plating room were probably released to the environment through the floor drain as part of the rinsing process. Chlorinated hydrocarbons, including 1,1,1-TCA and mono-aromatics such as toluene and xylene, were used in the plating, cleaning and rinsing processes. Analysis revealed 1,1,1-TCA, TCE, 1,1-DCE, 1,1-DCA, PCE, methylene chloride, and chloroform in the soil between the plating room and the western boundary. Shallow soils in this area had been removed and

replaced as a remedial effort during plant closure. It is expected that the contaminant levels under the building are lower than levels in the soil adjacent to the building because the sides of the clay tile pipe (sump) provided a barrier between the disposed solvents and the unsaturated soils underlying the building. Concentrations in soil beyond the perimeter of the building can be attributed to several transport processes, including vapor phase migration and separate spills and releases in that area. Once contaminants are introduced into the saturated soil, dissolved phase transport in the direction of groundwater flow could have impacted the soil west of the plating building. The volatile and semi-volatile contamination found in the soil is a source to the groundwater and soil around the building.

A conceptual model of the source and fate of contamination found beneath the plating building was presented in the RI (it is also presented in this report; see Figure 1-5). Figure 1-5 illustrates the conceptual model of contaminant source and transport in the vicinity of the plating building. Contaminants held in the unsaturated zone above the water table migrate laterally and vertically in the vapor phase, ultimately being dissolved in groundwater. Once in the groundwater, contaminants travel along groundwater flow paths toward the Chenango River.

2. **Fate of Organics at the North End of the Main Building.** The source of volatile and semi-volatile compounds in the soil and groundwater may be derived from up to three different locations. First, there was a reported release of petroleum product adjacent to and under the loading dock and building. This release is probably responsible for the free-phase petroleum hydrocarbon product found floating on the water table. Second, the groundwater has elevated concentrations of polynuclear aromatic (PNAs) compounds usually associated with fossil fuels. These PNAs may be derived from two possible locations: the loading dock release of petroleum products and/or the releases that occurred on the adjacent petroleum bulk storage facility property or releases on the unfenced portion of the General Instrument property bordering the storage facility, which resulted from activity at the storage facility. Third, the groundwater has elevated concentrations of chlorinated compounds (predominantly 1,2-DCE) which is probably derived from downgradient migration of solutes released beneath the plating room. Very little 1,2-DCE was encountered in the soil beneath the plating room, and very high concentrations were discovered in the soil near MW-8. Although this suggests a different source, it is in all probability related to solvent use around the plating building. The 1,2-DCE contaminated soils around MW-8 will be grouped with the contaminated soils associated with the plating building and will be considered a single source.

In summary, the exact source of the three types of contamination, free-phase petroleum product, PNAs, and chlorinated solvents (mostly 1,2-DCE) is the result of three possible sources. Those sources have been identified as: (1) petroleum spills near the main building; (2) petroleum spills resulting from activities at the bulk storage facility next door; and (3) residual solvents from the plating building.

The fate of the contamination discovered at the north end of the main building is similar to that of the contaminants found beneath the plating building. Contaminants are migrating laterally and vertically in the unsaturated zone, and once in the groundwater, toward the Chenango River to the west.

3. **Fate of Organic Compounds North of Wooden Shed.** There is soil contaminated with petroleum hydrocarbons located north of the wooden shed. This contamination is derived, in part, from persons unknown and in part from other off-site spills. General Instrument vacated and closed this facility in 1985, including the removal of remaining heating oil. Any spills subsequent to facility closure cannot be attributed to General Instrument. This soil is a source of volatile and semi-volatile contamination to the groundwater. We expect that these contaminants are migrating in the unsaturated zone and groundwater by the same processes affecting releases under the plating room and at the north end of the main building.

Atmospheric concentrations of VOC were measured with a photoionization detector. The concentration of airborne VOCs at a distance of more than a couple of feet from the soil is at background; however, elevated concentrations were measured at the soil/air interface. It is believed that, for the most part, releases to the atmosphere are diluted and dissipate rapidly.

4. **Fate of Residual Contamination in the South Field.** Chlorinated hydrocarbons persist at low concentrations (near the MCLs) in the groundwater beneath the South Field. These organic solutes are migrating in the groundwater toward the Chenango River, and are held as residual product in the pore spaces of the vadose zone. At these low levels, the natural attenuation capacity of the aquifer will degrade and dilute the contaminant before it could reach a vector of human exposure.

E. **Baseline Risk Assessment.** A baseline risk assessment was conducted under USEPA guidelines as part of the Remedial Investigation Report. The purpose of the risk assessment is to determine whether existing contaminant concentrations in soil, groundwater, and air pose an unacceptable health risk to either on-site workers or nearby residents. Risks are quantified by evaluating exposure routes, calculating potential chemical exposure doses for each route, and comparing the numbers to existing toxicity and carcinogenicity data.

Based on the distribution of contaminants on site and the environmental setting of Sherburne, New York, feasible pathways of exposure were identified and quantified. Inhalation of volatile contaminants of surface soils, ingestion of soil, and potential future residential use of contaminated groundwater were quantitatively evaluated. One pathway, future residential use of the shallow aquifer downgradient of the General Instrument site, resulted in elevated risk of carcinogenic effects. Land downgradient of the site is within the Village of Sherburne, and any Village residents are required to pay for utility connection fees. In addition to organic compounds and their carcinogenic effects, some wells exceeded guidance values or standards for inorganics. Upgradient wells also were found to exceed some 6 NYCRR Part 703 standards for inorganics. Since the upgradient wells represent ambient background conditions at the site, it appears that the groundwater in the shallow aquifer beneath the site is not potable by today's standards. Private wells are therefore unlikely. However, there is no ordinance prohibiting installation of a private residential well.

Overall, the risk to human health posed by the General Instrument Corporation site in Sherburne, New York, appears to be minimal. The one potential pathway for elevated health risks, future downgradient water supply wells, is unlikely.

CHAPTER 2

IDENTIFICATION OF OPERABLE UNITS

Operable units are defined by the USEPA (USEPA, 1988a) as portions of an overall response action that, by themselves, mitigate or eliminate a release of contaminants, a threat of release of contaminants, or an exposure pathway. An operable unit can also reflect the final remediation of a defined portion of a site. Therefore, the purpose of identifying operable units for a contaminated site is to break up the site into more easily managed entities for which remedial alternatives can be evaluated. When evaluating a site with multiple sources of contamination, or with multiple exposure pathways, the identification of operable units facilitates identification of remedial action objectives and helps narrow the ranges of remedial technology and process options which must be evaluated.

Three operable units are identified at the Sherburne site. Operable Unit No. 1 encompasses the contaminated soil beneath the plating building and at the north end of the main building. Operable Unit No. 2 consists of the petroleum-related soil contamination at the north end of the wooden shed. Operable Unit No. 3 includes groundwater contaminated by organic compounds from all sources in the soil.

2.1 OPERABLE UNIT NO. 1

Operable Unit No. 1 contains contaminated soil beneath the plating building, as well as soils adjacent to the plating building and extending to the property boundary at the railroad tracks (see Figure 2-1). The compounds of interest are primarily volatile organic compounds (VOCs), such as chlorinated solvents and xylene (see Tables 2-1 and 2-2). Table 2-3 lists semi-volatile organic compounds (SVOCs) present in Operable Unit No. 1. Both VOCs and SVOCs, as described in the RI, are largely adsorbed to the silty permeable soil beneath the site. The contaminants are transported to the groundwater (Operable Unit No. 3) during infiltration events and migrate laterally through the unsaturated zone by dispersive processes.

The soil in the vicinity of the plating facility was identified as a separate operable unit because once the contaminants reached the soil, regardless of the source, they share a similar fate and migration. This operable unit groups soil contaminated from two main sources. Solvents, including VOCs and SVOCs, entered the soil from the drainage systems associated with the plating room and additional unidentified sources. Additional volatile and semi-volatile contamination in the soil has been attributed to a petroleum spill at the northwest corner of the main building. Because the soil is contaminated with such a variety of chemicals with no clear delineations between sources, all this contaminated soil has been grouped into the one operable unit.

2.2 OPERABLE UNIT NO. 2

Operable Unit No. 2 consists of soil contaminated by petroleum hydrocarbon spills that occurred north of the wooden shed, near the north property boundary. Similar to Operable Unit No. 1, the unit boundary will be defined as the property line between the TACO site and the neighboring bulk petroleum storage facility (see Figure 2-1). Volatile and semi-volatile compounds identified are listed in Tables 2-4 and 2-5. Petroleum hydrocarbons were detected in surface soil samples. Field observations in conjunction with test pit sampling in this area revealed the contact between contaminated soil and groundwater.

Petroleum hydrocarbons were released to the soil at the north end of the site in two separate locations: the northwest corner of the main building, and north of the woodshed; however, the spill near the main building was included in Operable Unit No. 1. The spill north of the woodshed was considered a separate operable unit because its boundaries are more well defined. Other than xylene, the soil is contaminated with a range of SVOCs.

2.3 OPERABLE UNIT NO. 3

Operable Unit No. 3 consists of the VOC- and SVOC-contaminated groundwater. It has been further divided into the groundwater under the site and the contaminated plume, which extends to the west, under the farmer's field (the West Field). The source of the contaminants in the dissolved plume is the contaminated soil of Operable Unit No. 1. The VOC and SVOC contamination was transported from the soil to the groundwater during infiltration events. Tables 2-6 and 2-7 list the volatile and semi-volatile contaminants found in the contaminant plume under the site. Figure 2-2 and Table 2-6 illustrate the western migration of the contaminant plume and analytical results from samples of groundwater taken by the use of temporary borings. Operable Unit No. 3 also includes the free-phase petroleum product found at Monitoring Wells MW-8 and MW-18.

During August 1993, three additional monitoring wells were installed in the West Field to define the extent of the dissolved plume. Table 2-8 lists contaminant concentrations which were detected in samples taken from the three additional wells in September 1993. Figure 2-3 shows the location of the additional three wells. Figure 2-4 illustrates the distribution of the chlorinated organic dissolved plume, both on site and off site.

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SECTION 3

REMEDIAL ACTION OBJECTIVES

3.1 INTRODUCTION

The preliminary development of remediation alternatives in a Feasibility Study is a five-fold process: (1) develop the remedial action objectives; (2) identify ARARs (Applicable or Relevant and Appropriate Requirements); (3) determine the general response actions; (4) identify appropriate remedial processes; and (5) combine into remedial alternatives. The information required for this evaluation includes a determination of the nature and extent of the contamination and the potential for the contamination to adversely affect a potential receptor. This evaluation was provided in the Remedial Investigation Study. The alternatives for remediation presented in this screening are developed by combining technologies that have been evaluated and determined to be appropriate for the site characteristics.The alternatives comply with the scope of remediation established by ARARs which include contaminant cleanup levels, areal extent of remediation, and performance and design standards. This procedure follows United States Environmental Protection Agency (USEPA) criteria (USEPA, 1988a), which is endorsed by the NYSDEC for the preparation of feasibility study reports for state Superfund sites.

The remedial action objective for the General Instrument site is to provide for protection of human health and the environment by controlling the sources of contamination at the site and minimizing the potential exposure pathways.

Remedial action objectives were further refined and alternatives were developed for the General Instrument site as required by the ECL Article 27, Title 13 (State Superfund). The State Superfund Act requires remedial action alternatives to be protective of human health and the environment. In addition, a remedial action must meet or exceed Applicable or Relevant and Appropriate Requirements (ARARs). The ARARs specific to the General Instrument Feasibility Study are discussed in Section 3.3.

ARARs are established requirements that must be met to assure cleanup levels that will protect public health and the environment. Alternatively, a Public Health Evaluation (PHE) or Baseline Risk Assessment can be used to develop risk-based cleanup criteria. The Risk Assessment determines whether the existing soil, groundwater, surface water and air concentrations pose a public health risk.

In order to meet the requirements of the State Superfund, remedial actions must provide protection from exposure to or release of hazardous substances from the General Instrument property. Therefore, remedial action objectives for this site include reduction of contaminant volume at the source, mitigating groundwater contamination to the extent practical, and reducing the potential hazard of exposure to the contaminants.

The procedure for remedial alternative development and a decision flow path that graphically illustrates the procedure is presented in Figure 3-1.

Alternatives are then assembled which will satisfy the remedial action objectives for the site. The assembled alternatives provide an appropriate range of options and sufficient information for comparison. Usually, the range of alternatives will vary depending on site-specific conditions, but generally encompass both source and groundwater control actions and technologies.

Alternatives for source control actions include consideration of a range of technologies that:

1. Provide permanent solutions to the contaminant problem such that long-term management, such as maintenance and monitoring, is minimal.

2. Provide a form of treatment which results in reduction of toxicity, mobility, or volume of contaminants to the maximum extent practicable.

3. Provide containment combined with a minimum amount of treatment that results in protection of human health and the environment by preventing exposure or reducing the mobility of the waste.

4. Involve no action, often developed as a baseline against which the other alternatives can be evaluated.

Groundwater control actions address both cleanup levels, and the time frame within which the cleanup objectives might be achieved. Depending on specific site conditions and the aquifer characteristics, alternatives should be developed that achieve chemical ARARs or other risk-based levels determined to be protective within varying time frames using different methodologies. Because the contaminated aquifer is not presently used as a drinking water source, alternatives such as institutional measures may be appropriate.

The remainder of this chapter presents the chemical, location, and action-specific ARARs for the site. General response actions are defined and further refined according to site conditions, as remedial alternatives are presented in Chapter 4.

3.2 DEVELOPMENT OF REMEDIAL ACTION OBJECTIVES

In general, the remedial action objective for any contaminated site is to protect human health and the environment. Specific remedial objectives developed for the TACO site will strive to allow development of a broad range of alternatives. Remedial action objectives will be specific for the contaminants of concern, the potential exposure routes and receptors, and the acceptable contaminant level or range for each exposure route.

Remedial action objectives for protecting human receptors are equally based upon a contaminant level and exposure route, rather than contaminant levels alone. Protection may be achieved by reducing exposure (such as capping an area, limiting access, or providing an alternate water supply) as well as by reducing contaminant levels. Remedial action objectives for protecting environmental receptors typically seek to preserve or restore a resource such as groundwater; environmental remedial objectives are expressed in terms of the specific medium of interest and target cleanup levels.

The acceptable contaminant levels, or appropriate target cleanup levels, for the protection of human receptors are determined in a risk assessment. Alternatively, by using protective contaminant-specific ARARs, or by establishment of alternate limits based on the technical feasibility and capability of chosen treatment, appropriate target cleanup levels are determined.

Contaminant levels in each media are compared with acceptable levels. Acceptable exposure levels are determined on the following evaluation:

1. **For carcinogens.** Whether the chemical-specific ARAR provides protection within the risk range of 10^{-4} to 10^{-7}, and the chemical-specific ARAR addresses the total risk from exposure to multiple chemicals.

2. **For non-carcinogens.** Whether the chemical-specific ARAR is sufficiently protective if multiple chemicals are present at the site.

3. **For all contaminants.** Whether environmental effects (in addition to human health effects) are adequately addressed by the ARARs.

4. **For all contaminants.** Whether the ARARs adequately address all significant pathways of human exposure identified in the baseline risk assessment. For example, if the exposure from the ingestion of fish and drinking water are both significant pathways of exposure, application of an ARAR that is based on drinking water ingestion (e.g., MCLs) may not be adequately protective.

Additional details for establishing acceptable exposure levels when no ARARs exist are provided by the United States Environmental Protection Agency (USEPA, 1989).

3.3 IDENTIFICATION OF ARARs

New York Environmental Conservation Law, Article 27, Title 13 requires that remedial actions comply with all applicable laws, specifically the requirements of New York State Department of Environmental Conservation (NYSDEC) law and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by Superfund Amendment and Reauthorization Act (SARA).

CERCLA and SARA mandates were developed to provide guidance for lead agencies (USEPA or state conservation agencies) in the selection of on-site remedial actions that meet the ARARs as established in the Resource Conservation and Recovery Act (RCRA), Clean Water Act (CWA), Safe Drinking Water Act (SDWA), Clean Air Act (CAA), the Toxic Substance Control Act (TSCA), and other federal and state environmental laws. CERCLA §121 requires on-site remedial actions to attain promulgated state ARARs that are more stringent than federal ARARs. The requirements that must be complied with are those that are legally applicable or relevant and appropriate to the substance or circumstance of release.

A requirement under other environmental laws may be either applicable or "relevant and appropriate", but not both. Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a contaminated site. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria or limitations promulgated under federal or state law that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a contaminated site, addresses problems or situations sufficiently similar to those encountered at the site. Identification of ARARs is done on a site-specific basis in two parts: the first task is to determine whether a requirement is applicable; if it is not applicable, the second task is to determine whether it is relevant and appropriate.

ARARs may be grouped into three categories:

1. Location-specific requirements are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they occur in special locations.

2. Ambient or chemical-specific requirements are usually health- or risk-based numerical values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in or discharged to the ambient environment.

3. Action-specific requirements are usually technology- or activity-based requirements or limitations on actions, such as performance and design, taken with respect to hazardous wastes.

The purpose of implementing a remedial action at a site is to protect human health and the environment. Cleanup goals for the chosen remedial actions are determined by risk-based factors or by standards and guidance values which are ARAR for the site. Additional criteria termed TBCs (To Be Considered) are considered in absence of ARARs, or if guidelines have not been established by state, federal, or local statutes for the contaminants at the site. Although TBCs do not have ARAR status, they can be considered with ARARs and risk assessment-based goals to set cleanup goals. Two approaches which may be used for establishing remedial action cleanup goals for a site, in the absence of ARARs, are:

1. **Cleanup to Background.** This approach requires a database of the contaminant concentrations to develop a statistically valid range of their ambient levels.

   Cleanup levels lower than background levels are not, in general, practicable; e.g., if the background levels of a particular contaminant is at the 10^{-4} risk level, a more stringent cleanup level is not practicable. However, if background levels are above ARARs and the groundwater is a drinking water source, it may be appropriate to initiate a coordinated response with other agencies. If background levels are high because of natural sources, wellhead treatment may be the most effective solution, although such groundwater is probably not a drinking water supply.

2. **Cleanup Levels by Risk Assessment.** The USEPA has adopted the policy that TBCs should not be used unless they are necessary to protect human health and the environment. Because there are currently not ARARs to address the full range of contaminated sites (Smith and Zamuda, 1988), risk assessment can be used to identify cleanup levels.

USEPA uses a 10^{-6} risk level for carcinogens in the absence of ARARs based on a contaminant's cancer potency factor (CPF). Non-carcinogen levels may be determined based on its reference dose (RfD), below which the contaminant does not exhibit a toxic effect.

USEPA guidance on ARARs indicates, that while chemical-specific advisory levels, such as carcinogenic potency factors are not actually ARARs, they may factor significantly into the establishment of protective cleanup levels.

A. **Review of Location-specific ARARs.** A habitat survey performed by an independent consultant identified habitat areas and tributaries of the Chenango River that could be subject to federal or state restrictions. A review of the statutes pertaining to these areas is provided below and compiled in Table 3-1. Wetlands and the 100-year floodplain identified near Sherburne were obtained from the Chenango County wetlands map, provided by the NYSDEC (1978) and shown on Figure 3-2.

1. **Rivers and Streams.** New York State Water Quality Regulations (6 NYCRR Parts 700-705) - Under 6 NYCRR Parts 608, any discharges from the site must be protective of the Chenango River. The section of the Chenango River adjacent to the TACO site is ranked Class B (trout). Other portions of the Chenango River and its major tributary, Mad Brook, have been ranked as Class B and D, respectively. Smaller unnamed tributaries to the Chenango River vary from Class A to D. The applicable classifications under 6 NYCRR Part 701.19 are provided below:

a. **Class "A".** Best usage of waters - sources of water supply for drinking, culinary or food processing purposes and any other usages.

b. **Class "B".** Best usage of waters - primary contact recreation and any other uses except as a source of water supply for drinking, culinary or food processing purposes. Class "B" trout includes additional dissolved oxygen requirements designed to protect the waters for trout habitats.

c. **Class "C".** Best usage of waters - fishing and fish propagation. The water quality shall be suitable for primary and secondary contact recreation even though other factors may limit the use for that purpose.

d. **Class "D".** Best usage of waters - the waters are suitable for fishing. The water quality shall be suitable for primary and secondary contact recreation even though other factors may limit the use for that purpose. Due to such natural conditions as intermittency of flow, water conditions not conducive to propagation of game fishery or stream bed conditions, the water will not support fish propagation.

2. **100-Year Floodplains.** The General Instrument site was not identified as being within the 100-year floodplain as delineated by the NYSDEC. However, the 100-year floodplain encroaches within 500 feet of the site, thus remedial actions must be conducted in compliance with NYSDEC regulations pertaining to floodplain management. Remedial actions that involve activities or treatment, storage or disposal of hazardous wastes within the 100-year floodplain are regulated under 6 NYCRR Part 373-2.2(j)(1) and 6 NYCRR Part 500. These requirements state that facilities, impoundments, waste piles, landfills and miscellaneous units must be designed such that no adverse effect on human health and the environment will result if washout occurs.

New York State regulations under 6 NYCRR Part 373-2.2(j)(2) also prohibit the placement of any non-containerized or bulk liquid hazardous waste in any salt dome formation, salt bed formation, underground mine or cave. None of these features were identified in the Sherburne vicinity, thus remedial activities should not be restricted by these regulations.

3. **Endangered Species.** A survey by an independent consultant did not identify any rare, threatened or endangered species of plants or animals within the vicinity of the General Instrument site. Also, a review of the Significant Habitat Unit and New York Natural Heritage Program files revealed no previous reports of significant habitats or natural communities in the vicinity of Sherburne.

The only documentation of a rare species was the Large Leaf Aster near the General Instrument site in 1942. This species may be found in woodlands and forests (Gleason and Cronquist, 1963). However, the consultant concluded that an adverse affect on this species due to remedial actions would be unlikely, since there are no forests within one-half mile of the site. Regulations pertaining to critical habitat area as defined under the Endangered Species Act are contained in 50 CFR 200 and 402, and 6 NYCRR Part 182.

B. **Chemical-specific ARARs and TBCs.** This section presents potential chemical-specific ARARs and other requirements or criteria to be considered (TBCs) which were identified and reviewed. ARARs and TBCs are presented below and in Table 3-2 with respect to the particular medium of concern.

1. **Soil.** Federal and state standards have yet to be promulgated for the cleanup of soils, except in the case of PCBs. PCBs were not detected above a level that would require remediation at the General Instrument site. Thus, chemical-specific ARARs for soil were not established.

Chemical-specific cleanup criteria for soil have recently been established by the NYSDEC for both inactive hazardous waste sites and petroleum-contaminated sites. In a Technical and Guidance Memorandum (TAGM) No. 4046, dated November 16, 1992, soil cleanup objectives were established for common volatile and semi-volatile organic contaminants found at hazardous waste sites. STARS (Spill Technology and Remediation Series) Memo #1, issued in August 1992, established similar cleanup guidelines for petroleum-contaminated sites. Both guidance documents will be used as goals for any soil treatment process(es) chosen.

2. **Groundwater.** ARARs and TBCs for groundwater are listed below. The aquifer which has been affected by contaminant release in and around the General Instrument site is not currently used. Because it is not a source of drinking water, careful consideration of background water quality and natural attenuation mechanisms should be made when establishing cleanup goals in conjunction with groundwater and drinking water ARARs and TBCs.

a. New York State Water Quality Regulations - Groundwater Classifications and Standards (6 NYCRR Parts 700-705). According to NYSDEC groundwater classification standards, the shallow groundwater in the Sherburne area should meet the Class GA requirements. GA waters are fresh groundwaters found in the saturated zone or unconsolidated deposits and consolidated rock or bedrock, and can be, or are, used as a source of potable water supplies. Quality standards for Class GA waters shall be the most stringent of the following regulations:

- 6 NYCRR Part 703
- 10 NYCRR Subpart 5-1
- SDWA (PL 93-523)
- 10 NYCRR Part 170

The quality standard limits pertaining to concentrations of substances or chemicals for each of the regulations cited above are provided in Appendix D, Tables D-1 through D-4.

However, during the Remedial Investigation, analyses of water from upgradient, off-site monitoring wells determined that groundwater in the shallow aquifer does not meet all Class GA standards. For analytes that exceed promulgated standards in background monitoring wells, groundwater cleanup standards will be background concentration. Promulgated standards will be ARAR for all other constituents (organic chemicals of concern).

b. New York State Effluent Standards and/or Limitations for Discharges to Class GA Waters (6 NYCRR Parts 703.6-703.7) and Technical and Operational Guidance Series (TOGS 1.1.1.) Ambient Water Quality Standards and Guidance Values (September 1990) - Part 703.6 provides effluent standards which apply to a discharge from a point source or outlet or any other discharge that may enter the unsaturated or saturated zones. Schedules I and II of Part 703.6 list chemical effluent standards and/or limitations that shall be incorporated into a State Pollutant Discharge Elimination System (SPDES) permit for discharges to groundwater. The SPDES program is administered by the state and is authorized by the USEPA to establish more stringent requirements than those established by the federal NPDES program. These values are applicable for establishing criteria for groundwater cleanup and reinjection and are considered ARARs.

