EPA WORK ASSIGNMENT NUMBER: 181-2LZ9
EPA CONTRACT NUMBER: 68-01-7250
EBASCO SERVICES INCORPORATED

FINAL WORK PLAN
REMEDIAL INVESTIGATION/ FEASIBILITY STUDY

BEC TRUCKING SITE
VESTAL, NEW YORK

W.A. NO. 181-2LZ9

MARCH 1988

NOTICE

The information in this document has been funded by the United States Environmental Protection Agency (USEPA) under the REM III Contract No. 68-01-7250 to Ebasco Services Incorporated (Ebasco).

EPA WORK ASSIGNMENT NUMBER: 181-2LZ9
CONTRACT NUMBER 68-01-7250
EBASCO SERVICES INCORPORATED

FINAL WORK PLAN FOR
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
BINGHAMTON EQUIPMENT COMPANY (BEC) TRUCKING SITE
VESTAL, NEW YORK

MARCH 1988

Prepared By:

John F. Gorgol

John F. Gorgol, E.I.T.
Site Manager
EBASCO Services Incorporated

Approved By:

Dev R. Sachdev

Dev R. Sachdev, Ph.D., P.E.
Regional Manager, Region II
EBASCO Services Incorporated

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

FIGURES

TABLE OF CONTENTS (continued)

TABLES

1.0 INTRODUCTION

Ebasco Services Incorporated (Ebasco) is submitting this Work Plan to the U. S. Environmental Protection Agency (EPA) in response to EPA Work Assignment Number 181-2LZ9 dated September 21, 1987 under Contract Number 68-01-7250. Preparation of this Work Plan was accomplished pursuant to Ebasco's Work Plan Memorandum dated October 23, 1987.

This Work Plan presents Ebasco's technical scope of work as well as an estimated level of effort, costs and schedule for performing a Remedial Investigation and Feasibility Study (RI/FS) for the Binghamton Equipment Company (BEC) Site (the site), located in the Town of Vestal, Broome County, New York.

1.1 PROJECT APPROACH

The overall strategy for performing the RI/FS for the BEC Trucking Site is somewhat different than the strategy for most other sites because of the absence of preliminary site characterization information. The objective of the Phase I field investigation is to conduct a search for the existence of contamination at the site. If the Phase I field investigation indicates a need for Phase II investigation, a Technical Direction Memorandum (TDM) will be prepared for EPA approval which will contain proposals for a Phase II field investigation. The need for possible treatability studies would also be addressed at that time.

The Phase I program is the only field investigation plan scoped, budgeted and scheduled in this Work Plan. Not including the two extra months requested by EPA for PRP review of the Final RI/FS Work Plan, and if additional field investigations and/or treatability studies are not required, the RI/FS, as proposed in this Work Plan, is scheduled to be completed in approximately 18 months.

1.2 PROJECT PLANNING

This RI/FS Work Plan was prepared based upon review and consideration of the data, information, and documents obtained through the following activities:

- A project kick-off meeting was held with the EPA RPM and the REM III Site Manager on October 7, 1987. Copies of project files and pertinent reports were provided by the EPA at that time. These include copies of the preliminary HRS ranking report, Vestal Wellfield exploration report, and RI/FS Work Plan of the Robintech Inc./National Pipe Co. Site.

- On October 21, 1987, a site reconnaissance was conducted to inspect and confirm the existing site conditions and the environment surrounding the site. Rough surveying of the physical features on- and off-site was conducted to prepare a site map for this Work Plan. A representative from the NYSDEC was present at the site and provided valuable background information.

- On November 23, 1987, publications discussing regional geology were received from the US Geological Survey. This information has been incorporated in this Work Plan.

- On November 23, 1987, a Scoping meeting with EPA Region II was held. During that meeting, the Ebasco project team presented their concepts, approach, and scope for the RI/FS. Comments from EPA have been incorporated into this Work Plan.

- On December 7, 1987, a follow-up site visit was conducted to confirm conditions observed on October 21, 1987 and to evaluate proposed monitoring well locations. In addition, representatives from the Town of Vestal Engineering Department and Broome County Health Department were interviewed and all pertinent information was acquired or recorded.

- On December 9, 1987, an information package on the Vestal Well 4-2 Superfund Site was received from the EPA. Data from this package was utilized in preparation of this Work Plan.

The Work Plan was prepared in accordance with the following guidance documents:

- The June 1985 EPA Guidance on Remedial Investigation under CERCLA,

- The June 1985 EPA Guidance on Feasibility Studies under CERCLA,

- The "Superfund Amendments and Reauthorization Act" requirements (particularly as related to remedial alternatives and ARARs),

- J. W. Porter's December 1986 and July 1987 memoranda on "Interim Guidance on Superfund Selection of Remedy", and

- The March 1987 EPA Guidance on Data Quality Objectives for the RI/FS Process.