Part 703.7 presents additional effluent limitation criteria which may establish more stringent effluent limitations on a site-specific basis after consultation with the Department of Health. There is also a provision to impose effluent standards for substances not included in Schedules I or II of Part 703.6. The guidance values listed in the TOGS 1.1.1 memorandum (also referred to as Ambient Water Quality Standards and Guidance Values) are TBCs for effluent limitations since they have not been promulgated.

Parts 701.3 and 701.7 describe the methods for deriving limits for chemicals that do not appear either in Part 703.6 or in the TOGS 1.1.1 memorandum. Part 701.15 provides the regulation for establishing effluent limits if the methods in 701.3 and 701.7 are inappropriate. In this case, an effluent limit can be derived by applying a value of 50 micrograms per liter (µg/l) for any chemical that belongs to one of the following classes:

- Alkanes
- Aliphatic and aromatic alcohols
- Aliphatic and aromatic aldehydes, ketones or esters
- Halogenated aliphatics
- Unsaturated aliphatics with an aldehyde, ketone or nitrile functional group
- Aromatic hydrocarbons - benzene derivatives only, halogenated aromatic hydrocarbons
- Phthalates

- Polynuclear hydrocarbons
- Aliphatic and aromatic nitro, cyano and amino compounds

In addition, the maximum ambient water quality value for the total of dissolved organic chemicals is 100 µg/l as described in Part 701.15(f). The limits are defined in Part 701, are applicable, and are considered ARARs.

c. New York State Sanitary Code Drinking Water Supplies (10 NYCRR Subparts 5-1 and 5-3) - The rules and regulations set forth under this code apply to current and potential sources of drinking water. Subpart 5-1 specifically addresses sampling frequency, MCLs, analytical protocols, and various other aspects of public water supplies. Subpart 5-3 addresses the protection of underground and surface sources of drinking water. MCLs are enforceable standards (therefore, ARARs) for the allowable concentrations of inorganics, organics, total trihalomethanes, turbidity, coliform bacteria and radioactivity.

The New York State Sanitary Code was amended in January 1989. The amendment established MCLs, monitoring, and notification requirements for specific organic chemicals in public water supplies. An MCL of 5 µg/l has been set for any principal organic contaminant (POC). The POCs are defined as any chemical belonging to any of six general chemical classes (excluding those with specific MCLs):

- Halogenated alkanes
- Halogenated ethers
- Halobenzenes and substituted halobenzenes
- Benzene and alkyl- or nitrogen-substituted benzenes
- Substituted, unsaturated aliphatic hydrocarbons
- Halogenated non-aromatic cyclic hydrocarbons.

An MCL of 50 µg/l has been set for any unspecified organic contaminant (UOC). UOCs would include any organic chemical not covered by another MCL. In addition, the MCLs for methoxychlor and 2,4-D have been changed to 50 µg/l in order to be consistent with the MCLs for the UOCs. A specific MCL for vinyl chloride has also been established as 2 µg/l. An MCL of 100 µg/l has been set for the combined total POCs and UOCs.

The code revision also addresses the requirements for monitoring water in which contaminants have been or may be present in amounts exceeding the MCL. This rule has been adopted and promulgated, and therefore will be considered an ARAR.

d. Suggested No Adverse Response Levels (SNARLs) - USEPA Health Advisories and National Academy of Sciences (NAS) provide drinking water suppliers with guidance on contaminants that may be encountered occasionally in water systems and are believed to pose a near-term risk, yet are unregulated. These guidelines are developed by the Office of Drinking Water in the form of health advisories (SNARLs) and are considered TBC.

3. **Surface Water.** The water quality of the Chenango River and Potash Creek may be affected by groundwater and surface runoff, discharge from storm drains, sewage treatment plant effluents, and industrial treatment plant discharges. Thus, these receiving waters could potentially be contaminated from runoff and waste streams generated by remedial activities at the General Instrument site. Therefore, surface water criteria could be used for determining a cleanup level and for establishing criteria for the evaluation of impacts of proposed remedial alternatives on surface water bodies. A review of the surface water ARARs is presented below.

a. New York State Pollutant Discharge Elimination System (6 NYCRR Parts 750-758 and 701.5) and Technical and Operational Guidance Series (TOG S 1. 1. 1) Ambient Water Quality Standards and Guidance Values (April 1987) - SPDES (6 NYCRR Chapter X, Article 3, Parts 750-757) prescribes procedures and rules pursuant to ECL Article 17, Title 8, relating to the regulation of all discharges within the state authorized under the NPDES program. Because New York is designated to administer the SPDES program, the state effluent requirements supersede those established by the USEPA for the NPDES program. Parts 750 through 754 pertain to permit requirements, applications, public participation, and provisions of SPDES permits, respectively. Part 754 specifies provisions of SPDES permits, effluent limitations, schedules of compliance, and various other provisions. The derivation of water quality effluent limitations used in SPDES permits is included in 6 NYCRR Part 701.15. The ambient water quality standards in the TOGS 1.1.1 memorandum provide the basis for chemical-specific effluent limitations. The procedure for deriving limits for chemicals not appearing in the ambient water quality standards is identical to the derivation of groundwater standards. These values could be used to determine groundwater and leachate seepage cleanup levels as well as the required quality of any discharges to receiving waters. Treated groundwater that is discharged to a publicly-owned treatment works (POTW) must meet the pretreatment requirements of the POTW. If the POTW does not have established pretreatment standards, the remedial action should be evaluated to determine if the POTW's SPDES permit will be violated as a result of the discharge.

Both on-site and off-site direct discharges from state Superfund sites to surface waters are required to meet the substantive requirements of the SPDES program. Substantive requirements include discharge limitations, monitoring requirements, and best-management practices.

b. New York State Water Quality Regulations (NYSWQR)- Surface Water and Groundwater Classification and Standards, 6 NYCRR Parts 700-705 - As discussed in Section A(1), the Chenango River is classified as a Class B (trout) surface water body.

The Chenango River is the ultimate receiving water for the community of Sherburne. Any discharge to the Chenango River resulting from remedial activities would be required to comply with the appropriate surface water classification. NYSWQR standards require that all classes of waters receiving waste discharges shall be such that no impairment to the best usage of waters in any other class shall occur by reason of such waste discharges. The contaminant levels associated with each classification have been promulgated and are considered ARARs.

c. Federal Water Quality Criteria (FWQC) - Federal water quality criteria, established under the Clean Water Act, are non-enforceable values developed for the protection of aquatic life and human health. These values are used by the states to establish enforceable standards with respect to the extended uses of each water body. SARA requires that the federal criteria be applied to cleanups where they are relevant and appropriate. These criteria are relevant and appropriate to cleanups in the Sherburne area, both for surface water and for groundwater contaminants not covered by other enforceable standards.

New York State has not yet developed water quality standards in full compliance with the CWA, but was expected to achieve compliance in Fiscal Year 1990 (55 FR 14350). Consequently, WQC will be considered ARARs for the General Instrument site where more stringent standards do not exist.

4. **Air.** Although there were no atmospheric excursions identified in the RI, air requirements are ARAR for the site because remedial actions may involve atmospheric discharge.

a. **New York State Air Guide-1 Guidelines for the Control of Toxic Ambient Air Contaminants** - Guidelines of the NYSDEC Division of Air Resources provide a screening method to determine whether permits should be issued for point or multi-point sources and stack emissions. Acceptable ambient levels (AALs) are provided as a guideline for issuing permits under 6 NYCRR Part 212. Contaminant-specific AALs are determined by NYSDEC and New York State Department of Health (NYSDOH) toxicologists using risk assessment technology suitable for the contaminant. These guidelines are representative of average acceptable contaminant concentrations to safeguard receptors on an annual basis against potential chronic effects that result from continuing exposures.

The specific National Emission Standards for Hazardous Air Pollutants (NESHAPS) standard or the applicable AAL is used for the approval process for any high toxicity air contaminants. These guidelines are annual average ambient concentrations that should not be exceeded for any off-site receptor. These guidelines are ARARs for the site and can be applied to any treatment facilities that may be constructed as part of the remedial action.

b. New York State Air Pollution Control Regulations (6 NYCRR Parts 201, 202 and 219) - The air pollution regulations, Parts 201 and 202, govern the requirements necessary to construct or operate a contamination source. The operator of such a source, such as an air stripper, may be required to have the emissions analyzed and to report the results to the State Commissioner. Alternatively, specifications for the treatment unit, combined with calculations demonstrating maximum contaminant levels in gaseous emissions, may be used to demonstrate air quality standards are not being violated.

Particulate emission limits from incineration facilities are set under 6 NYCRR Part 219. These levels are based on the mass emission rate in pounds per hour (lb/hr). Should an incineration facility be operated at the General Instrument site, it would be required to conform to the emission limits. Therefore, if any air contamination source were constructed as part of a remedial measure, these regulations would be considered relevant and appropriate.

C. **Review of Action-specific ARARs.** Action-specific ARARs are usually technology- or activity-based requirements or limitations taken with respect to hazardous wastes. Activity requirements govern the design, construction and operation of remedial actions as provided by RCRA, or 6 NYCRR Part 370 et seq. authorized under RCRA. Action-specific requirements indicate how a selected alternative must be achieved. Requirements that will be considered in developing and evaluating remedial alternatives at the General Instrument site are referenced below.

1. **Solid Waste Management (6 NYCRR Part 360)** - The requirements of 6 NYCRR 360 regulate solid waste management facilities. However, hazardous waste management facilities are excluded from these regulations.

Title 6 NYCRR Part 360 regulations are ARAR for the Sherburne site if the remedial actions chosen for the site involve off-site disposal of nonhazardous materials in a landfill, including construction and demolition debris. Such activities include disposal of demolished structures, materials, tools, treatment residuals or sludges. Any waste generated at the site not meeting the jurisdictional requirements of 6 NYCRR Part 370 et seq. could be managed and disposed in accordance with 6 NYCRR Part 360. Continuous performance monitoring of the residuals generated by the chosen treatment technology is required to ensure that the materials are suitable for disposal in New York State solid waste management facilities. Disposal of the following materials are explicitly regulated.

a. Ash from on-site incineration would be subject to Part 360 disposal regulations.

b. Sludges may be disposed at facilities specifically authorized by NYSDEC. Sludges must be stabilized and dewatered to 20 percent solids. Landfills accepting sludge whose wet weight exceeds 25 percent of the combined total weight of sludges and other solid wastes on a daily basis must provide a leachate collection, treatment and monitoring program.

c. Tanks accepted for disposal must have their ends removed, cleaned of residue, and be compressed to their minimum practical volume.

Materials excavated from the Sherburne site that do not meet the jurisdictional requirements of Part 360 regulations must be managed and disposed as a hazardous waste. Treated materials may be disposed on site if both state and federal land disposal regulations are met (6 NYCRR Part 376 and 40 CFR 268).

2. **Hazardous Waste Management (6 NYCRR Parts 370-376).** Parts 370-376 of 6 NYCRR affect all aspects of hazardous waste management and are ARARs for the General Instrument site, including remedial actions that involve the treatment, storage or disposal of hazardous waste originating from the site. The general terms and conditions established for treatment, storage and disposal (TSD) facilities that manage hazardous waste are contained in 6 NYCRR Part 370. The listing and identification of hazardous wastes which are subject to regulation under Parts 370 and 373 are contained in 6 NYCRR Part 371.

The Hazardous Waste Manifest System and standards related to recordkeeping for generators, transporters and facilities are described in 6 NYCRR Part 372. The requirements for hazardous waste treatment, storage and disposal are presented in 6 NYCRR Subpart 373-1. Included is specific information about requirements for containers, tanks, surface impoundments, waste piles, incinerators, land treatment facilities and landfills. Section 373-1.6 lists the requirements for recording and reporting of groundwater monitoring results.

Section 373-2.5 addresses releases from solid waste management units and groundwater protection; Subsection 2.6(c) addresses the groundwater protection standard; and Subsections (h), (i) and (j) address monitoring requirements, the detection monitoring program, and the compliance monitoring program.

Section 373.2.15 addresses the regulations and operational requirements for owners and operators of facilities that incinerate or burn hazardous waste, which would be ARAR if an incineration alternative were selected.

Part 374 of 6 NYCRR addresses the standards for the management of specific hazardous wastes and specific types of hazardous waste management facilities, such as energy recovery facilities that burn hazardous wastes.

Part 375 of 6 NYCRR addresses remedial actions at inactive hazardous waste sites.

3. **Storm Water Permit Requirements.** The site may be subject to the storm water permit requirements in 40 CFR 122-124. If construction of a temporary hazardous waste treatment, storage, and disposal facility on the site is required as part of the remedial actions and it results in point source discharges of storm water, a permit may be required. During the design phase of the remedial project, an evaluation will be made to determine if storm water discharge regulations are applicable to the site. If so, a management plan will be developed at that time.

4. **Department of Transportation Rules.** Regulations for the transportation of hazardous materials are described in Title 17 of New York State Transportation Law. Part 507 of this law provides for the administration of CFR 49 Part 170 et seq. of USDOT regulations. All USDOT standards contained in CFR 49 are incorporated by reference to apply to the transportation of hazardous materials within the State of New York. Thus, compliance with NYSDOT Hazardous Materials Transporter regulations encompasses all USDOT regulations by statute.

Extraction of groundwater for off-site disposal could incur "generator" status. Generator requirements and permitting procedures are listed under 49 CFR 172 and 177; 40 CFR 263 and 6 NYCRR Part 364; and 370 et seq. These regulations would be ARAR for any remediation efforts involving off-site transport of waste materials.

5. **Direct Discharge Requirements** - Several types of cleanup activities could be considered "direct discharges" from a point source under ECL Article 17, Title 8. Activities which may trigger action-specific requirements for the discharge include:

a. On-site waste treatment in which wastewater is discharged directly into a surface water body in the area of contamination or in very close proximity to this area via a pipe, ditch, conduit or other means of "discrete conveyance".

b. Off-site treatment in which wastes from the site are piped or otherwise discharged through a point source to an off-site surface water.

c. Any remedial action in which site runoff would be channeled directly to a surface water body via a ditch, culvert, storm sewer or other means.

Contaminated groundwater that flows naturally into surface water is not considered a point source discharge. However, contaminated groundwater entering surface water may still be subject to federal water quality criteria or state water quality standards. These criteria are not ARAR, but elucidate whether proposed remedial actions would be regulated by promulgated standards. Chemical-specific requirements for remedial activities were described earlier in this section. Remedial actions involving the activities listed would be required to comply with the appropriate ARAR.

6. **Occupational Safety and Health Administration (OSHA) Regulations** - OSHA requirements are applicable to workers implementing the remedial alternatives. Exposure to or direct contact with contaminated materials and any hazardous chemicals used in treatment processes will be of particular concern.

SARA requires that the Secretary of Labor promulgate standards for the health and safety protection of employees engaged in hazardous waste operations pursuant to Section 6 of the Occupational Safety and Health Act of 1970. These regulations are ARAR for all remedial activities at the Sherburne General Instrument site.

CHAPTER 4

DEVELOPMENT AND SCREENING OF REMEDIAL ALTERNATIVES

4.1 GENERAL RESPONSE ACTIONS

General response actions describe those actions that will satisfy the remedial objectives. General response actions are developed for each medium of interest, defining containment, treatment, or removal that may be used singly or in combination.

The scope of general response actions may be classified as either: (a) a source control action; or (b) a groundwater control action. A source control action may be defined as the construction or installation and startup of those actions necessary to prevent the continued release of hazardous substances, pollutants or contaminants into the environment. These substances would be released primarily from a source in the ground; or from a source inside buildings or other structures. In practice, source control actions include activities that provide either a permanent solution, such as destruction, removal, or solidification of waste; or a reduction in toxicity, volume of waste, or risk of the discrete waste source. This reduction may be accomplished by treatment or control technologies.

The second type of response actions to be considered are groundwater control actions. A groundwater control action is defined as a construction or treatment system that ameliorates impact to groundwater. Such actions may include active aquifer restoration, containment through hydraulic control, extraction and treatment or diversion. Because of the type of contamination at the site, cleanup at the TACO site will involve both source and groundwater control actions.

Once general response actions have been determined, potential remedial technologies are evaluated with respect to technical implementability and effectiveness. Available information from the RI site characterization, regarding contaminant types and concentrations and on-site characteristics, were used to screen technologies and process options that are obviously unsuited to the site. During this screening step, process options and entire technology types were evaluated to eliminate those that would not be effective in achieving the remedial objectives or are difficult to implement.

Implementability evaluation encompasses both the technical and institutional feasibility of implementing a technological process. Technical implementability was used as an initial screen of technology types and process options to eliminate those that cannot be deployed successfully at the site. Institutional aspects of implementability include such factors as the ability to obtain permits for off-site action; availability of treatment, storage and disposal services; and the availability of equipment and labor. These aspects are given greater attention at later stages of development.

Unproven technologies were screened to eliminate those that are unreliable or perform poorly for the contaminants of concern. For example, certain grouting methods and in-situ treatment methods are currently in the design/development phase and have not been demonstrated effective in the field. A technology's performance record, construction, and operation and maintenance problems are scrutinized to help ensure selection of a successful remedy. However, at this point, the screening of technologies focuses on effectiveness factors more than implementability or unproven technology factors (per the USEPA 1985 directive).

Effectiveness evaluation screening of technology types considered factors such as the presence of inorganic contaminants and the subsurface conditions. The effectiveness evaluation focused on: (1) the potential effectiveness of process options in handling the estimated areas or volumes of media and meeting the contaminant reduction goals identified in the general response actions; (2) the effectiveness of the process options in protecting human health and the environment during the construction and implementation phase; and (3) how proven and reliable the process is with respect to the contaminants and conditions at the site. Evaluation was accomplished by reviewing site and contaminant characteristics identified in the RI.

The final evaluating tool at this stage in the FS process is cost. If more than one option appears to be effective and implementable for the site conditions, then the alternative development process will focus on the method with the lowest price.

4.2 EVALUATION CRITERIA

The NYSDEC, incorporating USEPA criteria, gives preference to treatment technologies "that, in whole or in part, results in a permanent and significant decrease in the toxicity, mobility, or volume of hazardous substances, pollutants or contaminants," to the maximum extent practicable (NYSDEC, 1990). The hierarchy of remedial technologies for hazardous waste disposal sites, from most desirable to least desirable, is outlined below. The NYSDEC considers only destruction, separation, and treatment or solidification and chemical fixation of inorganic wastes as permanent remedies. However, solidification and chemical fixation of wastes containing "low" level organic constituents may be considered as a permanent remedy if it can be justified.

1. **Destruction.** This type of remedy irreversibly destroys or detoxifies all or most of the hazardous wastes to "acceptable cleanup levels". The treated materials then have no residue containing unacceptable levels of hazardous wastes. This type of remedy results in permanent reduction in the toxicity of all or most of the hazardous wastes to "acceptable cleanup levels(s)".

2. **Separation and Treatment.** This type of remedial action separates or concentrates the hazardous wastes, thereby resulting in a treated waste stream with acceptable levels of hazardous wastes and a concentrated waste stream with high levels of contaminants, e.g., treatment of contaminated leachate by granulated activated carbon. This type of remedy results in permanent and significant reduction in volume of waste mixed with hazardous wastes. In these instances where the concentrated waste stream can be destroyed or detoxified as in "Destruction" above, preference shall be given to this additional treatment.

3. **Solidification and Chemical Fixation.** This type of remedy is most appropriate for a site containing predominantly inorganic hazardous wastes. It significantly reduces the mobility of inorganic hazardous wastes. This type of remedy may not significantly reduce the toxicity or volume of the inorganic hazardous wastes, but significantly and permanently reduces the mobility, and hence the availability, of the inorganic hazardous wastes to environmental transport and uptake.

4. **Control and Isolation Technologies.** This type of remedial action significantly reduces the mobility of the hazardous wastes, but does not significantly reduce the volume or toxicity of the hazardous wastes. Included in these actions are construction of physical barriers to control migration of leachate, contaminated groundwater and surface runoff, solidification and fixation of organic hazardous wastes, and pumping and treatment of contaminated leachate and groundwater.

A preliminary screening of remedial technology options for the TACO site is presented below. Technology types are classified as inappropriate or appropriate based on documented effectiveness in field and laboratory studies, compatibility with specific site conditions at the TACO site, and general costs. At this point of the technology screening process, no distinction has been made between media compatibility, i.e. a technology may be appropriate for groundwater, but not soils.

4.3 SITE APPROPRIATE TECHNOLOGIES

A. **Source Control (Soils).** Remedial process options amenable to contaminated soil initially considered for Operable Units Nos. 1 and 2 included physical, chemical, and biological processes, as presented in Tables 4-1 and 4-2. Applicability of in-situ technologies must be determined on a site-specific basis using laboratory and pilot-scale testing (USEPA, 1985). The following is a discussion of applicable remedial options for contaminated soil.

1. **Thermal Treatment.** Thermal destruction has been used as a final treatment process for hazardous wastes for several decades (Freeman, et. al., 1987). Thermal technologies use high temperatures to completely oxidize organics to CO_2 and H_2O and other combustion byproducts. Destruction and removal efficiencies in excess of 99 percent are common. Recent innovations in thermal treatment processes include infrared incineration, pyrolysis, molten salt, molten glass, supercritical water and plasma arc reactors. Conventional thermal destruction processes include incinerators (i.e., liquid injection, rotary kiln, cement kiln), boilers and industrial processes.

   The USEPA has promulgated strict regulations for the incineration of hazardous wastes, which specify operating temperatures and performance standards. Exact control parameters for each facility would be determined during the approval process. However, thermal treatment of petroleum contaminated soil is not subject to the same rigorous temperature standards. Although mobile thermal units for treatment of petroleum-contaminated soil are available in New York State, their use is feasible for larger amounts of soil than that which requires treatment for Operable Unit No. 2 (regardless of the options chosen for Operable Unit No. 1).

2. **Soil Washing.** The technique of soil washing involves the application of water or surfactant to remove contaminants from excavated bulk waste media. Soil washing is retained as a viable technology to treat contaminated soils excavated from the General Instrument site. This technique has been shown to be effective for the cleanup of hazardous waste and petroleum spill sites (Traver, et. al., 1989). Most progress with soil washing technologies has been made in Europe. Although significant cost reductions relative to thermal treatment technologies have been documented, soil washing technologies do not achieve the same degree of contaminant removal. Removal efficiencies of 75 to 95 percent (Nunno, 1988) are typical.

   Adsorbed contaminants are removed by feeding the excavated soils into a tank containing a solvent which will dissolve the contaminants from the soil into the solvent phase. The removal mechanism for mass transfer may be dissolution, chelation or physical shearing. Three types of extractive treatments exist for cleaning excavated soils: (1) surfactant-water wash to remove organics; (2) an acid-water or chelate-water wash to remove metals; and (3) an organic solvent to remove hydrophobic organics and PCBs. In addition, hydrogen peroxide, sodium hypochlorite and other agents can be used to chemically change the contaminants. A complete description of all the processes is not practical, but the more promising processes for the General Instrument site include the Biotrol System and other systems which employ extraction with various solvents. The actual type of solvent used is predicated by the nature of the soils and contaminants. Some of the characteristics that influence the design of a soil washing system include pH, particle size, humic content, contaminant concentration, and ionic strength. The sensitive design parameters include surfactant strength and concentration contact time, agitation and temperature.

The ability of the wash media to treat the excavated soils should be demonstrated in a bench or pilot treatability study. The data gathered during this investigation provides initial design information and expected performance criteria and verifies the expected removal efficiency and content of the residuals. If the pilot study results indicate that soil contaminants could not be treated to acceptable levels, soil washing technologies should not be considered further. Instead, other treatment technologies should be evaluated or the feasibility of direct land disposal of the excavated soils in a RCRA facility should be determined.

An important consideration for the cost effectiveness of surfactant-assisted soil washing is the ability of the spent surfactant to be recycled. The ability of various processes to treat the spent wash media would also need to be evaluated in a pilot study, or alternatively, an assessment should be made regarding the costs for pretreatment and transport of the wash media to a POTW.

3. **Soil Vapor Extraction (SVE).** Soil vapor extraction was determined to be a viable and promising in-situ technology to remove organic contaminants from the vadose zone. This technique has been successfully used to remediate several Superfund sites and petroleum spill sites.

Soil vapor extraction consists of inducing a flow of air through the soil by applying a negative pressure at the wellhead. As the air pressure in the soil is lowered, contaminants will volatilize from the dissolved to the gaseous phase and will be entrained in the air stream which then can be treated. SVE can remove a greater mass of residual solvent contamination in a shorter time than groundwater extraction. The kinetic constraints of groundwater extraction from aquifers contaminated with DNAPL has been well documented (Haley, et al., 1989), resulting in indefinite extraction time frames. A study by the USEPA predicted that SVE technologies would require one-tenth of the time that a soil flushing study would take to remove VOCs from contaminated soil (White, et al., 1986). Although SVE is regarded as an innovative technology for the remediation of

VOC-contaminated soil, it uses well-established principles and conventional equipment. Recent EPA reports cite SVE as the remedy selected for 31 Superfund sites (Roy, 1991). However, SVE can not be used to remove hydrocarbons heavier than the mid-diesel range from the soil. Because some SVOC contaminants exist in the soil of both Operable Unit No's. 1 and 2, a pilot test may be required to determine if all the soil contaminants at the Sherburne site are amenable to remediation by SVE.

4. **Thermal Desorption.** Thermal desorption technologies consist of a physical mass transfer process using air, heat and mechanical agitation to desorb contaminants from the soil particles into a gaseous phase. This technology is still in the developmental stage, but preliminary findings indicate that it may not be effective for removal of less volatile contaminants (Esposito, et al., 1989; Offutt, et al., 1988). Thermal desorption did offer significant cost reductions compared to thermal destructive technologies in a pilot study.

5. **Biological.** The biodegradation of hazardous wastes has not been used extensively (Baker, et al., 1988), but the technology is expanding rapidly and may be appropriate at Sherburne. Two strategies have been developed for the treatment of hazardous waste contamination: bioaugmentation, which involves the introduction of specially-selected microbes or genetically-engineered strains to degrade a particular pollutant; and biostimulation, which involves manipulation of the subsurface environment to enhance indigenous microbial activity. Current applications of biotechnology are focused on biostimulation, as bioaugmentation is not well received by the public and is still in the research and development phase.

The ability of microorganisms to degrade petroleum-derived hydrocarbon has been extensively documented and has been successfully applied at petroleum spill sites, making the technology appropriate for Operable Unit No. 2. The majority of technical documentation for these applications has focused on aerobic degradation. Aerobic degradation of petroleum products results in the complete mineralization of the organic compounds to CO_2 and H_2O. However, the priority pollutants in Operable Unit No. 1 include halogenated aliphatic hydrocarbons, which are more difficult for aerobic microbes to degrade completely.

Anaerobic degradation of chlorinated aliphatics has been observed in laboratory studies by methanogenic organisms (Wilson, et al., 1986). Anaerobic degradation does not result in the complete mineralization of substrate to CO_2 and H_2O, and in some cases may result in the creation of compounds similar to and/or more toxic than the parent compound (Valentine and Schnoor, 1986). For example, Vogel and McCarty (1985) reported that both TCE and DCE were dehalogenated in a methanogenic environment to vinyl chloride (VC) and CO_2. The toxicity and carcinogenicity of VC is much greater than either parent compound.

Anaerobic degradation requires careful monitoring and maintenance of subsurface conditions, such as the exclusion of oxygen, which is toxic to obligate anaerobes even at the low dissolved oxygen levels, and an adequate supply of nutrients such as P and N. Conditions for methanogenesis require a redox level less than -300 mV, a condition which could be difficult to maintain at the Sherburne site. Even under ideal conditions, anaerobic biotransformations of halogenated aliphatics are relatively slow, and may not degrade the contaminants within an acceptable time period.

In summary, aerobic biodegradation was not eliminated for Operable Unit No. 2. However, due to uncertainty about the ability to degrade the halogenated aliphatic hydrocarbons under field conditions (TCA, TCE, DCE and VC) it has been rejected for Operable Unit No. 1. Although anaerobic processes have been proven effective at laboratory studies to degrade these contaminants, anaerobic degradation is considered to be an unproven technology for full-scale site remediation.

6. **Thermal Treatment (Asphalt Process).** One last remedial process option for treatment of excavated soils is thermal treatment and incorporation into an asphalt emulsion. The resultant mixture is then suitable for paving. This process is available in neighboring states and is an option for Operable Unit No. 2. The process does have an upper limit on total petroleum hydrocarbon and inorganic contamination levels which it can utilize, and is more suitable for sandy soils with limited amounts of fines and moisture. Information from the various process vendors would be required to verify the soil contamination and type is within the upper limit of concentrations for which the process is permitted. Despite some uncertainties for use at the site, this process has been retained as an option for Operable Unit No. 2 only.

7. **Containment.** Capping involves covering the affected area to prevent rainfall infiltration through contaminated soils and to reduce VOC emissions from contaminated soils. Caps are made from geosynthetics, clay, concrete or asphalt. For the General Instrument site, asphalt and concrete are considered to preserve the use of the area for automobile and truck traffic. The advantages of capping are cost and effectiveness at reducing infiltration. Additional benefits include reduction in volatile emissions from the soil. Currently, much of the General Instrument site

is paved. Additional unpaved areas could be covered, thereby providing additional protection. Some form of capping may also be advantageous as part of a soil vapor extraction system to prevent short circuiting.

8. **Disposal.** There are two methods for disposal of excavated soil from the Sherburne site. Soils treated on site can be utilized as fill for the excavated areas if the treatment has resulted in the soil meeting required cleanup goals. Disposal of untreated or treated soil can also be done at a properly operated and regulated facility, provided the untreated soil meets all RCRA treatment standards. However, disposal off site also requires transportation of the soil which may be subject to additional permit requirements.

9. **No Action.** The requirements of the National Contingency Plan (NCP) are such that a full range of source control alternatives must be evaluated. Thus, the no action alternative is the basis for which all other remedial alternatives are compared.

B. **Groundwater Control.** The following is a discussion of appropriate groundwater remedial options for the TACO site. A presentation of these options and how they relate to remediation of Operable Unit No. 3 is given in Table 4-3.

1. **Downgradient Wells.** Downgradient wells, or "interceptor wells", are used primarily to contain the lateral extent of a plume. They can be effective when the exact dimensions and migration patterns of a plume are understood. Interceptor wells are commonly used to protect a sensitive downgradient receptor, such as drinking water supply or other point of contact. Although downgradient receptors are not a present concern at the Sherburne site, a downgradient well could be used to intercept the plume as part of a pump and treat groundwater system.

2. **Recovery Wells.** Recovery wells are designed to withdraw free-phase product from an aquifer. They are usually effective as a remediation and containment process in medium to low permeability conditions, and less effective in high permeability aquifers.

A recovery well used for recovery of floating product usually operates with two pumps in one well. The lower pump creates a cone of depression around the well, which causes floating product to flow towards the well. A second "skimmer" pump floats at the water/product interface, removing product as it enters the well. Recovery wells are less effective on sinking product because of a lack of a mechanism to move free-phase product towards the well. Because of the free product layer found in MW-8 and MW-18, free product recovery will be an integral component of any remedial alternatives chosen for Operable Unit No. 3.

3. **Extraction/Injection Wells.** Extraction/injection wells enhance the movement of contaminant towards a recovery point by creating a low pressure area near the extraction well and a high pressure area near the injection well. The system is effective and efficient because it provides a point of disposal of treated water by re-injecting previously contaminated groundwater. Therefore, this system is a possible component of a pump and treat system for remediation of the groundwater at the Sherburne site.

4. **Surface Water or Groundwater Discharge.** Surface water discharge refers to removal of water from an aquifer, treatment, and subsequent release to an on-site surface water stream. This method is employed when the levels of contaminant are low, and discharge to groundwater is not desired. It is cost effective if an appropriate surface water body is nearby, but appropriate regulatory approval is required. Groundwater discharge refers to discharging the treated groundwater back to the aquifer. Again, appropriate regulatory approval is required.

5. **Discharge to POTW.** Discharge to POTW requires that the local POTW treatment plant could handle the load. A maximum allowable concentration will be determined for instantaneous, daily, monthly and annual loading. If the Sherburne POTW can properly handle treated water, it will be considered as an option for discharge of water.

6. **Biological.** See Item No. 5 of Section 4.3A. Although above-ground bioreactors are being used for treatment of a wide variety of organics in extracted groundwater, systems to date have been designed for/limited to low flow rates (i.e., less than 30 gpm).

7. **Stripping.** Air stripping is a conventional method of treating groundwater that is contaminated with volatile organic compounds. By providing contact between contaminated water and air, the contaminants diffuse from water to the air and are removed in the air stream. Most common is use of a "packed tower" stripper. Water is forced through the tower where it forms a film on the packing media, greatly increasing the surface area of water exposed to air. At the same time, a countercurrent stream of fresh air is pumped over the objects; the volatile compounds then move from the water into the air. The air is discharged to the atmosphere at the top of the tower, and the water is collected. Other types of air stripping systems include spray aeration, tray aeration, and diffused aeration systems. The packed tower system has been shown to achieve 90 to 98%

removals of volatile contaminants from groundwater, and may be effective for remediation of Operable Unit No. 3.

8. **Carbon Adsorption.** Carbon adsorption employs the process found in many fish aquariums. Contaminants are generally electrochemically charged and will be attracted to the surface of activated carbon. The carbon then becomes a "concentrator", removing the compounds from the water to the carbon. Contaminated carbon is then treated and disposed of property.

9. **UV/Oxidation.** Destruction of organic contaminants in the groundwater extracted from the General Instrument site by ultraviolet/oxidation was considered as a viable chemical treatment option. UV/oxidation uses ultraviolet radiation and ozone or hydrogen peroxide to oxidize dissolved organic compounds. The use of this innovative technology is currently being promoted by the USEPA's SITE program, and it has recently been implemented for full-scale remediation of hazardous waste sites. Field demonstrations have reported TCE removal efficiencies greater than 99% (Lewis, et al., 1989). Removal efficiencies of other VOCs were approximately 90%. Recent applications of UV/oxidation have been made to remediate semi-volatile and PCB-laden waters and soils, but detailed results of these studies were not available (Roy, 1990). The effectiveness of UV/oxidation for organic removals from soils or sediments could be reduced by the presence of humics, although the relatively low humic levels in groundwater should not significantly diminish UV/oxidation performance for this application. Because of the recent commercial development of this method, only limited sizes of reactors are available. This treatment system flow rates appear to be limited to less than 30 gpm.

10. **Permeable Reaction Wall.** Developed at the Waterloo Centre for Groundwater Research, permeable reaction walls are achieving consistent degradation rates for halogenated organics (USEPA, 1993). This form of in-situ treatment consists of a subsurface "wall" of porous material containing iron filings. The elemental iron serves to promote reductive dehalogenation of chlorinated compounds, such as TCE and PCE, as the groundwater flows through the "wall."

The permeable reaction wall was tested in situ at the Canadian Bases Borden site to confirm the effectiveness. A 2m wide by 1m thick wall was constructed of 78% by weight coarse sand and 22% by weight iron filings to treat a plume of dissolved TCE and PCE (250,000 µg/l and 43,000 µg/l, respectively). Three hundred forty-eight sampling points (upgradient , downgradient, and in the wall) were used to evaluate the progress of the degradation. Results indicate 95% removal of TCE and 91% removal of PCE (USEPA, 1993) Mass balance calculations confirm the increase in downgradient chlorides comparable to the amounts of TCE and PCE which have been degraded. Because of the potential benefits of this system over pump and treat methods, combined with the pilot scale results achieved at the Borden site, this method has been retained for further evaluation.

11. **Air Sparging.** Air sparging, or in-situ air stripping, consists of air injection into the saturated zone concurrently with operation of a soil vapor extraction system. The air bubbles strip volatile compounds out of the groundwater into the soil gas, where they are removed using the extraction well system. Recent studies have suggested that air sparging has potential to remove more volatile contaminants in a shorter time frame than conventional pump and treat remedial alternatives (Looney, et al., 1991). However, because of the shallow depth to groundwater at the Sherburne site, the sparging system could result in significant mounding of the water table. If this occurred on site, the free product could be spread further. At this time, air sparging has been retained as a viable option. Pilot testing would be required to verify significant mounding would not occur which may adversely affect the vapor extraction portion of the system.

12. **Institutional Controls.** At the present time, impacted groundwater is not used for potable purposes and there is no immediate or projected need to utilize the groundwater. There are no sensitive receptors potentially impacted by the plume of contamination even if that contamination is allowed to naturally attenuate and degrade over time. A simplistic model of the plume predicted natural attenuation due to dispersion effects and biodegradation would result in no adverse impact upon the Chenango River. For some interim period, some form of institutional control may be an effective means of ensuring that there are no potential exposures while other remedial methods, including natural attenuation and source removal, have acted to restore contaminated groundwater to health-based standards. With respect to groundwater on the former TACO property and within the control of General Instrument Corporation, institutional controls can be provided (by way of signage and other public notice) to deal with the plume until the on-site soil and groundwater treatment is completed. In addition, the removal of the free phase petroleum product and soil contamination, combined with active treatment of the most concentrated portion of the dissolved plume, will have a direct impact on groundwater concentrations under the adjacent property.

With respect to the off-site portion of the contamination in the field west of the site (see Figure 2-2), appropriate signage and notice to potential users, including the site owner, would be appropriate. Signage and notice would be undertaken in conjunction with a monitoring program which would serve two purposes: (1) monitor dissolved concentrations in the West Field to allow determination of where and when Class GA standards for organic compounds of concern have been reached; and

(2) verify that the plume does not reach the Chenango River. Cooperation of the owner of the portion of the West Field currently and potentially impacted can be attained by a variety of formal and informal means to effectively ensure that there is not attempted use of the groundwater for a purpose inimicable with the contaminant concentration levels.

13. **No Action.** Limited or no action response may be considered in three scenarios: (1) when natural attenuation will result in contaminant levels reaching cleanup levels in a reasonable time frame; (2) when it is impracticable to attain cleanup levels due to the nature of the site and the contaminants, and protectiveness can only be achieved by providing an alternate water supply or wellhead treatment; or (3) when no exposures to the contaminants exist. A natural attenuation response action generally includes monitoring to track the direction and rate of movement of the plume. Achieving cleanup levels may be impracticable in the following situations:

a. Widespread plumes from non-point sources, e.g., industrial areas.

b. The nature of the contaminant makes cleanup impracticable, e.g., the presence of a dense, non-aqueous phase liquid that sinks to the bottom of the aquifer, forming discontinuous pools of highly concentrated contamination.

c. Physical-chemical interactions that limit the effectiveness of contaminant removal, e.g., contaminants that sorb to the saturated soil and dissolve slowly into the groundwater at levels above health-based standards.

A waiver of the ARAR on the basis of technical impracticability may be appropriate.

4.4 INAPPROPRIATE TECHNOLOGIES OR PROCESS OPTIONS

Tables 4-1, 4-2 and 4-3 present the technologies and options which were initially considered for the General Instrument site. Several options, and hence technologies, were eliminated from further consideration, as provided in the following discussion.

A. Source Control (Soils).

1. **KPEG Dechlorination.** KPEG dechlorination was selected as a possible option to detoxify excavated soils at the TACO site. The KPEG process involves the application of

KOH-polyethylene glycol reagent to contaminated soils at approximately 300°F. The reaction is allowed to proceed for approximately five hours, then the reagent is decanted and recycled and the soil is neutralized and rinsed. This process has been shown to achieve an average of 83 percent removal efficiency for PCB-contaminated soils (Offutt, et al., 1990).

Laboratory treatment studies have resulted in 98 percent destruction of halogenated aliphatic compounds (Offutt, et al., 1990). KPEG treatment also resulted in high removal efficiencies for soil contaminated with non-halogenated volatiles and semi-volatile PNAs (99 percent and 91 percent, respectively). However, these removals have been attributed to volatilization and not destruction. Several factors limit the use of KPEG dechlorination to all soils. Some halogenated aliphatics react with the reagents to form explosive compounds, especially in the presence of heavy metals. In addition, high concentrations of aluminum in soils can inhibit the dechlorination reaction. Although the General Instrument soils were not found to be significantly contaminated above background levels with metals, the soils in the vicinity of the plating building were found to contain 10,900 to 22,600 mg/kg aluminum. Thus, the dechlorination process has been rejected due to the effectiveness criteria.

2. **Radio Frequency Heating.** In-situ volatilization of VOCs in the soil by radio frequency heating is an innovative technology being developed for treatment of soil. RF heating is used to heat the soil rapidly to 150-400°C, thereby volatilizing organic contaminants. Although primarily in the developmental stage, laboratory tests have confirmed removals between 90 and 99 percent in a variety of soil matrices.

The RF process consists of applying electromagnetic energy to an array of electrodes installed in the soil. The soil is heated by the same principle as a microwave oven, thus the method is not sensitive to the soils' thermal conductivity. The fully operational RF system consists of four subsystems: (1) the electrode array; (2) RF power generation; (3) vapor barrier and containment; and (4) gas condensate treatment.

Although one field test has been completed which resulted in greater than 90 percent removal of contaminants at depths up to 12 feet (Dev et al., 1988), this remedial technology has been rejected for the Sherburne site because of expected high power requirements due to the climate in Sherburne. Presumably, snow, snowmelt, and stormwater infiltration would have an impact on this type of enhanced volatilization.

meet land disposal restrictions. The availability of mobile units which could be sent to the Sherburne area was also a question. Finally, short-term effects could include uncontrolled volatile organic emissions from the site due to the excavation and sizing/classification operations. Thus, all excavation and treatment options were rejected due to costs, short-term effectiveness, and implementability.

Both excavation of "hot spots," followed by capping, and soil vapor extraction have moderate present-worth costs associated with them. Excavation and off-site treatment of hot spots, followed by filling the excavated areas and placement of an asphalt cap, would have more apparent short-term effects with respect to additional contaminants being added to the groundwater, but actual results will not be noticeable in the short-term, as groundwater concentration differences will not be apparent initially following installation of a cap. Additional short-term effects of "hot spot" excavation could be volatilization of organics into the air during excavation operations. In addition, there is no guarantee that all "hot spot" areas have been located. Any contaminants remaining under the cap could travel by vapor migration, and therefore, act as a residual source of groundwater contamination. Soil vapor extraction, on the other hand, has the potential to remove volatile organic contaminants from the soil in a controlled manner which would not pose inhalation exposure risks to site workers or nearby residents during the action. Because the system could also be operated as a bioventing system, the same equipment can later be used to reduce levels of semi-volatile organics and possibly some residual volatiles. Although the time frame to achieve cleanup goals may be longer than excavation and treatment options, the lower present-worth cost results in a recommendation of implementation of a soil vapor extraction system for treatment of soils in Operable Unit No. 1.

B. **Operable Unit No. 2.** Similar to Operable Unit No. 1, four alternatives were evaluated for treatment of the petroleum product contaminated soil located north of the wooden shed near the property boundary between the TACO site and the adjacent bulk petroleum plant. Present-worth costs for all options are relatively low, ranging from no costs associated with the no action alternative to $65,000 for the capping alternative. At the present time, the area of stained soil which was originally identified as Operable Unit No. 2 is not apparent. The area supports a healthy weed growth, and surficially stained material is not evidenced. For that reason, no action appears to be the logical alternative for dealing with the soil adjacent to the wooden shed. Because groundwater treatment alternatives will be accompanied by sampling and analysis of groundwater downgradient from Operable Unit No. 2, the sampling would indicate whether or not contaminants were continuing to leach from Operable Unit No. 2. Because of the healthy weed growth, there is the potential that natural biodegradation has occurred with resulting self-remediation.

C. **Operable Unit No. 3.** Operable Unit No. 3 was identified as consisting of the contaminated groundwater beneath the site and the plume of low level contaminated groundwater which extends to the west under the adjacent undeveloped property and agricultural property. This operable unit also consists of the free phase petroleum product near MW-8 and MW-18. Four major categories of remedial alternatives have been evaluated for actions with respect to this contaminated groundwater. The actual recommended alternative is combination of all alternatives but the no action one.

The no action with monitoring has been rejected on the basis of all evaluating criteria but cost and implementability. The groundwater does not meet applicable standards, and there are unacceptable health risks associated with consumption of the groundwater under the site. Although there is some evidence that natural biodegradation is taking place in the shallow aquifer (lack of volatile aromatics in MW-17), the range of concentrations of organics in the groundwater under the site, combined with the presence of the free phase petroleum product, indicate a need for active groundwater treatment on sit.e Because of the need for a free phase recovery system, the alternative selection process has focused on pump and treat methods on site so that the resultant cone of influence at the recovery well would result in efficient free product recovery as well.

Once free product recovery is determined complete, operation of the pump and treat system should be discontinued, with the only treatment being operation of a permeable reaction wall system. The permeable reaction wall has significant cost savings when compared to the other form of in-situ treatment (i.e., the air sparging trench.) The reaction wall system also has the potential to be constructed completely underground. Because there is no piping or power required for its operation, maintenance should not be as intrusive to the farmer's property. Although treatment will not impact the entire dissolved plume of contaminants, the clean water which should exit the treatment wall should aid in dispersion, dissolution, and degradation of the remaining low level organics which do not receive treatment.

Before implementing the funnel and gate reaction wall, pilot testing must be undertaken to verify the efficacy and reaction rates for the site. Should pilot testing result in unacceptable reaction rates (too slow), remediation should focus on on-site pump and treatment of groundwater in conjunction with institutional controls in the form of agreements with the owner of the West Field to prevent consumption of the groundwater until the actions taken on site to remediate the source and local groundwater result in long term effects on contaminant concentrations in the West Field.

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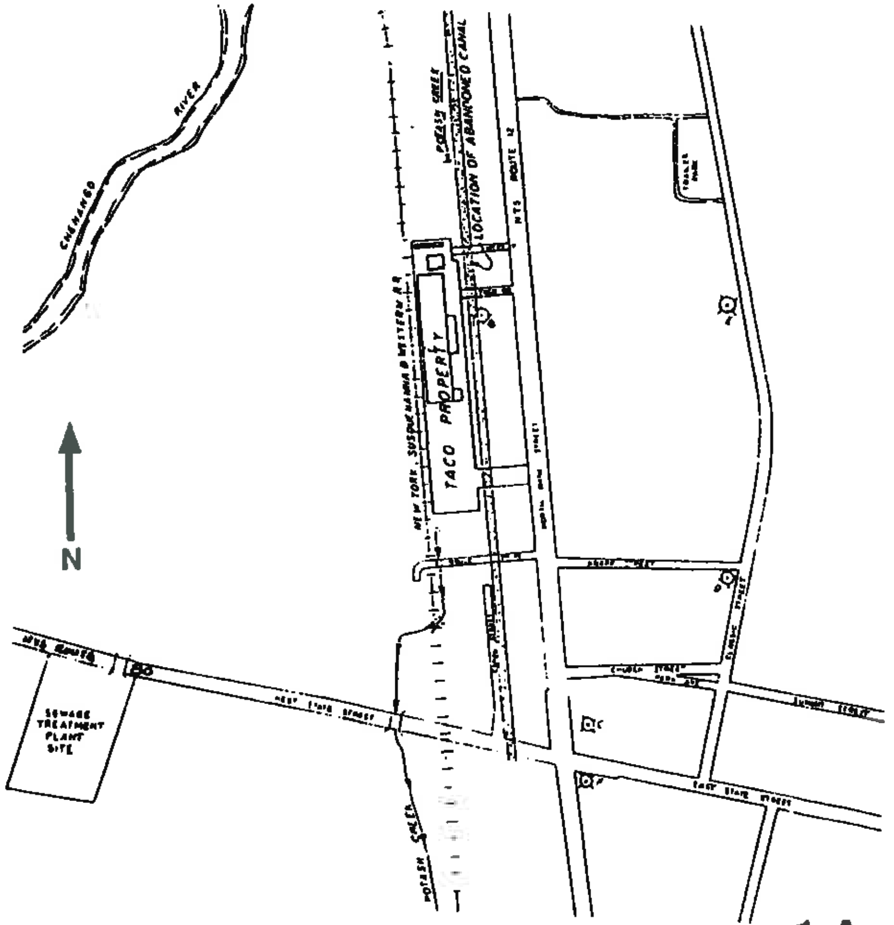
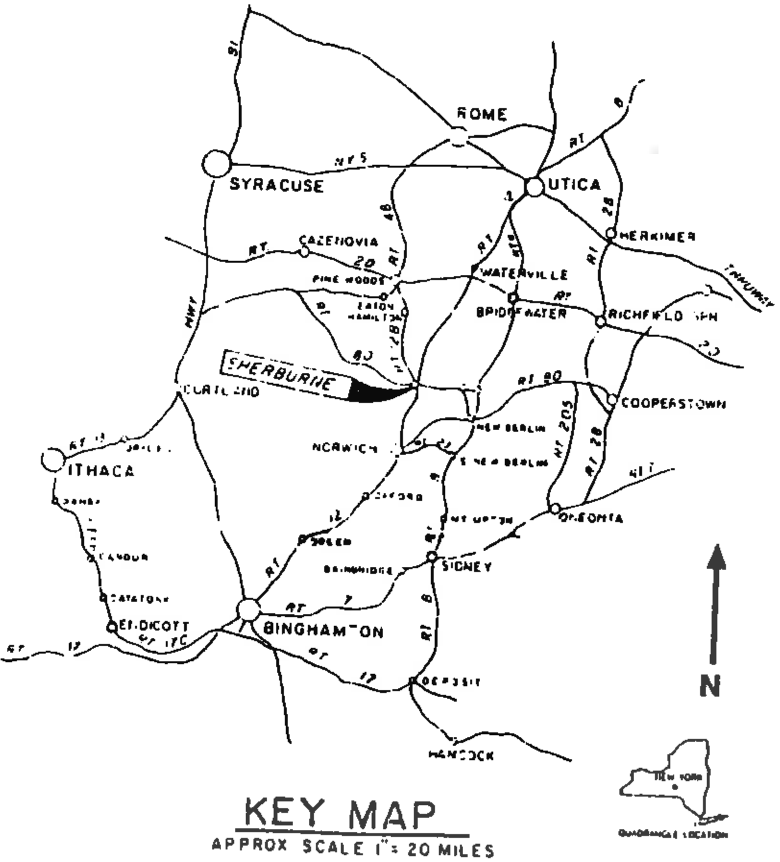


1 A

LOCATION MAP

APPROX. SCALE 1" = 500'

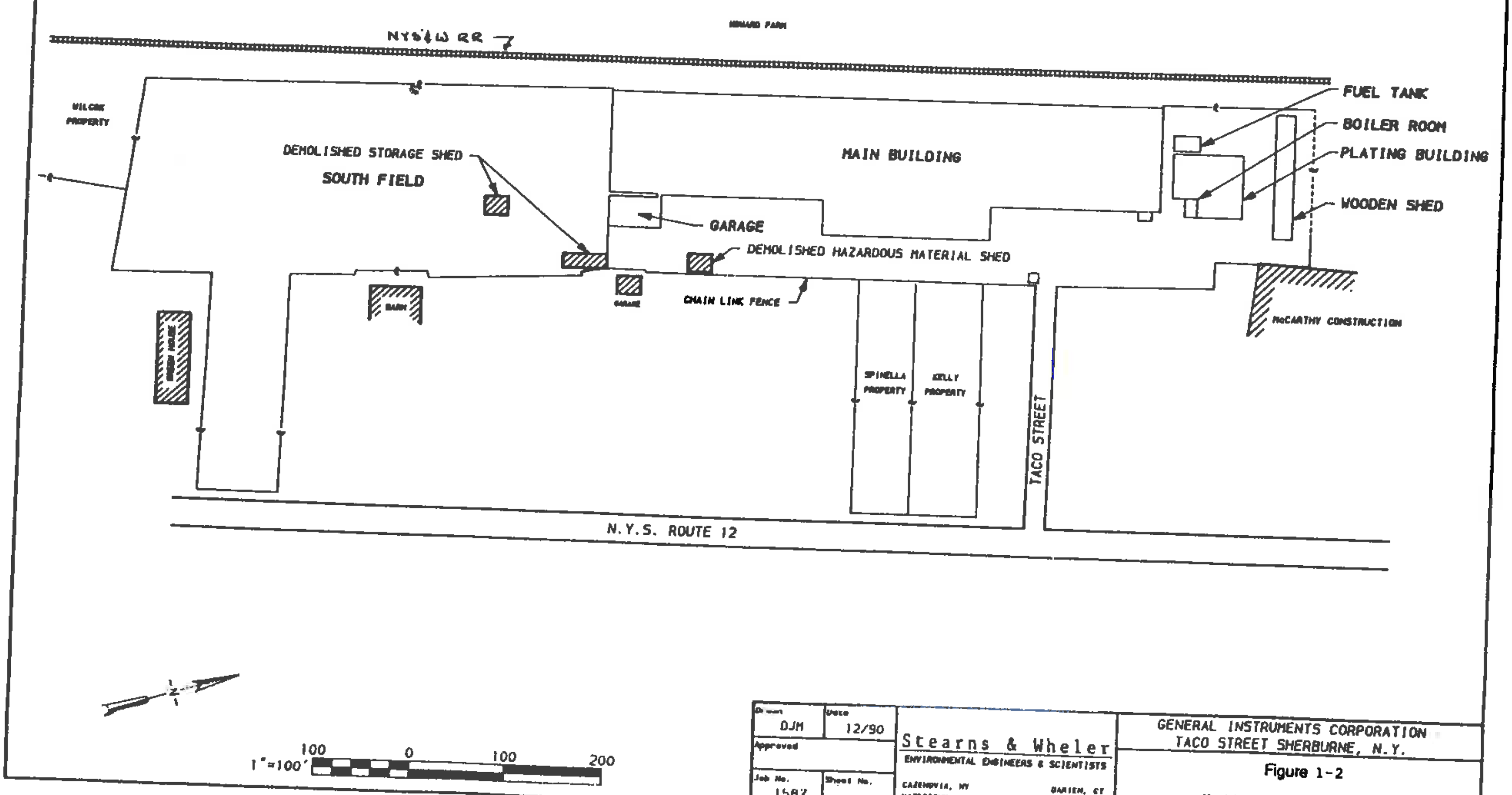


KEY MAP

APPROX SCALE 1" = 20 MILES

1 B

Drawn DJM	Date	Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS CAZENOVIA, NY DARIEN, CT WATERTOWN, NY TAMPA, FL	GENERAL INSTRUMENTS CORPORATION TACO STREET SHERBURNE, N.Y.
Approved			
Job No. 1587	Sheet No.		Figure 1-1 1A - Site Location Map 1B - Key Map



Drawn	Date
DJM	12/90
Approved	
Job No. 1587	Sheet No.

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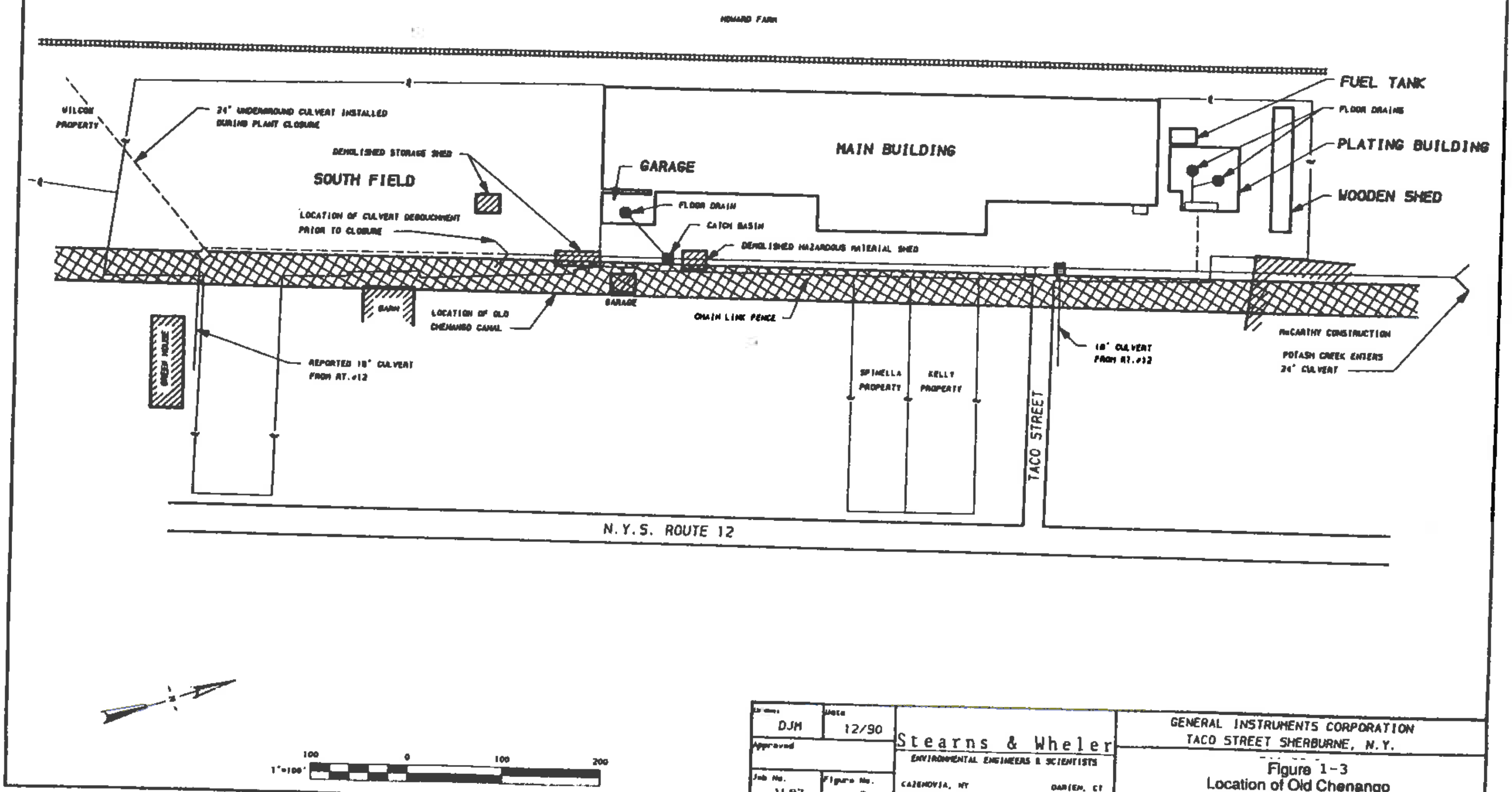
ENVIRONMENTAL ENGINEERS & SCIENTISTS
CAZENOVIA, NY
WATERTOWN, NY
DARIEN, CT
TAMPA, FL

GENERAL INSTRUMENTS CORPORATION
TACO STREET SHERBURNE, N.Y.

Figure 1-2

Buildings at the TACO Site



Drawn	Date
DJM	12/90
Approved	
Job No. 1587	Figure No. 3

Stearns & Wheler
ENVIRONMENTAL ENGINEERS & SCIENTISTS
CAZENOVIA, NY
WATERTOWN, NY
DARIEN, CT
TAMPA, FL

GENERAL INSTRUMENTS CORPORATION
TACO STREET SHERBURNE, N.Y.

Figure 1-3
Location of Old Chenango Canal and Potash Creek

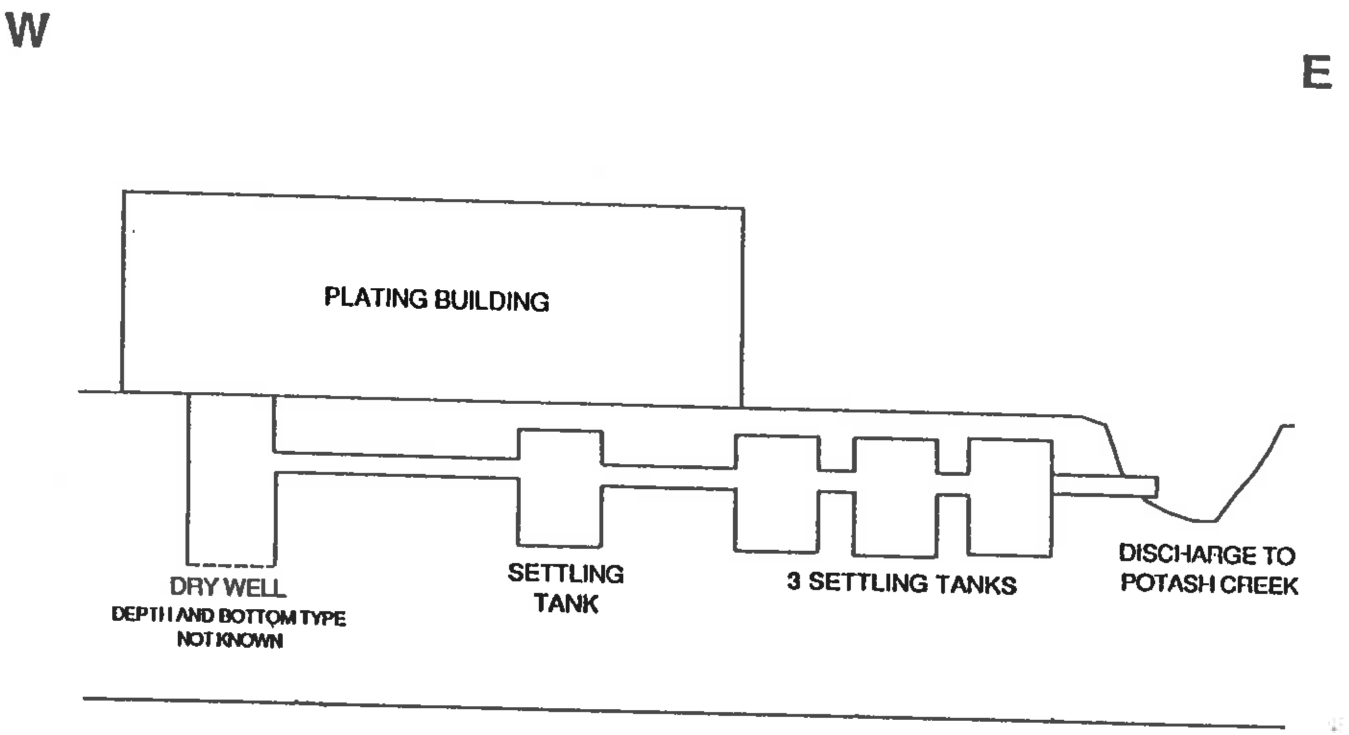


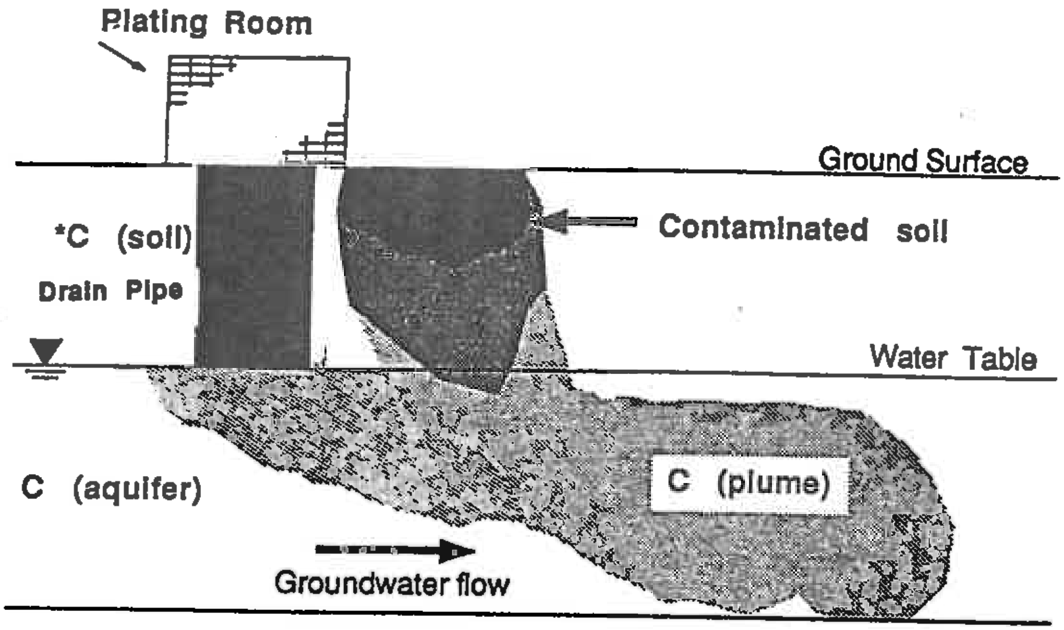
FIGURE 1-4
Schematic Cross-Section
Through Plating Room

General Instrument Corporation
Sherburne, NY

Stearns & Wheler
ENVIRONMENTAL ENGINEERS & SCIENTISTS

PROJECT NO. 1587

CONCEPTUAL MODEL



C (soil) >> C (aquifer)

Natural condition of the aquifer:
C (aquifer) = 0 µg/l

After Rainfall and Infiltration event:
C (plume) = C (aquifer) + [C (soil) X K]

where, K is a function of migration

With no rainfall:
C (plume) $\xrightarrow{\text{approaches}}$ C (aquifer)

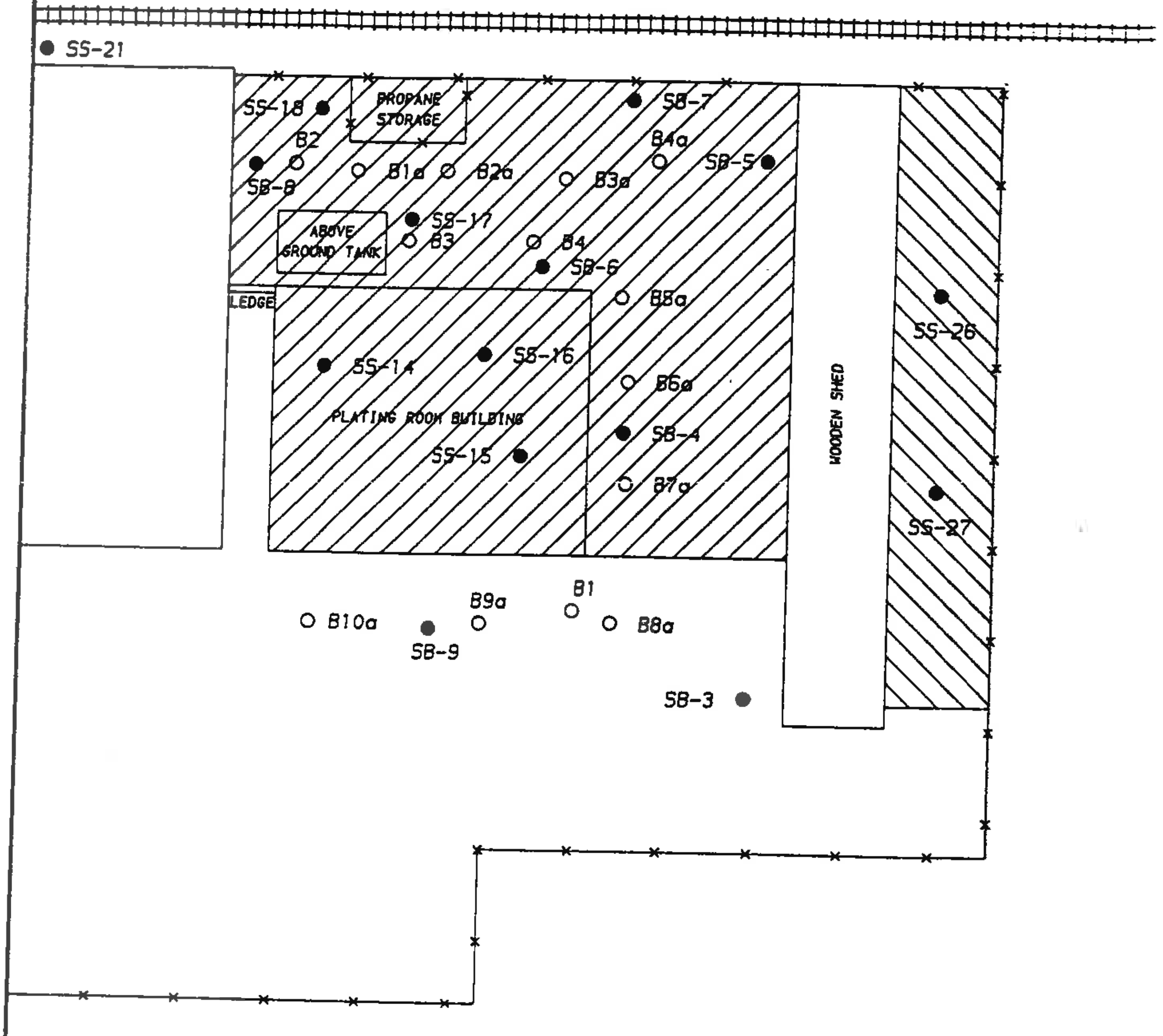
*C = Concentration of Contaminant

FIGURE 1-5
Conceptual Model
of Plating Room Contamination

Feasibility Study
General Instrument Corporation
Sherburne, NY

Stearns & Wheler
ENVIRONMENTAL ENGINEERS & SCIENTISTS

PROJECT NO. 1587



● ROUND 1 SOIL SAMPLE LOCATION

○ ROUND 2 SOIL SAMPLE LOCATION

▨ OPERABLE UNIT 1

▨ OPERABLE UNIT 2

1" ≈ 30'-0" 30 0 30 60

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FIGURE 2-1
LOCATION OF SOIL SAMPLES AND OPERABLE UNITS 1 AND 2

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ENVIRONMENTAL ENGINEERS & SCIENTISTS

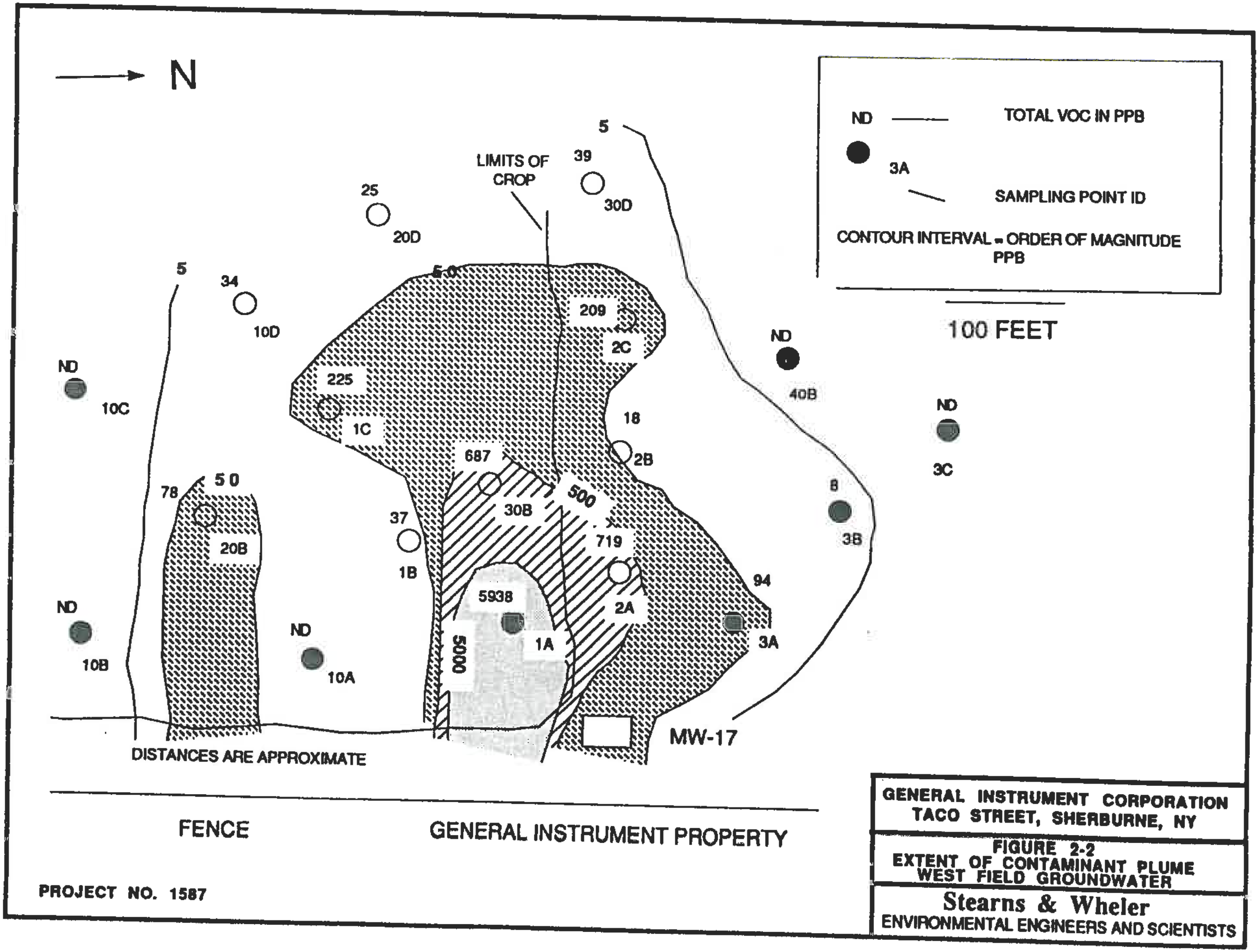

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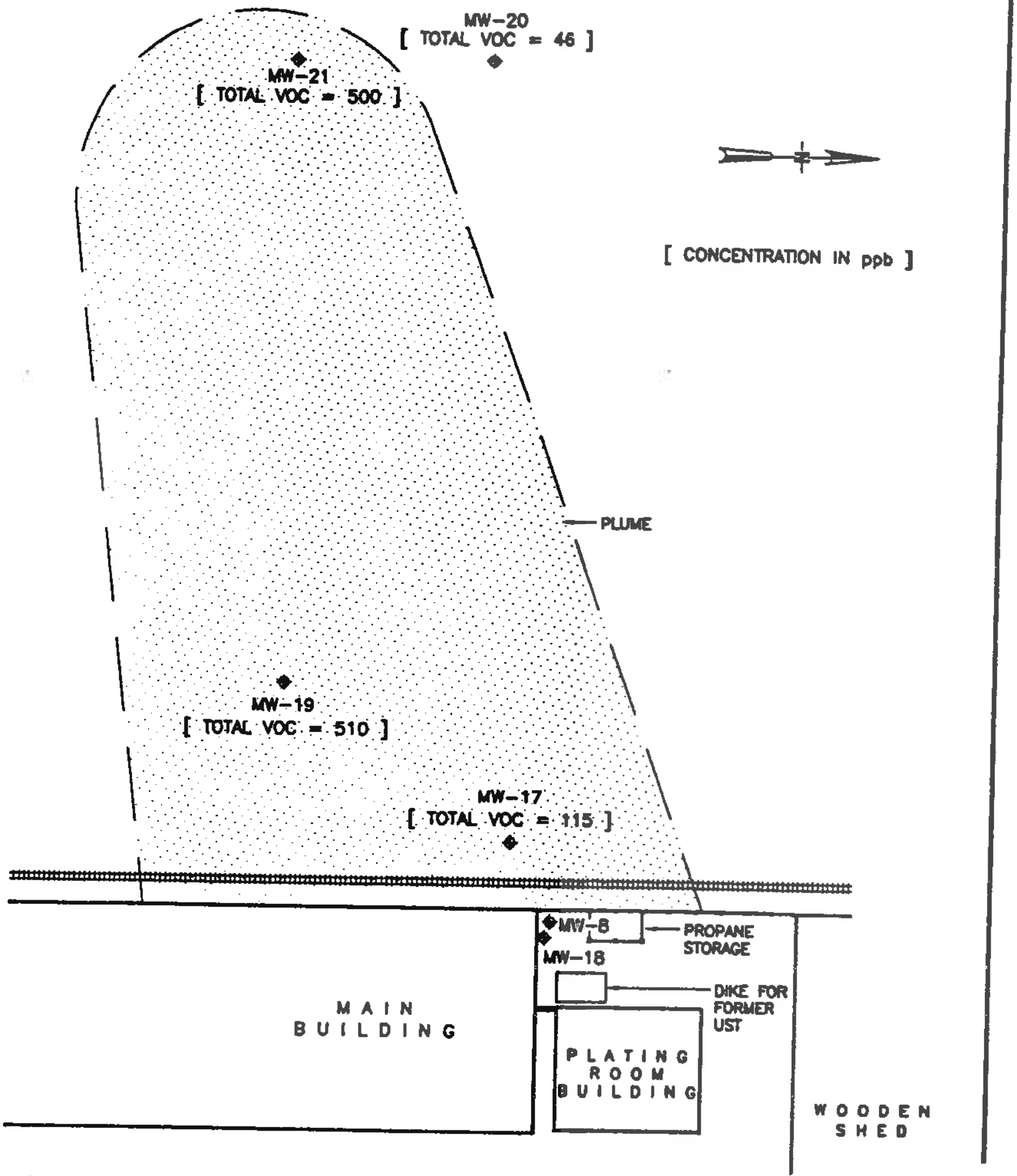
FIGURE 2-2
EXTENT OF CONTAMINANT PLUME
WEST FIELD GROUNDWATER

Stearns & Wheler
ENVIRONMENTAL ENGINEERS AND SCIENTISTS



NOTE: DRAWING NOT TO SCALE

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ENVIRONMENTAL ENGINEERS & SCIENTISTS

DATE: 7/94 JOB No.: 1587

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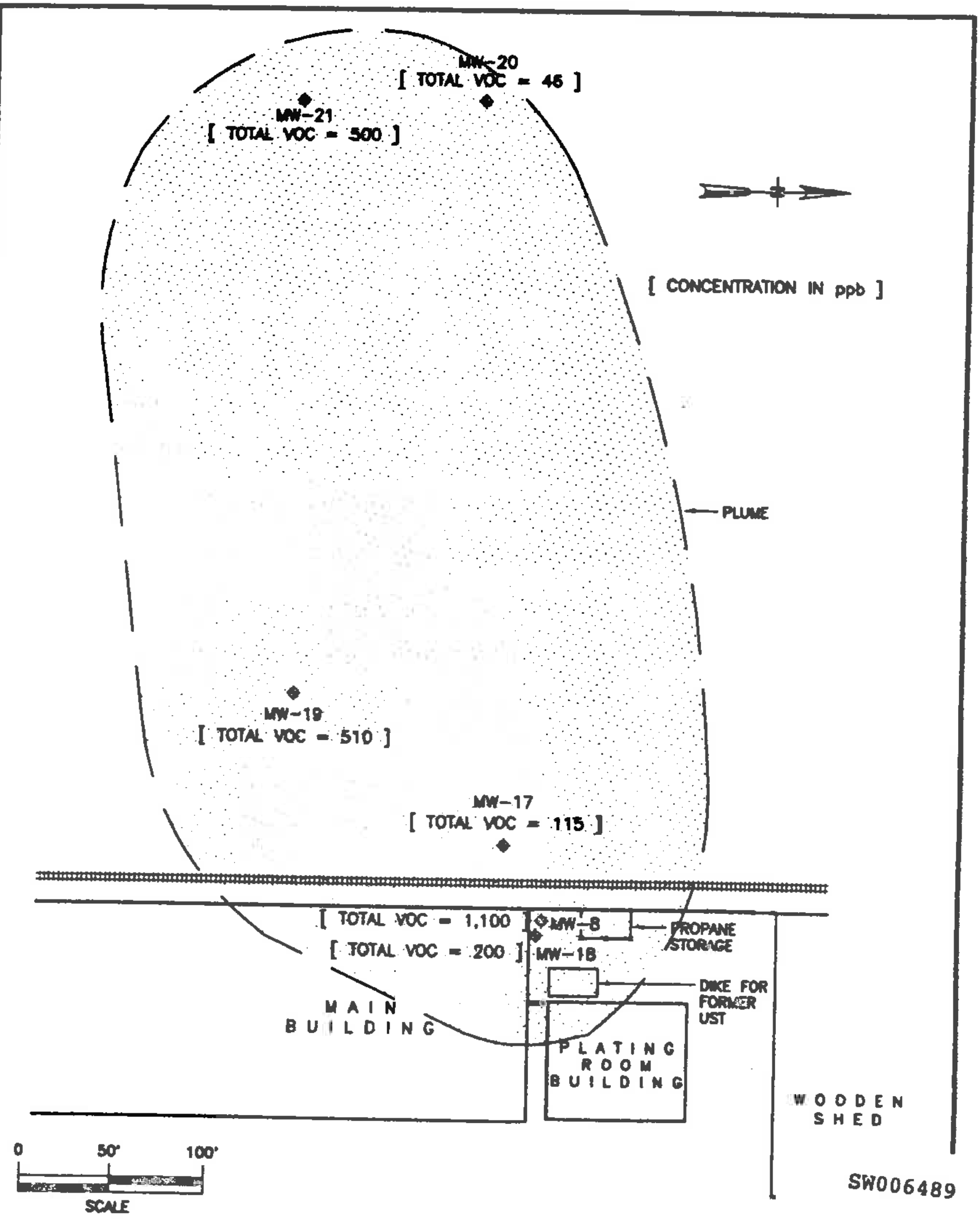
SHERBURNE, NEW YORK
FEASIBILITY STUDY

FIGURE 2-3
GROUNDWATER CONTAMINANT
CONCENTRATIONS IN WEST FIELD (1993)



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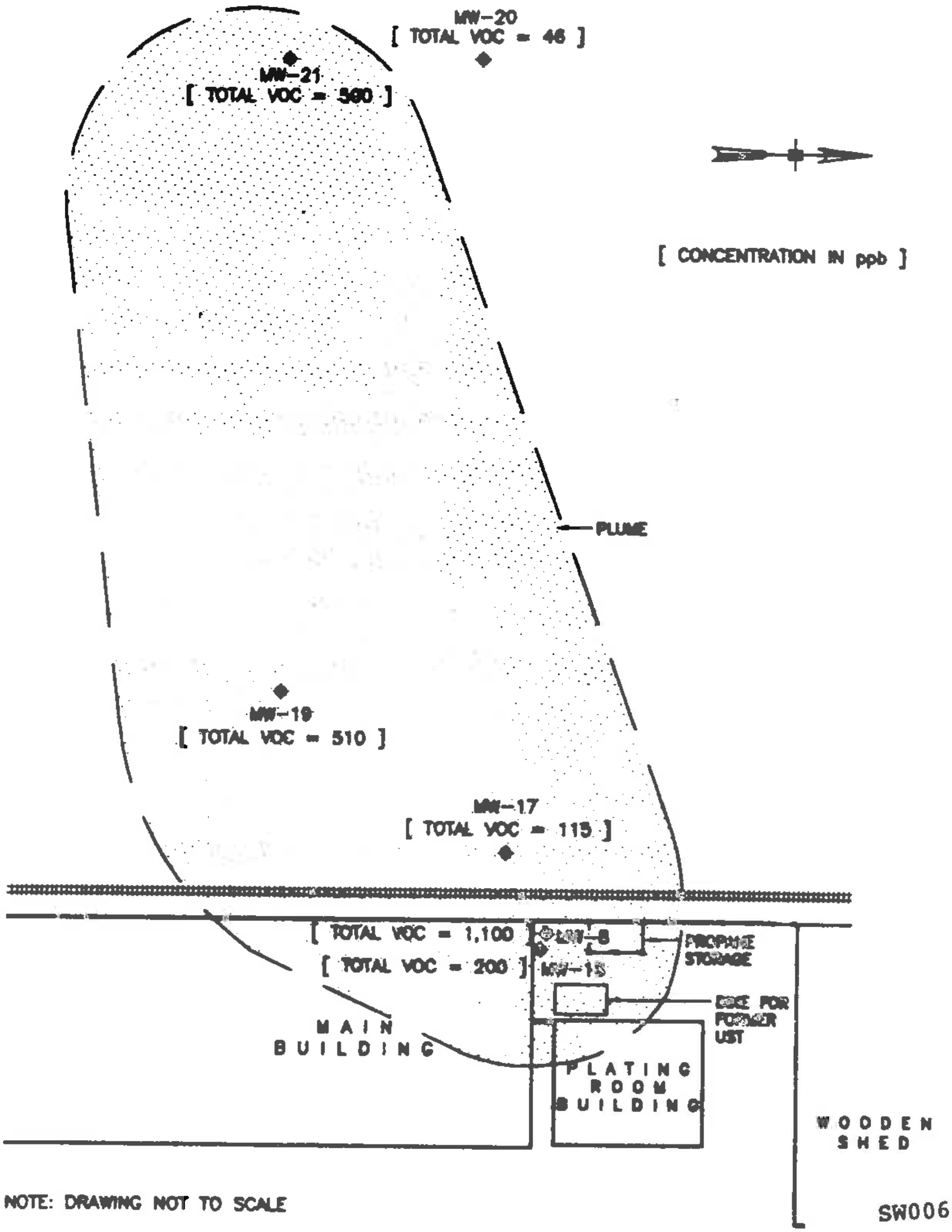
FEASIBILITY STUDY

FIGURE 2-4
LATERAL DISTRIBUTION OF
CHLORINATED VOC PLUME (1993)



NOTE: DRAWING NOT TO SCALE

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SHERBURNE, NEW YORK
FEASIBILITY STUDY

FIGURE 2-4
LATERAL DISTRIBUTION OF
CHLORINATED VOC PLUME (1993)

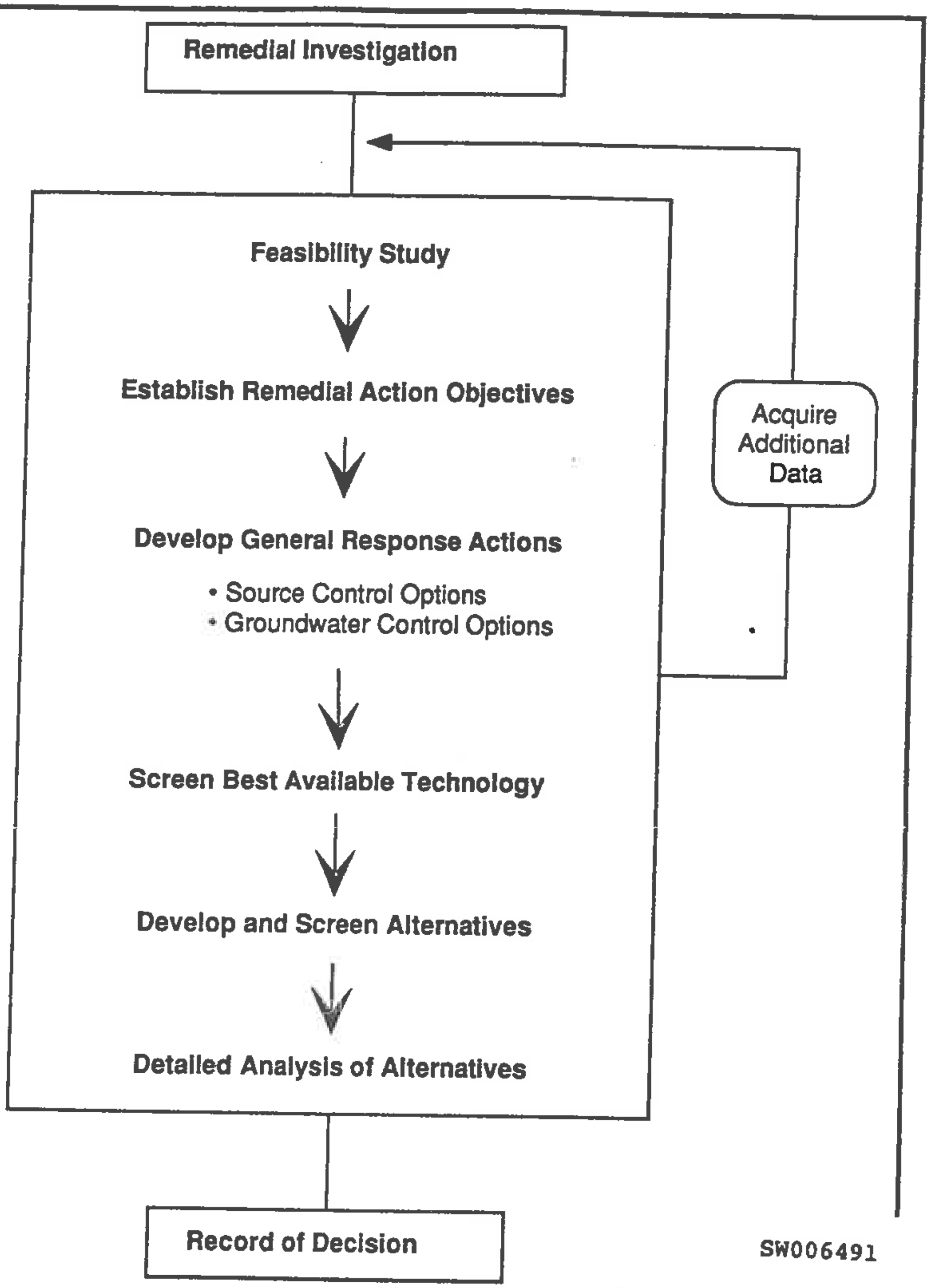
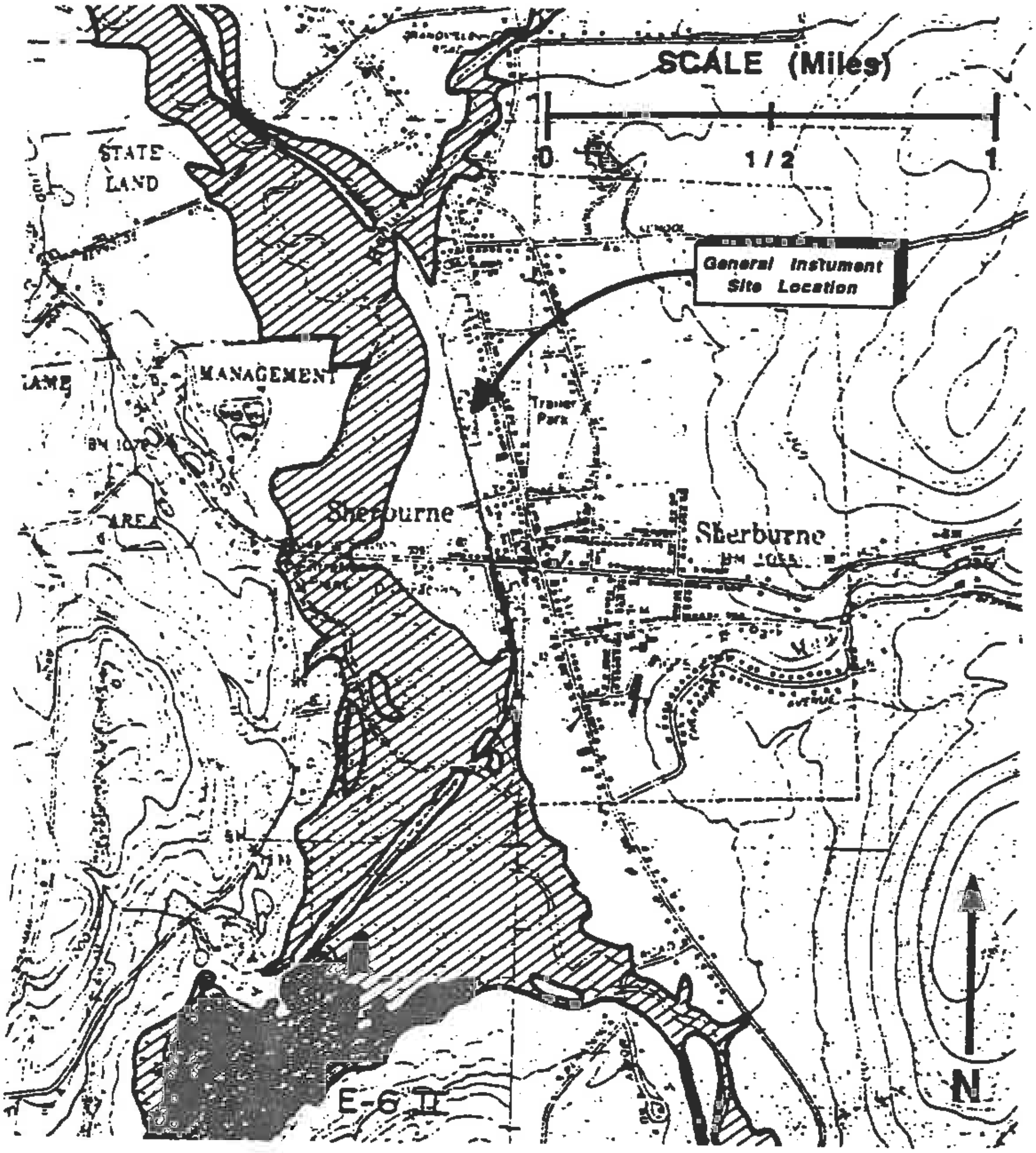


FIGURE 3-1
Decision Flow Path for Feasibility Study

Feasibility Study
General Instrument Corporation
Sherburne, NY

Stearns & Wheler
ENVIRONMENTAL ENGINEERS & SCIENTISTS

PROJECT NO. 1587



LEGEND

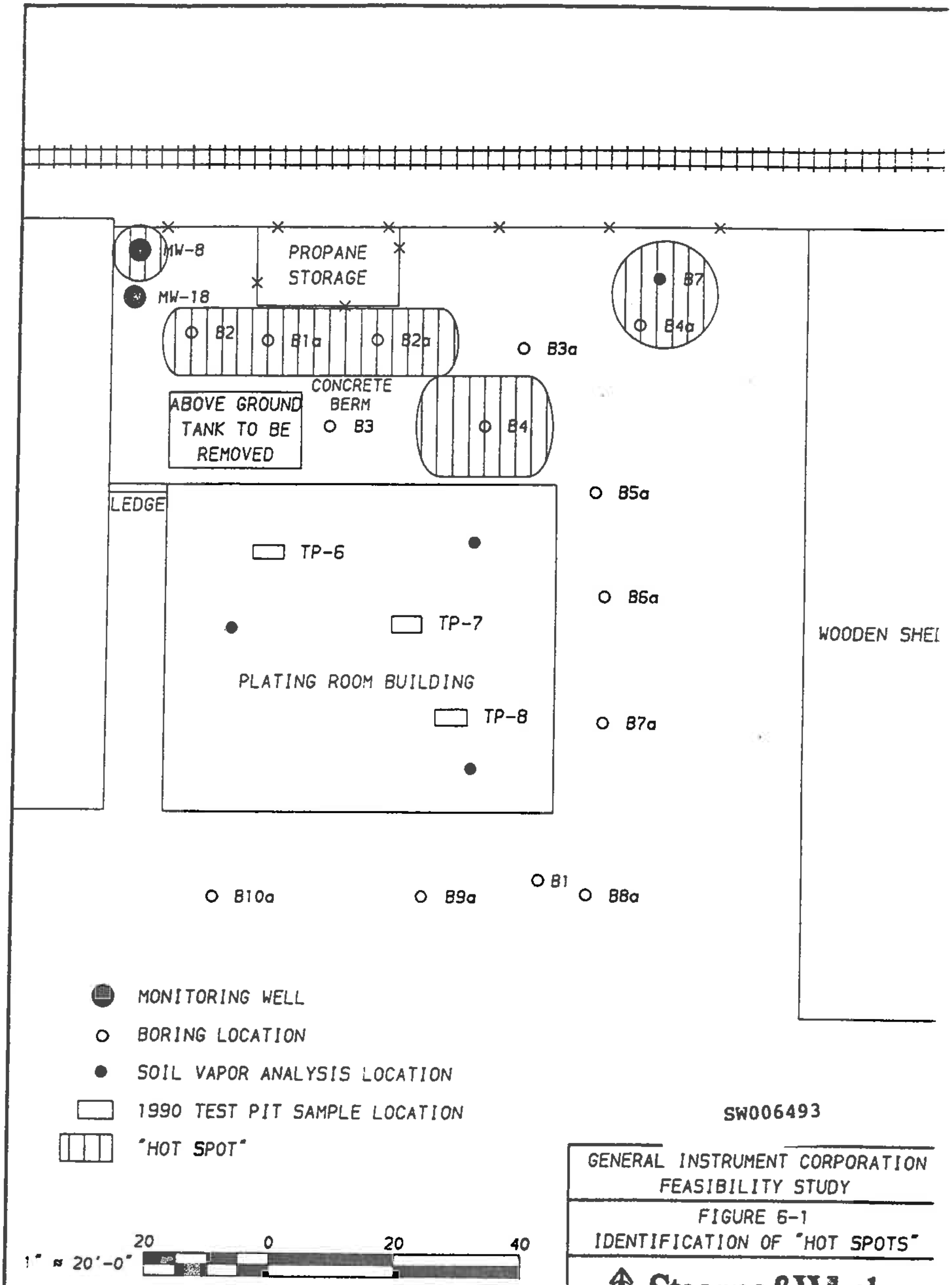
▨ 100 Year Flood Plain ■ Wetlands, 12.4 Acres or Greater

FIGURE 3-2
Wetlands and 100 Year Floodplains

General Instrument Corporation
Sherburne, NY

Stearns & Wheler
ENVIRONMENTAL ENGINEERS & SCIENTISTS

PROJECT NO. 1587



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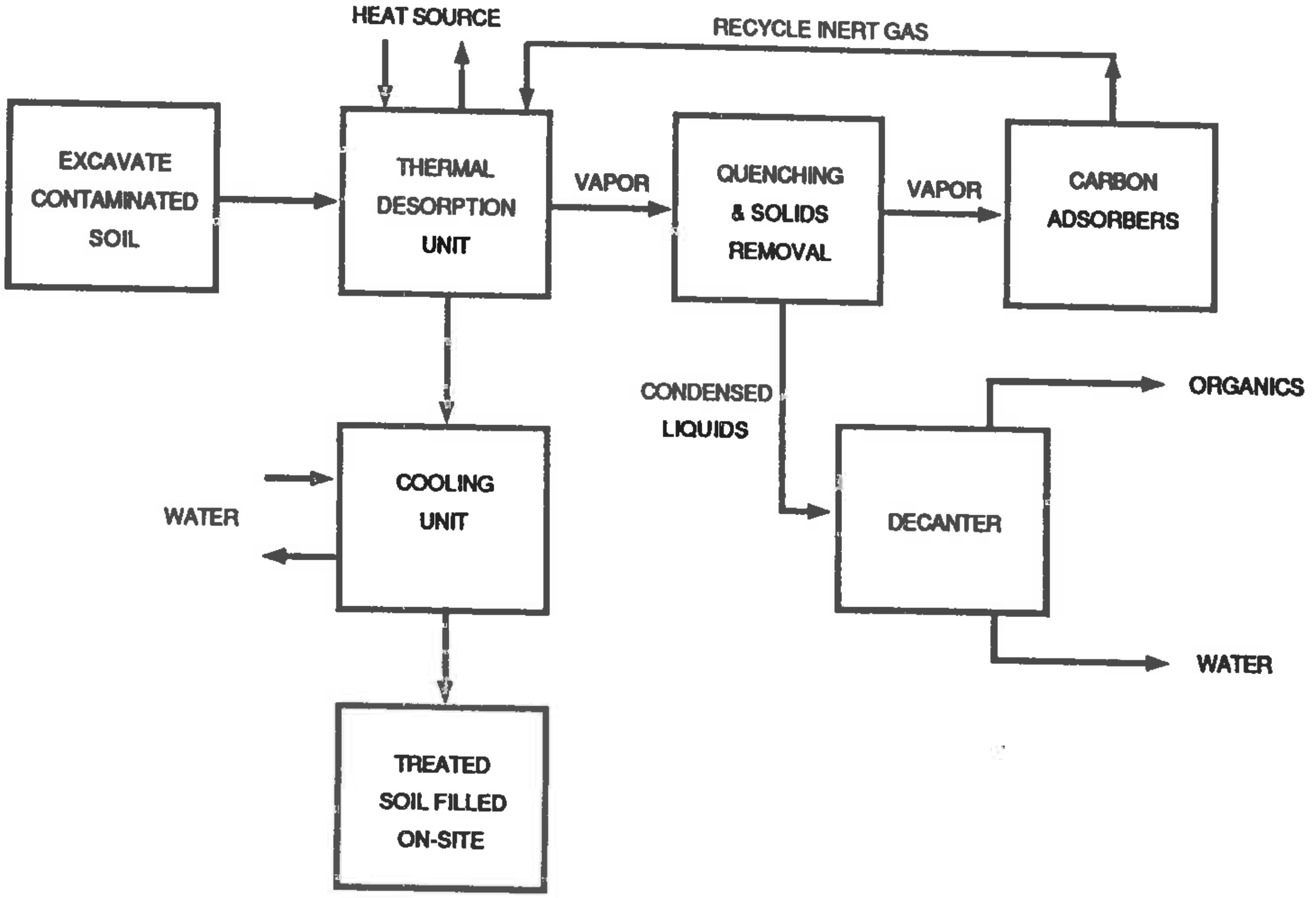
FEASIBILITY STUDY

FIGURE 6-1
IDENTIFICATION OF "HOT SPOTS"

Stearns&Wheler
ENVIRONMENTAL ENGINEERS & SCIENTISTS



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TACO STREET, SHERBURNE, NY

FIGURE 6-2
SOIL TREATMENT ALTERNATIVE III-B
THERMAL DESORPTION

Stearns & Wheler
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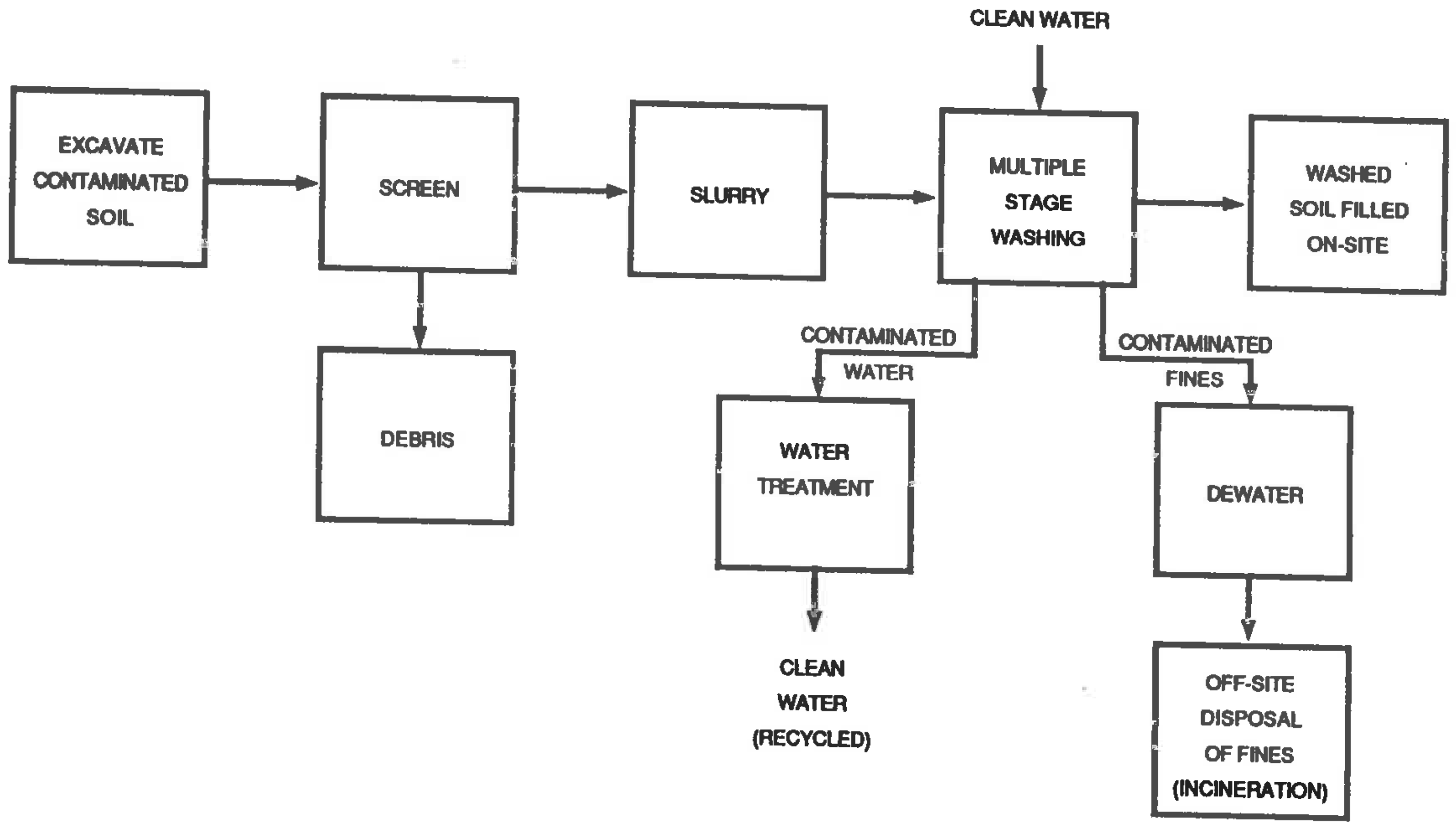

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TACO STREET, SHERBURNE, NY

FIGURE 6-3
SOIL ALTERNATIVE III-C
SOIL WASHING

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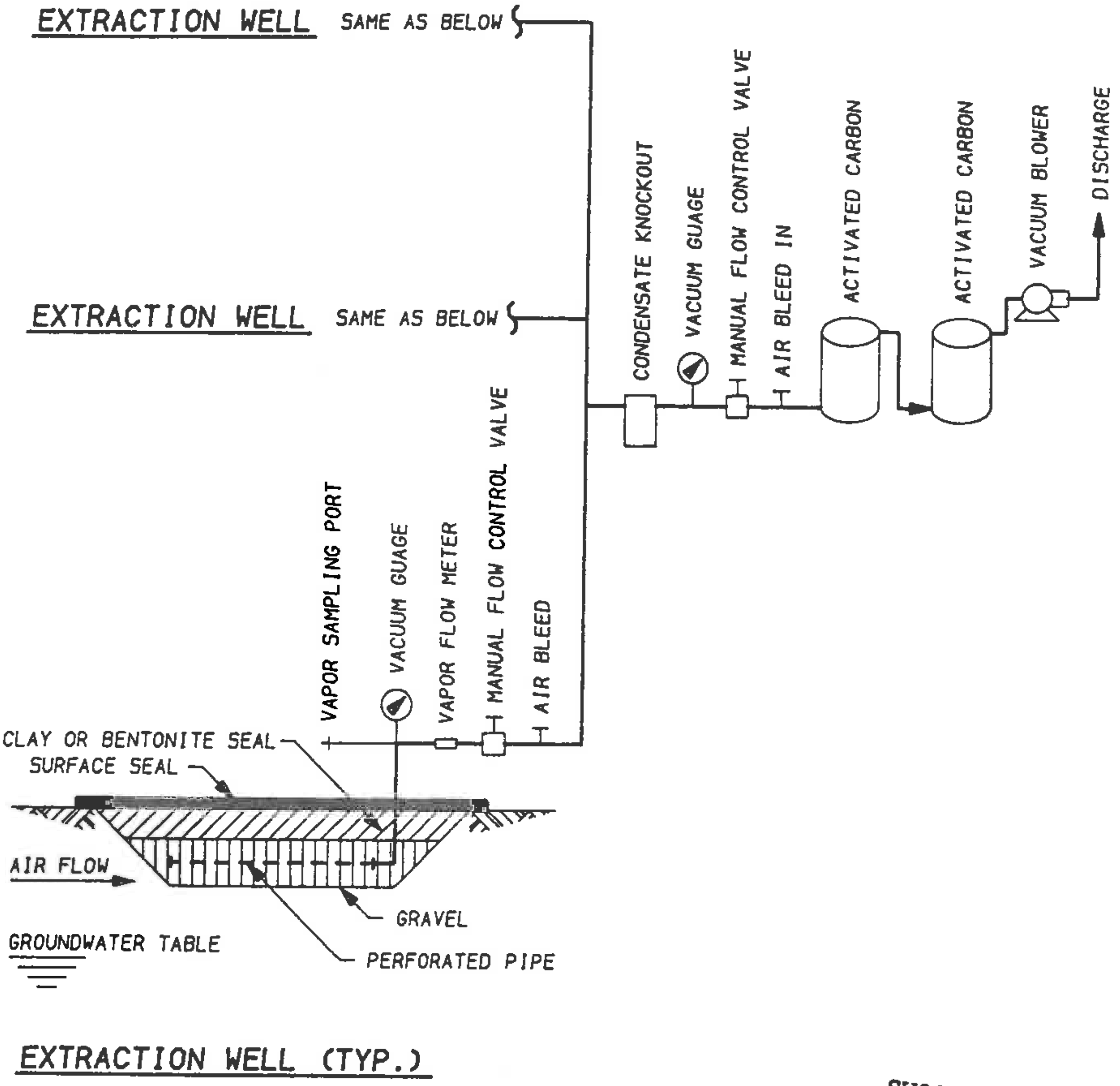
ENVIRONMENTAL ENGINEERS AND SCIENTISTS

PROJECT NO. 1587



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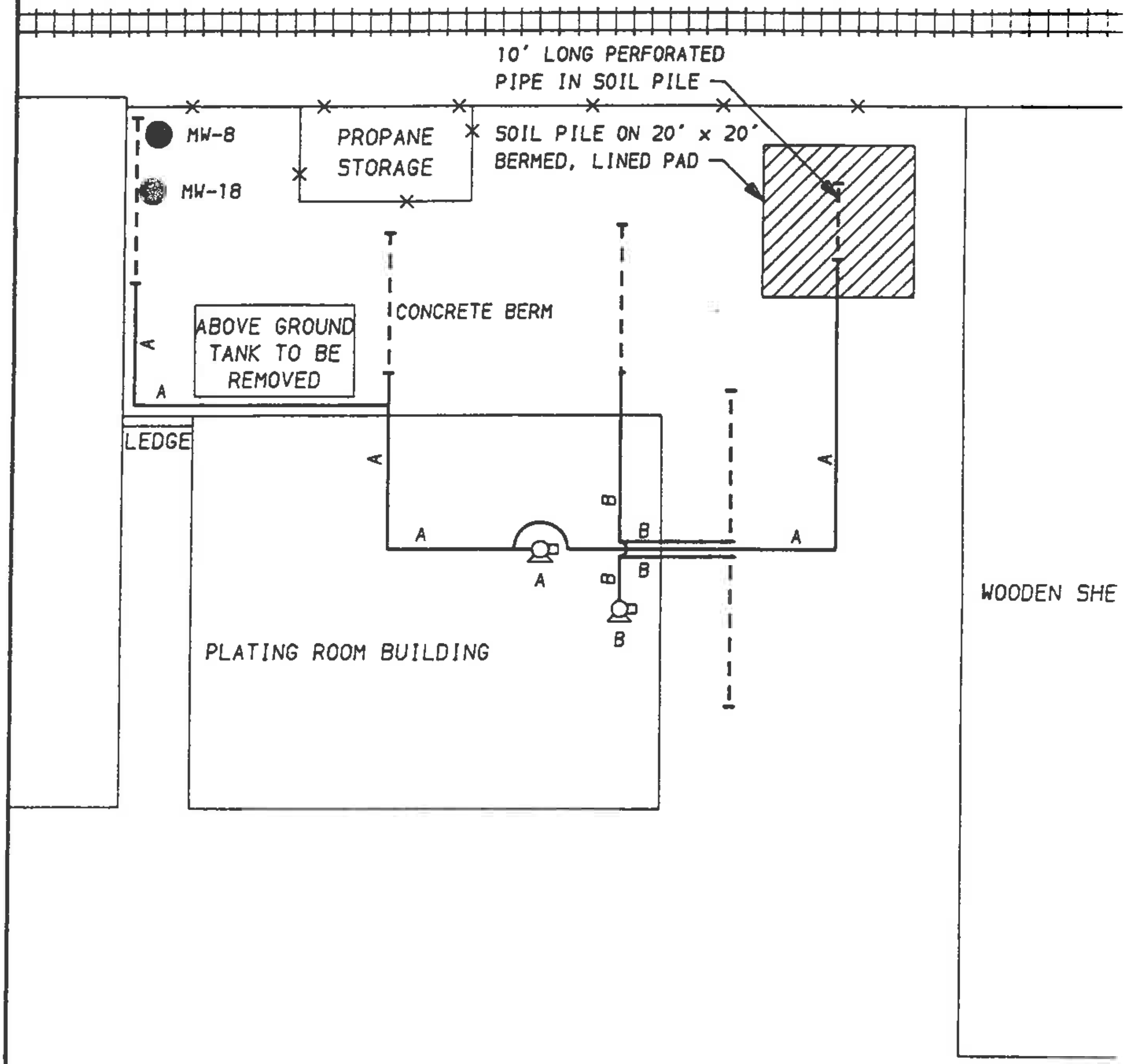
FEASIBILITY STUDY

FIGURE 6-4
SOIL VAPOR EXTRACTION
SCHEMATIC

Stearns&Wheler
ENVIRONMENTAL ENGINEERS & SCIENTISTS



● MONITORING WELL

- - - PERFORATED PIPE

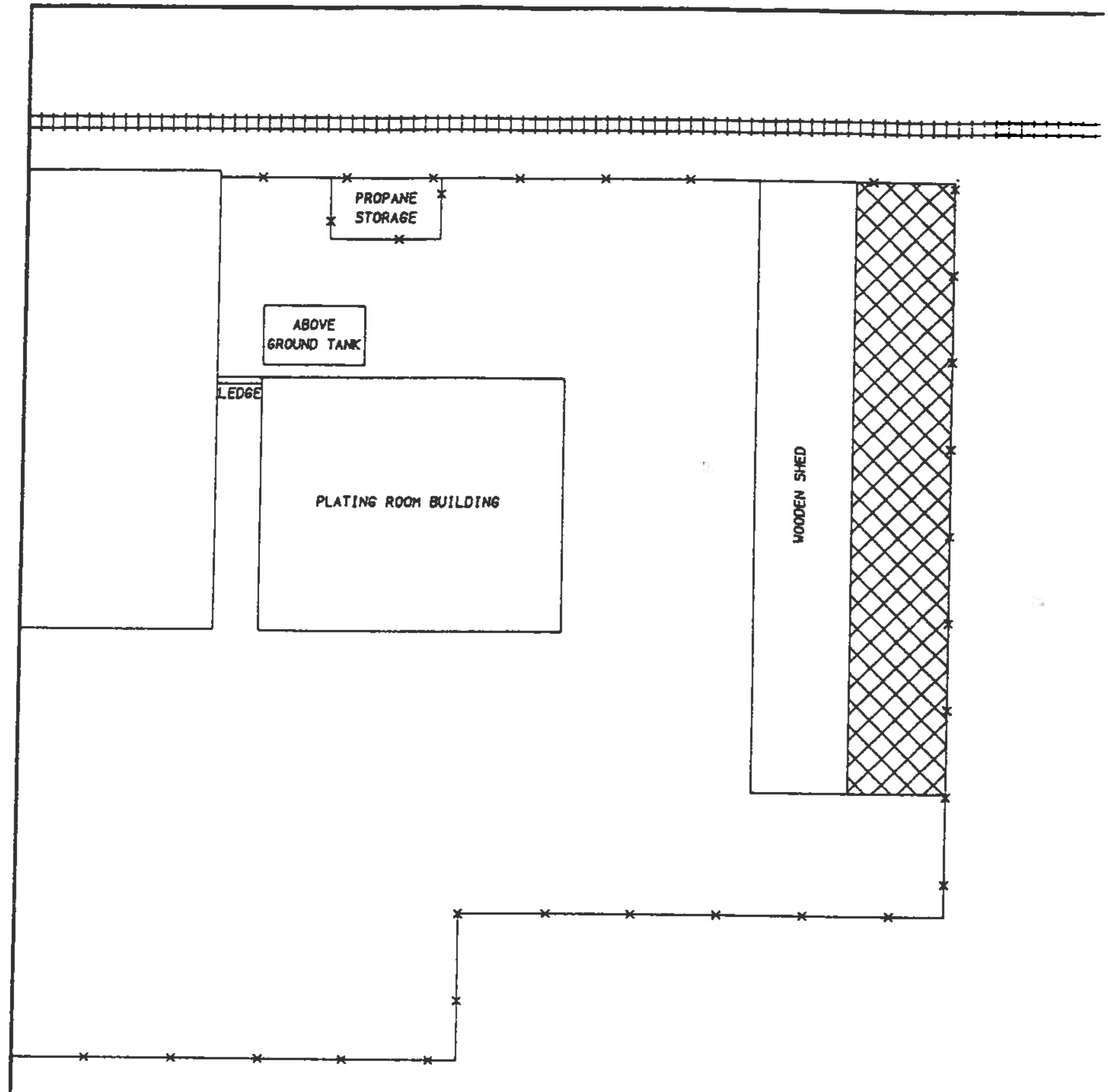
—— SOLID PIPELINE TO VACUUM

1" ≈ 20'-0" 20 0 20 40

GENERAL INSTRUMENT CORPORATION
FEASIBILITY STUDY

FIGURE 6-5
SOIL VAPOR EXTRACTION
SYSTEM LAYOUT

Stearns&Wheler
ENVIRONMENTAL ENGINEERS & SCIENTISTS



▨ OPERABLE UNIT 2 AREA TO BE CAPPED

1" ≈ 30'-0"   30   0   30   60

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TACO STREET, SHERBURNE, NY

FIGURE 6-6
OPERABLE UNIT 2
ALTERNATIVE II CAPPING

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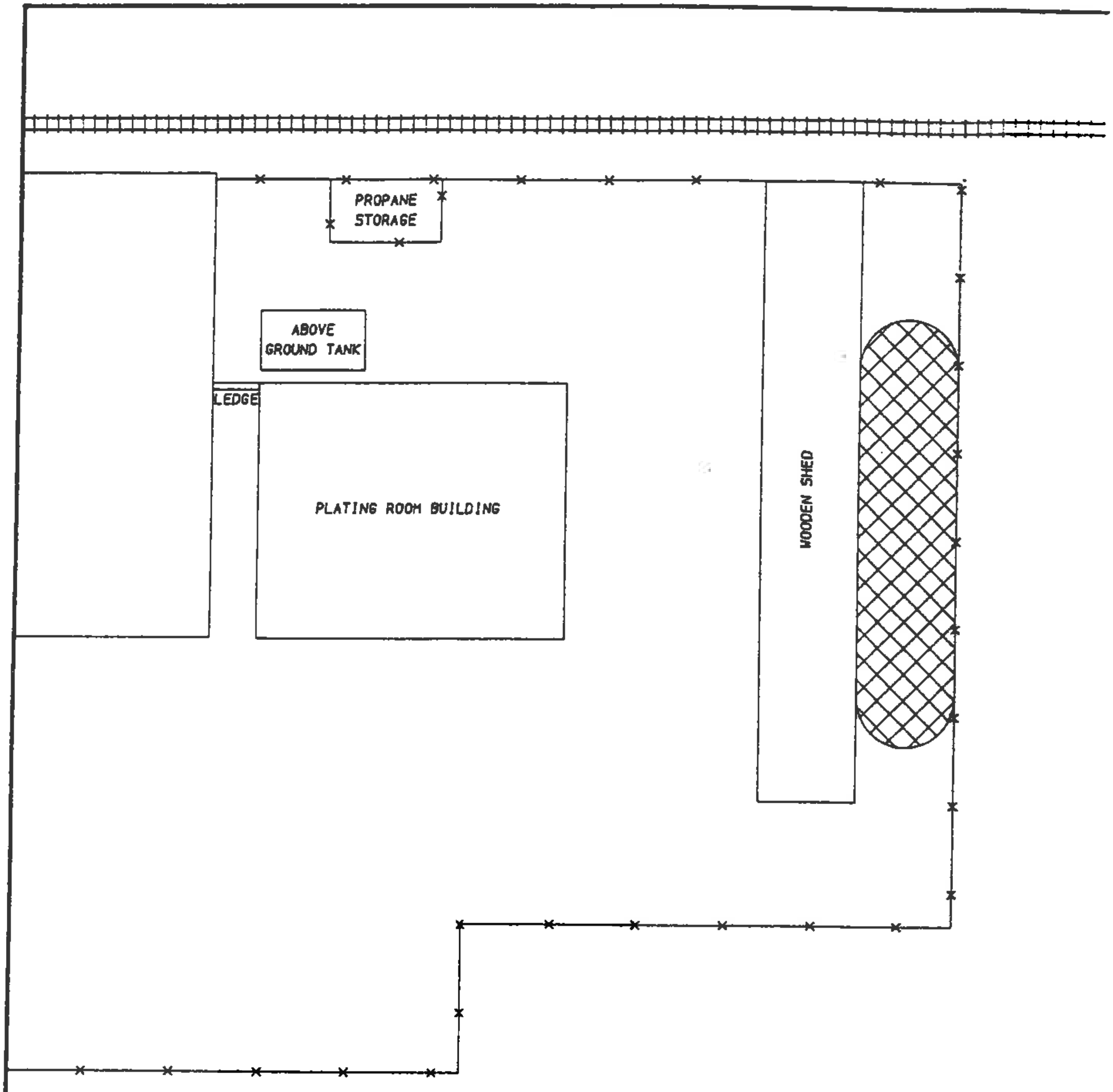
ENVIRONMENTAL ENGINEERS & SCIENTISTS



▨ OPERABLE UNIT 2 SOIL TO BE EXCAVATED

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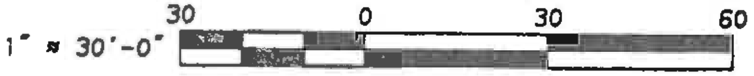
TACO STREET, SHERBURNE, NY

FIGURE 6-7
OPERABLE UNIT 2
SOIL TO BE EXCAVATED



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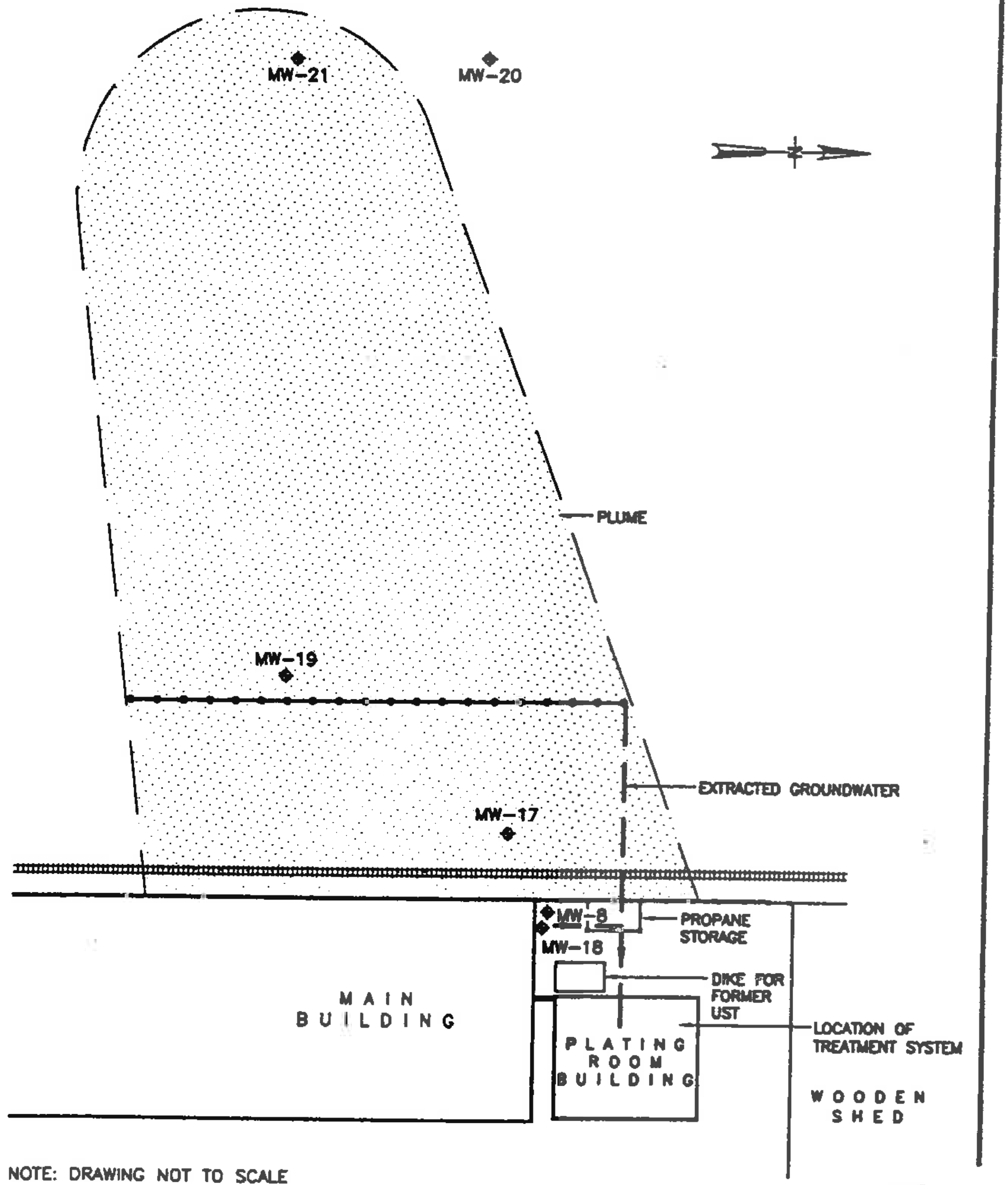

NOTE: DRAWING NOT TO SCALE

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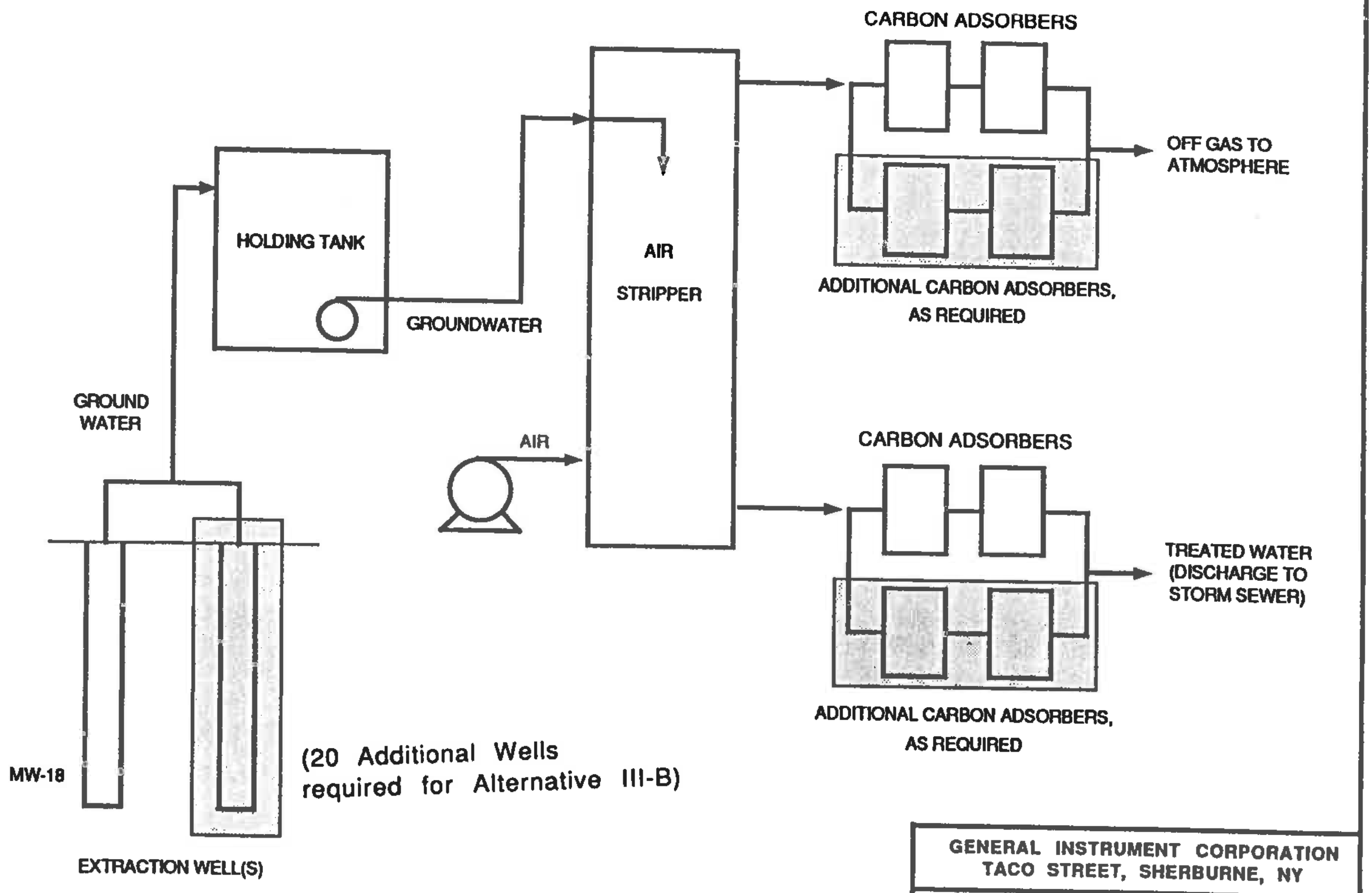
SHERBURNE, NEW YORK
FEASIBILITY STUDY

FIGURE 6-8
GROUNDWATER EXTRACTION SYSTEM
USING RECOVERY WELLS



PROJECT NO. 1587

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TACO STREET, SHERBURNE, NY

FIGURE 6-9
GROUNDWATER ALTERNATIVES III-A & III-B
AIR STRIPPING

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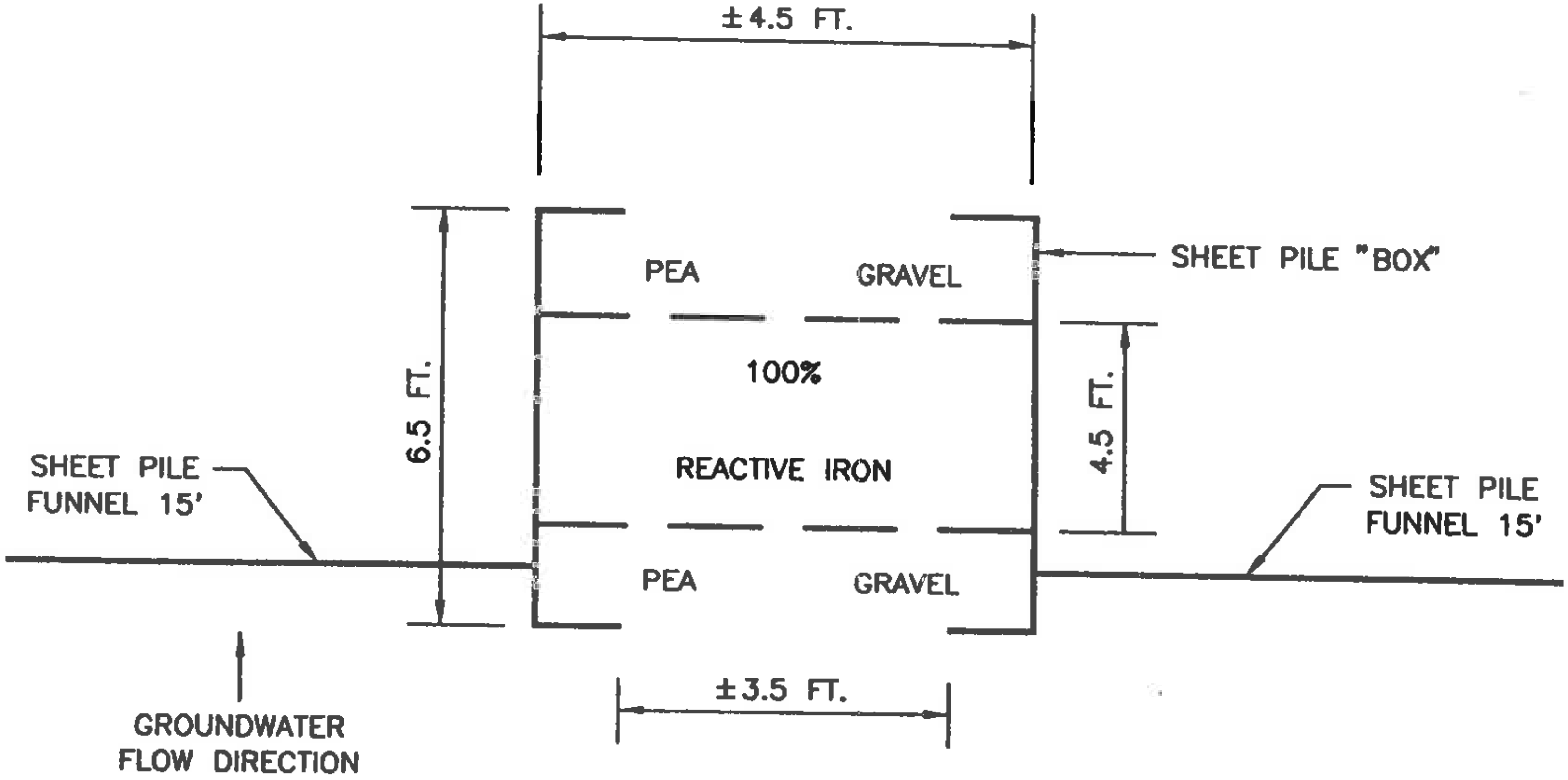
ENVIRONMENTAL ENGINEERS AND SCIENTISTS



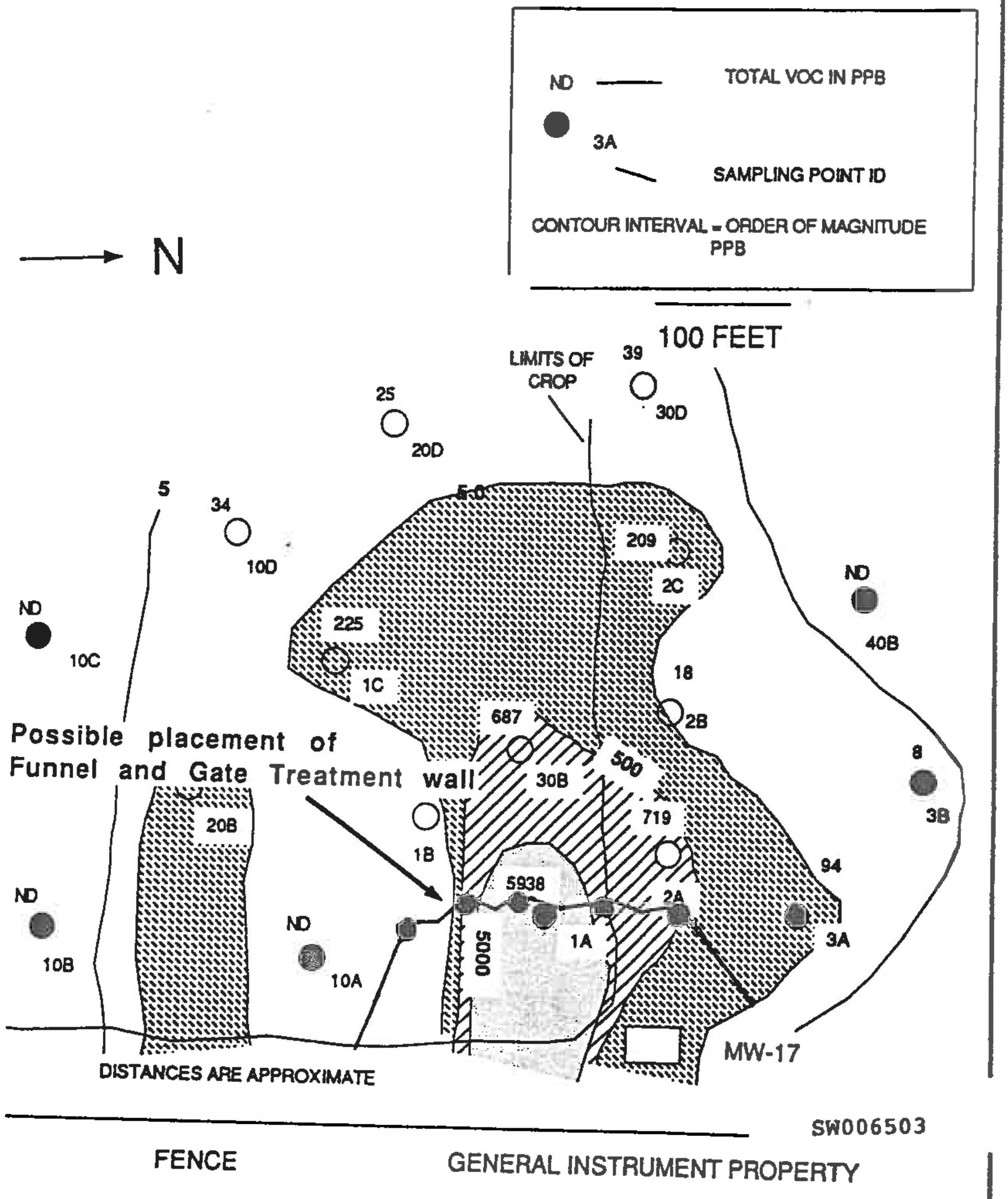
Schematic Supplied By
enviro**metal**
technologies
inc.

Stearns&Wheler
ENVIRONMENTAL ENGINEERS & SCIENTISTS

DATE: 7/94 JOB No.: 1587

GENERAL INSTRUMENT CORPORATION
SHERBURNE, NEW YORK
FEASIBILITY STUDY

FIGURE 6–10
CONCEPTUAL SKETCH
PERMEABLE REACTION WALL



GENERAL INSTRUMENT CORPORATION
TACO STREET, SHERBURNE, NY

FIGURE 6-11
GROUNDWATER ALTERNATIVE IV-A
PLACEMENT OF FUNNEL & GATE SYSTEM

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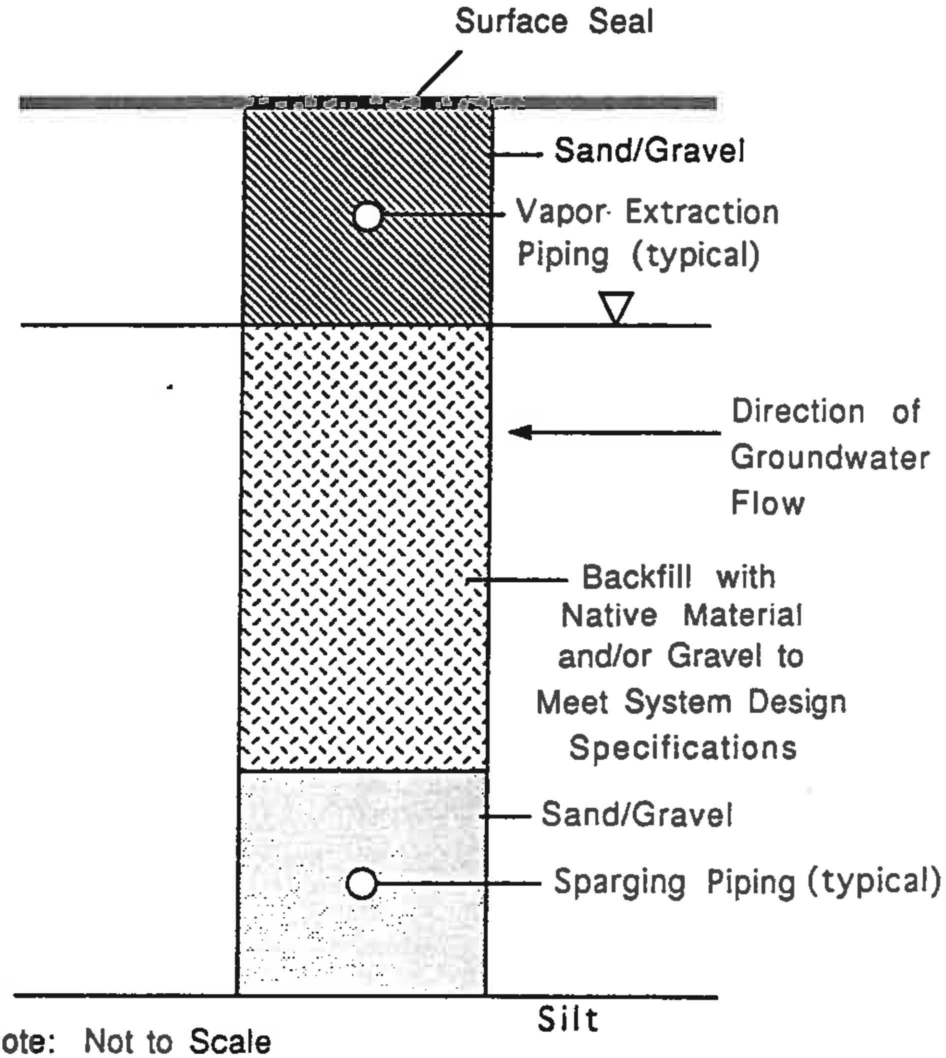
ENVIRONMENTAL ENGINEERS & SCIENTISTS

PROJECT NO. 1587



Note: Not to Scale

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TACO STREET, SHERBURNE, NY

FIGURE 6-12
CONCEPTUAL SKETCH
AIR SPARGING TRENCH

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PROJECT NO. 1587

TABLE 2-1

VOLATILE ORGANIC COMPOUNDS IN SOIL OF OPERABLE UNIT NO. 1

Sample Number	SB-3	SB-4	SB-5	SB-6	SB-7	SB-8	SB-9	SS-14	SS-15	SS-16	SS-17	SS-21
Location	South of Plating Bg.	N. Wall of Plating Bg.	Shed West	Pit Room W. Door	N/W Boundary	Near MW - 8	Pit Room E. Door	*biased high* T.P. #6	*biased high* T.P. #7	T.P. #8	T.P. #9	by R/R Tracks
Depth	2'-4'	2'-4'	2'-4'	2'-4'	2'-4'	2'-4'	2'-4'	>4'	2'-4'	2'-4'	0'-2'	0'-2'
Compound												
Methylene Chloride				460 E	580 E	320 E			13E	2E		
1,1-Dichloroethene												
1,1-Dichloroethane			46					40	18	9	12	
1,2-Dichloroethene (total)			18			1900	26		51	22	15	
Chloroform									7 E	1 E	.7 E	
2-Butanone			65					▨		▨	▨	
1,1,1-Trichloroethane				7400 E	▨	▨		270	390		10	
Carbon Tetrachloride				940								
Trichloroethene			6 E	700 E		1600	12		170		11	5 E
Benzene				82 E								
2-Hexanone		140										
Tetrachloroethene				130 E		530 E			4 E			
Toluene		13 E	8	150 E	1500	230 E	3 E		18 E		3 E	
Chlorobenzene				130E								
Ethylbenzene		13 E	3 E		1100	430 E		12 E	23 E		15	
Xylene (total)	6	120	16		13000	2100	4 E	140	160	4 E	57	

SUMMARY

	SB-3	SB-4	SB-5	SB-6	SB-7	SB-8	SB-9	SS-14	SS-15	SS-16	SS-17	SS-21
TOTAL BTEX	5.0	146.0	27.0	232.0	15600.0	2760.0	7.0	152.0	201.0	4.0	75.0	0.0
% OF VOC'S PRESENT	89.3	51.0	16.7	2.4	96.4	38.8	15.6	32.9	23.9	10.5	59.7	0.0
TOTAL HALOCARBONS	0.6	140.0	135.0	9630.0	580.0	4350.0	38.0	310.0	640.0	34.0	50.7	5.0
% OF VOC'S PRESENT	10.7	49.0	83.3	97.6	3.6	61.2	84.4	67.1	76.1	89.5	40.3	100.0
TOTAL VOLATILES	5.6	286.0	162.0	9862.0	16180.0	7110.0	45.0	462.0	841.0	38.0	125.7	5.0

All concentrations reported in µg/kg.
"E" denotes estimated value below detection limit
Shaded area indicates analyte was found in blank or sample was rejected for QA/QC.

TABLE 2-2

VOLATILE ORGANIC CONCENTRATIONS IN SOIL OF OPERABLE UNIT 1
RESULTS OF SAMPLING ROUND 2

General Instrument Corporation
Sherburne, NY Facility

		Concentration (ppb)																
Sample Point		B-1	B-1	B-2	B-2	B-3	B-3	B-4	B-4	B1A	B2A	B3A	B4A	B5A	B6A	B7A	B8A	B9A	B10A
Depth from surface		1-3ft.	5-7ft.	1-3ft.	5-7ft.	1-3ft.	5-7ft.	1-3ft.	5-7ft.	5-7ft.	5-7ft.	5-7ft.	5-7ft.	5-7ft.	5-7ft.	5-7ft.	5-7ft.	5-7ft.	5-7ft.
Contaminant	TAGM goal ppb																		
Carbon disulfide	2,700										66	38	34		702				
Chlorobenzene	1,700					48				843	61								
Chloroethane	1,200										142	1,880							
Chloroform	300										55								
1,1-Dichloroethane	200							24	2,880		648	16		28					
1,2-Dichloroethane	100								16,700										
1,2-Dichloroethene	300*							22	2,640										
Methylene Chloride	100									1,540	20	73					6	35	
1,1,2,2-Tetrachloroethane	600								1,700										
1,1,2-Trichloroethane									97										
1,1,1-Trichloroethane	800		121		368			20	51,100										
Trichloroethene	700	53			53			79											
Vinyl chloride	200				142														
Total Chlorinated VOCs		53	121	0	563	48	0	145	75.117	2,383	992	2,007	34	28	702	0	6	35	0
Benzene	60											320	32						
Toluene	1,500				3,870					244	1,370	37			11				
Ethylbenzene	5,500					125				70	3,990	1,224	212		37	856			
Xylene	1,200			12	2,350	153		39		263	12,700	3,940	129	149	48				
Total Aromatic VOCs		0	0	12	6,220	278	0	39	0	577	18,060	5,521	373	149	96	856	0	0	0
Total VOCs		53	121	12	6,783	326	0	184	75.117	2,960	19,052	7,528	407	177	798	856	6	35	0

Note: Shaded area denotes the sample exceeds clean-up goals set by NYSDEC TAGM

TABLE 2-3

SEMI-VOLATILE ORGANIC COMPOUNDS IN SOIL OF OPERABLE UNIT NO. 1

Sample Number	SB-3	SB-4	SB-5	SB-6	SB-7	SB-8 DL	SS-14	SS-15	SS-16	SS-17	SS-21
Location	South of Plating Bg.	N. Wall of Plating Bg.	Shed West	Pit Room W. Door	NW Boundary	Near MW - 8	T.P. #6	T.P. #7	T.P. #8	T.P. #9	by R/R Tracks
Depth Compound (Type)	2'-4'	2'-4'	2'-4'	2'-4'	2'-4'	2'-4'	>4'	2'-4'	2'-4'	0'-2'	0'-2'
Benzoic acid (Misc)	8 E	▨			130 E						
bis(2-Chloroethoxy)methane (Misc)		▨									
Naphthalene (PNA)		▨			180	2300			39	830	94 E
2-Methylnaphthalene (PNA)		▨		1600	450	8600	3300	61	49	2500	140 E
Acenaphthylene (PNA)		▨		140							710
Acenaphthene (PNA)		▨			96 E						140 E
Dibenzofuran (Misc)		▨					670			160	120 E
Diethylphthalate (PHTH)		▨			23 E						
Fluorene (PNA)		▨		360 E	160 E	1400					300 E
4-Nitroaniline (Misc)		▨									
N-Nitrosodiphenylamine (1) (Misc)		▨			52 E						
Phenanthrene (PNA)		▨		840	1200	2000	2300 E	110	81	680	2300
Anthracene (PNA)		▨		160 E	150 E						800
Di-n-butylphthalate (PHTH)	▨	▨		▨	▨			80	26		66 E
Fluoranthene (PNA)		▨	470 E	970	1600			140	95	350	4100
Pyrene (PNA)		▨	380 E	670	1100		220	99	53 E	180 E	2800
Butylbenzylphthalate (PHTH)		▨									48 E
Benzo(a)anthracene (PNA)		▨	270 E	420	520			55		200 E	1500
Chrysene (PNA)		▨	350 E	460	550		78	63		210	1900
bis(2-Ethylhexyl)phthalate (PHTH)	▨	▨	▨	4300	2500	▨	▨	▨	▨	▨	1100
Di-n-octylphthalate (PHTH)		▨		77 E	16 E		7				
Benzo(b)fluoranthene (PNA)		▨	420 E	470	440 E					240	1600
Benzo(k)fluoranthene (PNA)		▨	96 E	110 E	76 E					27	1200
Benzo(a)pyrene (PNA)		▨	320 E	380 E	420 E					180	1200
Indeno(1,2,3-cd)pyrene (PNA)		▨	440 E	360 E	380 E					140	350 E
Dibenzo(a,h)anthracene (PNA)		▨	160 E	59 E	48 E						
Benzo(g,h,i)perylene (PNA)		▨	380 E	380 E	280 E					130	160 E
SUMMARY											
TOTAL PNA's	0	▨	3286	7379	7650	14300	5898	516	317	5667	19294
% OF SVOC'S PRESENT	0	▨	100.0	99.0	97.1	100.0	89.7	91.2	92.4	97.3	98.8
TOTAL SEMI-VOLATILES	8	▨	3286	7456	7876	14300	6575	568	343	5827	19528

All concentrations reported in µg/kg.
"E" denotes estimated value below detection limit
Shaded area indicates analyte was found in blank or sample was rejected for QA/QC.

TABLE 2-4

VOLATILE ORGANIC COMPOUNDS IN SOIL
OF OPERABLE UNIT NO. 2

Sample Number	SS-26	SS-27
Location	Spill Surface	Spill (-20')
Depth	0'-2'	0'-2'
Compound		
Methylene Chloride	150 E	
1,1-Dichloroethene		
1,1-Dichloroethane		
1,2-Dichloroethene (total)		
Chloroform		
2-Butanone		
1,1,1-Trichloroethane		
Carbon Tetrachloride		
Trichloroethene		
Benzene		5 E
2-Hexanone		
Tetrachloroethene		
Toluene	100 E	32 E
Chlorobenzene		
Ethylbenzene		
Xylene (total)	6400	260

SUMMARY

TOTAL BTEX	6500.0	297.0
% OF VOC'S PRESENT	97.7	100.0
TOTAL HALOCARBONS	150.0	0.0
% OF VOC'S PRESENT	2.3	0.0
TOTAL VOLATILES	6650.0	297.0

All concentrations reported in µg/kg.
"E" denotes estimated value below detection limit
Shaded area indicates analyte was found in blank or sample was rejected for QA/QC.

TABLE 2-5

SEMI-VOLATILE COMPOUNDS IN THE SOIL OF OPERABLE UNIT NO. 2

Sample Number		SS-26	SS-27
Location		North of Wood shed	North of Wood shed
Depth		0'-2'	2'
Compound	Type		
Benzoic acid	MISC		
bis(2-Chloroethoxy)methane	MISC		
Naphthalene	PNA	590	*220 E*
2-Methylnaphthalene	PNA	4100	1100
Acenaphthylene	PNA		*270 E*
Acenaphthene	PNA		*84 E*
Dibenzofuran	MISC		*46 E*
Diethylphthalate	PHTH		
Fluorene	PNA	1100	*180 E*
4-Nitroaniline	MISC		
N-Nitrosodiphenylamine (1)	MISC		
Phenanthrene	PNA	2100	1200
Anthracene	PNA	*270 E*	*280 E*
Di-n-butylphthalate	PHTH		
Fluoranthene	PNA	820	2800
Pyrene	PNA	590	2300
Butylbenzylphthalate	PHTH		
Benzo(a)anthracene	PNA	*300 E*	1600
Chrysene	PNA	*340 E*	1700
bis(2-Ethylhexyl)phthalate	PHTH		
Di-n-octylphthalate	PHTH		
Benzo(b)fluoranthene	PNA	*270 E*	1600
Benzo(k)fluoranthene	PNA	*160 E*	1600
Benzo(a)pyrene	PNA	*270 E*	1600
Indeno(1,2,3-cd)pyrene	PNA	*100 E*	660
Dibenzo(a,h)anthracene	PNA		
Benzo(g,h,i)perylene	PNA	*63 E*	*320 E*

Summary

TOTAL PNA's		11073	17514
% OF SVOL PRESENT		100.0	99.7
TOTAL PHTHALATES		0	0
% OF SVOL PRESENT		0.0	0.0
TOTAL PHENOLICS		0	0
% OF SVOL PRESENT		0.0	0.0
MISC. SEMI-VOLATILES		0	46
% OF SVOL PRESENT		0.0	0.3
TOTAL SEMI-VOLATILES		11073	17560

All concentrations reported as µg/kg.
"E" denotes estimated value below detection limit.
Shaded area indicates analyte found in blank.

<u>TABLE 2-6</u>

VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER
(OPERABLE UNIT NO. 3)

General Instrument Corporation
Sherburne, NY Facility

Concentration (ug/L)

Compound		Monitoring Wells					100 ft radius of MW-17			200 ft radius of MW-17				300 ft radius of MW-17			400 ft radius of MW-17		
		MW-1	MW-2	MW-8	MW-18	MW-17	1A	2A	3A	1B	30B	2B	3B	20B	1C*	2C*	10D	20D	30D
Vinyl Chloride	1990			280 E	NS	6 E													
	1992			630 *	65	8 E		220											
1,1-Dichloroethene	1990				NS														
	1992																		
1,1-Dichloroethane	1990		7		NS	7													
	1992		9 E	44 *	6 E	5 E		132	26			6				48			9
1,2-Dichloroethene (total)	1990		5	7,700	NS	76													
	1992		3 E	9,700 *	210	62	5,650	132	42		478		8	32	83	40			
Chloroform	1990			63 E	NS														
	1992																		
1,1,1-Trichloroethane	1990	10	2 E	110 E	NS	96													
	1992				30	42		97	6		6					53			14
Trichloroethene	1990	3 E	6		NS	130													
	1992	4 E					288	561	20		203	12		46	135	68	34	25	16
Tetrachloroethene	1990	4 E			NS														
	1992	5 E			22	90													
Chlorobenzenene	1990																		
	1992									37									
Chloroethane	1990																		
	1992							102											
Toluene	1990			110 E	NS														
	1992			100 *	13														
Xylene (total)	1990			51 E	NS														
	1992			110 *	8 E														

Summary

		MW-1	MW-2	MW-8	MW-18	MW-17	1A	2A	3A	1B	30B	2B	3B	20B	1C*	2C*	10D	20D	30D
Total Halocarbons	1990	17	20	8,153		315													
	1992	9	12	10,374	333	207	5938	739	94	37	687	18	8	78	218	199	34	25	39
Total BTEX Compounds	1990	0	0	621		0													
	1992	0	0	210	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volatiles	1990	17	20	8,774		315													
	1992	9	12	10,584	354	207	5938	739	94	37	687	18	8	78	218	199	34	25	39

Note: Shaded area indicates samples from temporary probes located in field to west of site
"E" denotes estimated value below detection limit for that sample.
*Samples had "hits" of 1,2-Dichloroethane and/or 1,1,2,2-Tetrachloroethane

TABLE 2-7

SEMI-VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER
(OPERABLE UNIT NO. 3)

General Instrument Corporation
Sherburne, NY Facility

Parameter		Concentration (ug/L)				
		MW-8	MW-18	MW-17	MW-14	WES-3
Naphthalene	Round 1	510				
	Round 2	1400				
2-Methylnaphthalene	Round 1	510				
	Round 2	7300	25			
Acenaphthene	Round 1					
	Round 2	160 E	4 E			
Dibenzofuran	Round 1	88				0.2 E
	Round 2	130 E				
Fluorene	Round 1	120				
	Round 2	300 E	6 E			
N-Nitrosodiphenylamine	Round 1					
	Round 2	660 E				
Phenanthrene	Round 1	220				
	Round 2	1600	8 E			
Anthracene	Round 1					
	Round 2	280 E	2 E			
Fluoranthene	Round 1	12 E				
	Round 2	66 E				
Pyrene	Round 1	25 E			0.8 E	
	Round 2	43 E	1 E			
Chrysene	Round 1	4 E				
	Round 2	23 E				
bis(2-Ethylhexyl)phthalate	Round 1					
	Round 2		10 E			
Butylbenzylphthalate	Round 1	3 E				
	Round 2					
TOTAL SEMI-VOLATILES	Round 1	1492			0.8	0.2
	Round 2	11962	56			

"E" denotes estimated value below the detection limit for that sample.

TABLE 2-8

VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER
(OPERABLE UNIT NO. 3)

(September 1993 Results only)

General Instrument Corporation
Sherburne, NY Facility

		Concentration (ug/L)						
		Monitoring Wells						
Compound		MW-8	MW-18	MW-17	MW-19	MW-19D	MW-20	MW-21
Vinyl Chloride	1993-1							
	1993-2	88.9	83	7.5	14	23		
1,1-Dichloroethene	1993-1							
	1993-2							
1,1-Dichloroethane	1993-1						5	12
	1993-2	16.5	7	3	4	4	4	19
1,2-Dichloroethene (total)	1993-1	1020	285	34	278		10	152
	1993-2					1		
Chloroform	1993-1							
	1993-2							
1,1,1-Trichloroethane	1993-1	50	20	28	13		12	40
	1993-2	23	16	27	21	13	10	30
Trichloroethene	1993-1	20	25	57	529		23	479
	1993-2	13.4		73.2	220	414	28	334
Tetrachloroethene	1993-1							
	1993-2							
Chlorobenzenene	1993-1							
	1993-2							
Chloroethane	1993-1							
	1993-2							
Toluene	1993-1	230	95					
	1993-2	109	65					
Xylene (total)	1993-1	260	153					
	1993-2	231	214					
otal Substituted Aromatics	1993-1	20320	780					
Summary								
Total Halocarbons	1993-1	1,090	330	119	820	0	50	683
	1993-2	141.8	106	111	259	456	42	383
Total BTEX Compounds	1993-1	490	248	0	0			0
	1993-2	340	279				0	
Total Volatiles	1993-1	1,580	578	119	820		50	683
	1993-2	482	385	111	259	456	42	383

Notes: Samples split with NYSDEC prior to analysis. First Value is NYSDEC's lab result, second is Stearns & Wheler's lab result.

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TABLE 3-1

REVIEW OF LOCATION SPECIFIC ARARs

General Instrument Corporation
Feasibility Study

ACTIVITIES AFFECTING:	REGULATION	CITATION	
		Federal	State
Rivers and Streams	Wild and Scenic Rivers Act	40 CFR 6.302	6 NYCRR 608
Floodplain	Floodplain Management	40 CFR 6., Appendix A	6NYCRR 500
100 Year Floodplain	RCRA	40 CFR 264.18	6 NYCRR 373-2.2
Fish and Wildlife	Fish and Wildlife Coordination Act	16 USC 661 et seq	

TABLE 3-2

REVIEW OF CHEMICAL-SPECIFIC ARARs AND TO BE CONSIDERED CRITERIA

General Instrument Corporation
Feasibility Study

MEDIA	TITLE OF REGULATION	CITATION		TBC
		Federal	State	
SOIL	NYS Soil Clean up Objectives		NYSDEC TAGM 4046	X
	Petroleum-Contaminated Soil Guidance Policy		NYSDEC STARS Memo 1	X
GROUNDWATER	Water Quality Regulations		6 NYCRR 700-705	
	Groundwater Classifications & Quality Standards		6 NYCRR 703 10 NYCRR 5-1 10 NYCRR 170	
	Standards, Limitations for Discharge to Class GA Waters	NPDES	6 NYCRR 703 TOGS 1.1.1	
	Federal & State DOH Sanitary Codes for Drinking Water	SDWA MCLs SDWA MCLGs	10 NYCRR 5-1,5-3	X
	Ambient Water Quality Standards and Guidance Values		TOGS 1.1.1	
	SDWA	40 CFR 141, 143 PL 93-523		
	EPA Health Advisories & NAS SNARLS			X
SURFACE WATER	NYSPDES/ NPDES	NPDES	6 NYCRR 750-757 6 NYCRR 701.5	
	Ambient Water Quality Standards and Guidance Values		TOGS 1.1.1	
	Water Quality Regulations , Surface Water Classifications, & Standards	FWQC CWA Sect. 303,304	6 NYCRR 700-705	
AIR	NYS Air Guide		6 NYCRR 212	
	NYS Air Pollution Control Regulations		6 NYCRR 201,202	
	Particulate Emissions	40 CFR 50	6 NYCRR 219	

TABLE 3-3

REVIEW OF REMEDIAL ACTION-SPECIFIC ARARs

General Instrument Corporation
Feasibility Study

ACTION/RESPONSE	ACTIVITY TO MEET RESPONSE ACTION	CITATION	
		Federal	State
No Action	Monitoring		6 NYCRR 373 6 NYCRR 360
Containment	Cap	40 CFR 264	6NYCRR 373 6NYCRR 360
	Vertical Barriers	40 CFR 268	
Collect/Treat/Discharge	Discharge to Surface Waters	NPDES	6 NYCRR 751
	Discharge to POTW	40 CFR 403	
	Discharge to Groundwater	40 CFR 144	6 NYCRR 703
	Monitor	40 CFR 122, 125	6 NYCRR 751
Off-Site Treatment	Transportation of Contaminated Soil		Title 17, NYTL Part 507
	Manifest, Record keeping requirements		6 NYCRR 372
All work on site	OSHA Regulations	29 CFR 1926	

TABLE 4-1

Technology/Process Options for Operable Unit No. 1 (soil)

General Instrument Corporation
Sherburne, NY Facility

General Response	Technology	Process Options	Description	Comments
No Action	None	None	Used when natural attenuation will reduce threat	Required for consideration
Excavation	Excavation	Soil Removal	Remove all soil that has an unacceptable level of risk	Applicable to site
Containment	Containment	Low Permeability Barrier	Cap	Potentially Applicable
Treatment	Chemical	KPEG Dechlorination	Use alkali metal hydroxide and polyethylene glycol to dechlorinate waste	Not applicable to site
	Physical	Thermal Treatment	Incineration or Pyrolysis	Applicable
		Thermal Desorption	Volatilize contaminants to gas phase for treatment	Applicable
		Solvent Extraction	Extract contaminants by absorbing into solvent	Not used for similar contaminants
		Fixation or Immobilization	Chemically immobilize contaminants into solidified mass similar to cement	Not applicable to VOCs
		Soil Washing	Use surfactants to remove contaminants from soil	Potentially Applicable
	In-situ Physical	R.F. Heating	Use radio waves to heat soil and volatilize organics	Rejected
		Soil Flushing	Use surfactants to remove contaminants from soils	In situ control difficult
		Soil Vapor Extraction	Extract volatile soil vapors with vacuum or induced air	Applicable
		Vitrification	Current induced heating of soils results in vitrification	Not applicable
	In-situ Biological	Anaerobic	Degradation by microorganisms in low oxygen environment	Undesirable end-product (VC)
		Aerobic	Degradation by microorganisms in oxygenated environment	In situ control difficult
Disposal	Disposal	Onsite	Disposal of treated soil on site	Potentially applicable
		Offsite	Disposal of untreated or treated materials in appropriate facility	Potentially applicable

Note: Shaded Options have been removed from further consideration

TABLE 4-2

Technology/Process Options for Operable Unit No. 2 (soil)

General Instrument Corporation
Sherburne, NY Facility

General Response	Technology	Process Options	Description	Comments
No Action	None	None	Used when natural attenuation will reduce threat	Applicable to site
Excavation	Excavation	Soil Removal	Remove all soil that has an unacceptable level of risk	Applicable to site
Containment	Containment	Low Permeability Barrier	Cap	Potentially Applicable
Treatment	Chemical	KPEG Dechlorination	Use alkali metal hydroxide and polyethylene glycol to dechlorinate waste	Not applicable to site
	Physical	Thermal Treatment	Incorporation into asphalt paving material	Applicable
		Thermal Desorption	Volatilize contaminants to gas phase for treatment	Unnecessary
		Solvent Extraction	Extract contaminants by absorbing finto solvent	Not applicable
		Fixation or Immobilization	Chemically immobilize contaminants into solidified mass similar to cement	Not applicable to VOCs
		Soil Washing	Use surfactants to remove contaminants from soil	Unnecessary
	In-situ Physical	R.F. Heating	Use radio waves to heat soil and volatilize organics	Rejected
		Soil Flushing	Use surfactants to remove contaminants from soils	In situ control difficult
		Soil Vapor Extraction	Extract volatile soil vapors with vacuum or induced air	Applicable
		Vitrification	Current induced heating of soils results in vitrification	Not applicable
	In-situ Biological	Anaerobic	Degradation by microorganisms in low oxygen environment	Not applicable to petroleum
		Aerobic	Degradation by microorganisms in oxygenated environment	Potentially applicable
Disposal	Disposal	Onsite	Disposal of treated soil on site	Potentially applicable
		Offsite	Disposal of untreated or treated materials in appropriate facility	Potentially applicable

Note: Shaded Options have been removed from further consideration

TABLE 4-3

Technology/Process Options for Operable Unit No. 3 (Groundwater)

General Instrument Corporation
Sherburne, NY Facility

General Response	Technology	Process Options	Description	Comments
No Action	None	None	Used when natural attenuation will reduce threat	Required for consideration
Institutional Controls	None	Institutional Measures	Appropriate signage, agreements with owners of property overlying affected groundwater, and notice to potential users of groundwater, etc.	Applicable to site
Containment	Vertical Barrier	Slurry Wall	Trenches filled with bentonite/soil mixture act as barrier to groundwater flow	Applicable as part of funnel/gate
		Sheet Piling	Sheet piles driven into silty layer act as barrier to groundwater	Applicable as part of funnel/gate
		Grout Curtain	Vertical barrier constructed of grout acts as barrier to groundwater flow	Not necessary
		Upgradient Wells	Wells placed upgradient intercept groundwater before it reaches site	Not necessary
Collection	Drains	Subsurface Drains	Perforated piping placed in trenches intercepts groundwater plume	Required pumping rate too high
	Wells	Downgradient Wells	Downgradient wells intercept the contaminant plume	Applicable
		Recovery Wells	Well installed in area of free product to recover LNAPL layer	Applicable
		Extraction/Injection Wells	Extraction with upgradient injection increases efficiency of system	Applicable
Discharge	Pump	Surface Water Discharge	Extracted water discharged to stream or storm sewer	Applicable
		Deep Injection Well	Extracted water injected into deep well	Ban on use in NYS
		Groundwater Discharge	Discharge treated water back into aquifer	Applicable
		POTW Discharge	Discharge of treated/untreated water to local POTW	depends on Sherburne POTW
Treatment	Biological	Anaerobic	Degradation by microbes in low oxygen environment	Not applicable to contaminants
		Aerobic	Degradation by microbes in oxygen-enriched environment	Applicable
	Physical	Air Stripping	Packed tower or diffused aerator remove contaminants	Limited to flow< 30 gpm
		Carbon Adsorption	Adsorption of contaminants onto activated carbon	Applicable
		Steam Stripping	Separation of contaminants from groundwater by steam stripping	Not applicable to site
	Chemical	UV Oxidation	uv radiation and OH^- radical oxidize organics	Limited to flow < 37 gpm
		Solvent Extraction	Use surfactant or other solvent to dissolve adsorbed contaminants	In situ control difficult
		Sedimentation/Flocculation	Gravity separation of immiscible layers	Not applicable to contaminants
	In-situ	Biodegradation	Air injection, nutrient addition, etc., for enhanced mineralization of organics	Operation difficult to control
		Air Stripping (Air Sparging)	Air injection wells or trenches & SVE system for stripping and venting of VOCs	Applicable
		Permeable Reaction Wall	Permeable, subsurface wall containing iron catalyzes dechlorination of HOX's	Applicable

Note: Shaded Options have been removed from further consideration

Table 4-4

Preliminary Remedial Alternatives for Operable Unit No. 1

General Instrument Corporation
Sherburne, NY Facility

General Response Action	Technology Type	Process Option	Preliminary Alternative I	II	III A	III B	III C	IV
No Action	No Action	Monitoring Program	•	•	•	•	•	•
Excavation	Excavation	Excavate Hot Spots/Bring In Fill		•				
		Excavate all soil with PID>5ppm			•	•	•	
Treatment	Physical/Chemical	Thermal Treatment (Incineration)			•			
		Thermal Desorption				•		
		Soil Washing or Flushing with Surfactant					•	
	In-Situ	Soil Vapor Extraction/ Bioventing						•
Containment	Cap	Low permeable cap over soil		•				
Disposal	Disposal	On-Site				•	•	
		Off-site		•	•			

Table 4-5

Preliminary Remedial Alternatives for Operable Unit No. 2

General Instrument Corporation
Sherburne, NY Facility

General Response Action	Technology Type	Process Option	Preliminary Alternative I	Preliminary Alternative II	Preliminary Alternative III A	Preliminary Alternative III B
No Action	No Action	Monitoring	•	•	•	•
Excavation	Excavation	Excavate Stained Soils			•	•
Treatment	Physical/Chemical	Soil Venting/Bioventing				•
		Thermal Treatment			•	
Containment	Cap	Low permeability cap over soil		•		
Disposal	Disposal	Off-Site			•	
		On-Site				•

Table 4-6

Preliminary Remedial Alternatives for Operable Unit No. 3

General Instrument Corporation
Sherburne, NY Facility

General Response Action	Technology Type	Process Option	Preliminary Alternative					
			I	II	III		IV	
					A	B	A	B
No Action	No Action	No Action	•					
Institutional Controls	Institutional Controls	Monitoring	•	•	•	•	•	•
		Well Restrictions		•	•	•	•	•
Recovery	Plume and/or Contaminant Recovery	Downgradient Wells - (West Field)				•		
		On site Recovery Well(s)			•	•	•	•
		Free Product Recovery	•	•	•	•	•	•
Treatment	Biological	Aerobic Bioremediation			•	•		
	Physical/Chemical	Air Stripping			•	•		
		Activated Carbon Adsorption			•	•		
		uv Oxidation (w/H2O2 and/or O3)			•	•		
	In-situ	Air Sparging						•
		Permeable Reaction Wall					•	
Discharge	Discharge	to Surface water via storm sewer			•	•		
		to POTW			•	•		
		to Groundwater			•	•		

TABLE 6-1

COST ESTIMATE SUMMARY
OPERABLE UNIT NO. 1 (SOIL)
General Instrument Corporation
Sherburne, NY Facility

Alternative	Capital Cost	Annual O&M Costs	Total Cost Present Worth
1. No action with monitoring	$ 0	$ 6,000	$ 90,000
2. Excavation and capping	625,000	4,000	655,000
3. Excavation and treatment			
a. Thermal destruction	2,300,000	6,000	2,330,000
b. Thermal desorption	1,070,000	6,000	1,100,000
c. Soil washing	1,120,000	6,000	1,150,000
4. In-situ treatment			
a. SVE	280,000	100,000	880,000

TABLE 6-2

COST ESTIMATE SUMMARY
OPERABLE UNIT NO. 2 (PETROLEUM SPILLS)
General Instrument Corporation
Sherburne, NY Facility

Alternative	Capital Cost	Annual O&M Costs	Total Cost Present Worth
1. No action with monitoring	$ 7,000	$3,000	$20,000
2. Capping	22,000	3,000	42,000
3. Excavation and thermal treatment	29,000	4,000	49,000
4. Excavation and soil venting	12,000	4,000	32,000

TABLE 6-3

COST ESTIMATE SUMMARY
OPERABLE UNIT NO. 3 (GROUNDWATER)
General Instrument Corporation
Sherburne, NY Facility

	Alternative	Capital Cost	Annual O&M Costs	Total Cost (Present Worth)
1.	No action with monitoring	$	$ 19,000	$ 300,000
2.	Institutional controls		19,000	300,000
3A.	Pump and treat using air stripping (on-site only)	195,000(1)	194,000	1,700,000
3B.	Pump and treat using air stripping (on- and off-site)	1,000,000	289,000(2)	3,300,000
4A.	In-situ treatment (permeable reaction wall)	2,400,000	30,000(3)	2,700,000
4B.	In-situ treatment (air sparging)	2,500,000	170,000(4)	4,300,000

(1) O&M costs for first 10 years; estimated time until cleanup approximated at 20 years.
(2) O&M costs for first 10 years; estimated time until cleanup approximated at 5 to 10 years.
(3) O&M costs for reaction wall system only; estimated time frame for cleanup at 5 to 10 years.
(4) O&M costs for 15 years; estimated time frame for cleanup approximated at 15 years.

TABLE 6-4

PREDICTED CONTAMINANT CONCENTRATIONS IN EXTRACTED GROUNDWATER

General Instrument Corporation
Sherburne, NY Facility

COMPOUND	CONCENTRATION (ug/L)
1,1-Dichloroethane	16
1,2-Dichloroethene (Total)	3550
1,1,1-Trichloroethane	70
Trichloroethene	130
Tetrachloroethene	56
Vinyl Chloride	198
Toluene	74
Xylene	56
Naphthalene	955
2-Methylnaphthalene	2612
Acenaphthene	82
Dibenzofuran	109
Fluorene	142
n-Nitrosodiphenylamine	660
Phenanthrene	609
Anthracene	141