Ebasco's Work Plan contains six sections including this introduction. Specifically, Section 2.0 summarizes the existing data on this site; Section 3.0 describes Ebasco's scoping process for the planned RI/FS; Section 4.0 presents details of the RI tasks for the site investigation; Section 5.0 presents the FS tasks for selecting a remedial alternative for the site; and Section 6.0 summarizes Ebasco's project management approach, including Level of Effort (LOE) and Other Direct Cost (ODC) estimates and a project schedule. The LOE and ODC estimates and target schedule have been provided for all projected activities through the completion of the RI/FS.

2.0 SUMMARY OF EXISTING DATA

2.1 SITE LOCATION, SITE HISTORY, AND CURRENT CONDITIONS

The discussion in this section is primarily contained in documents obtained by Ebasco as discussed in Section 1.2 as well as the information collected during the two site visits.

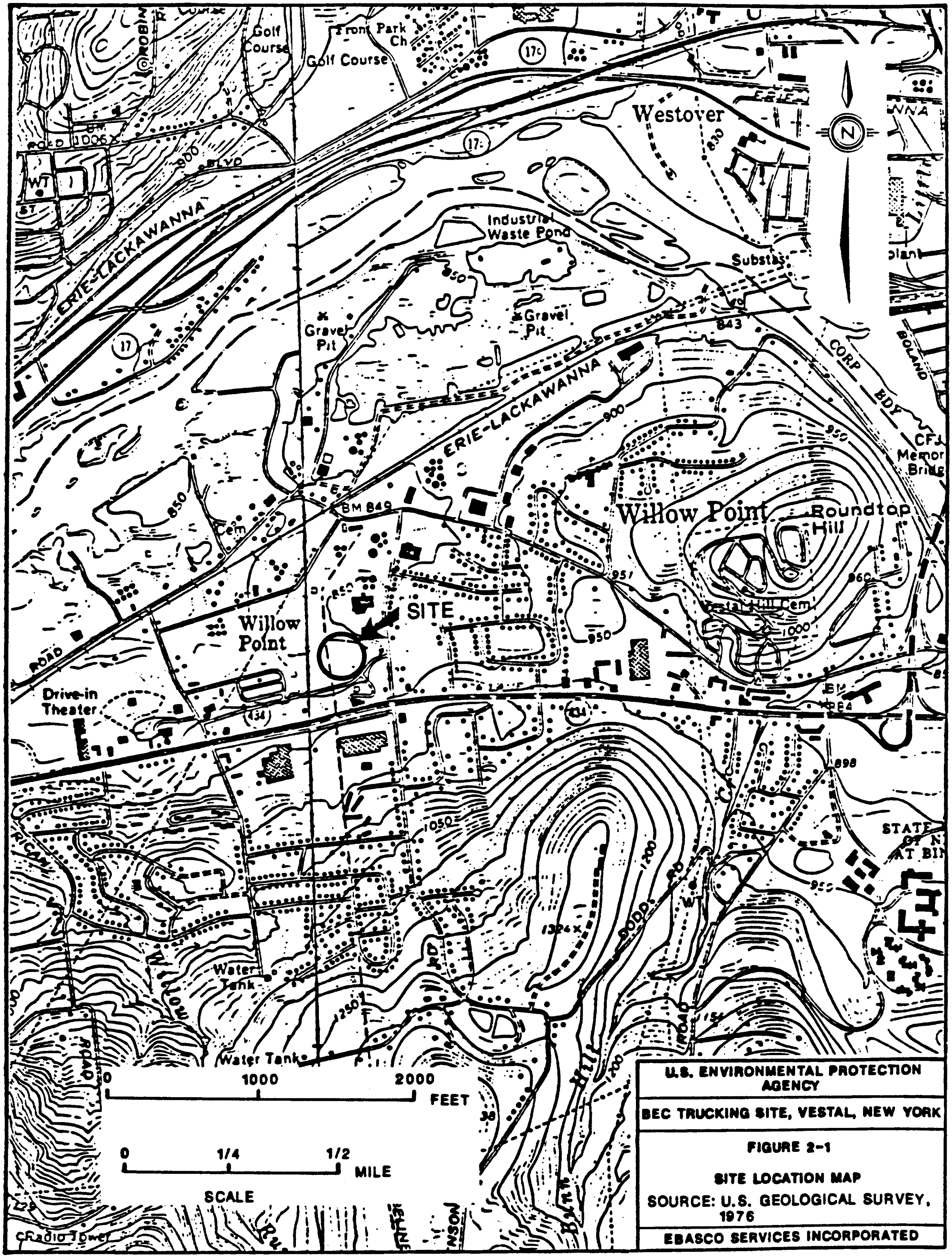
2.1.1 Site Location

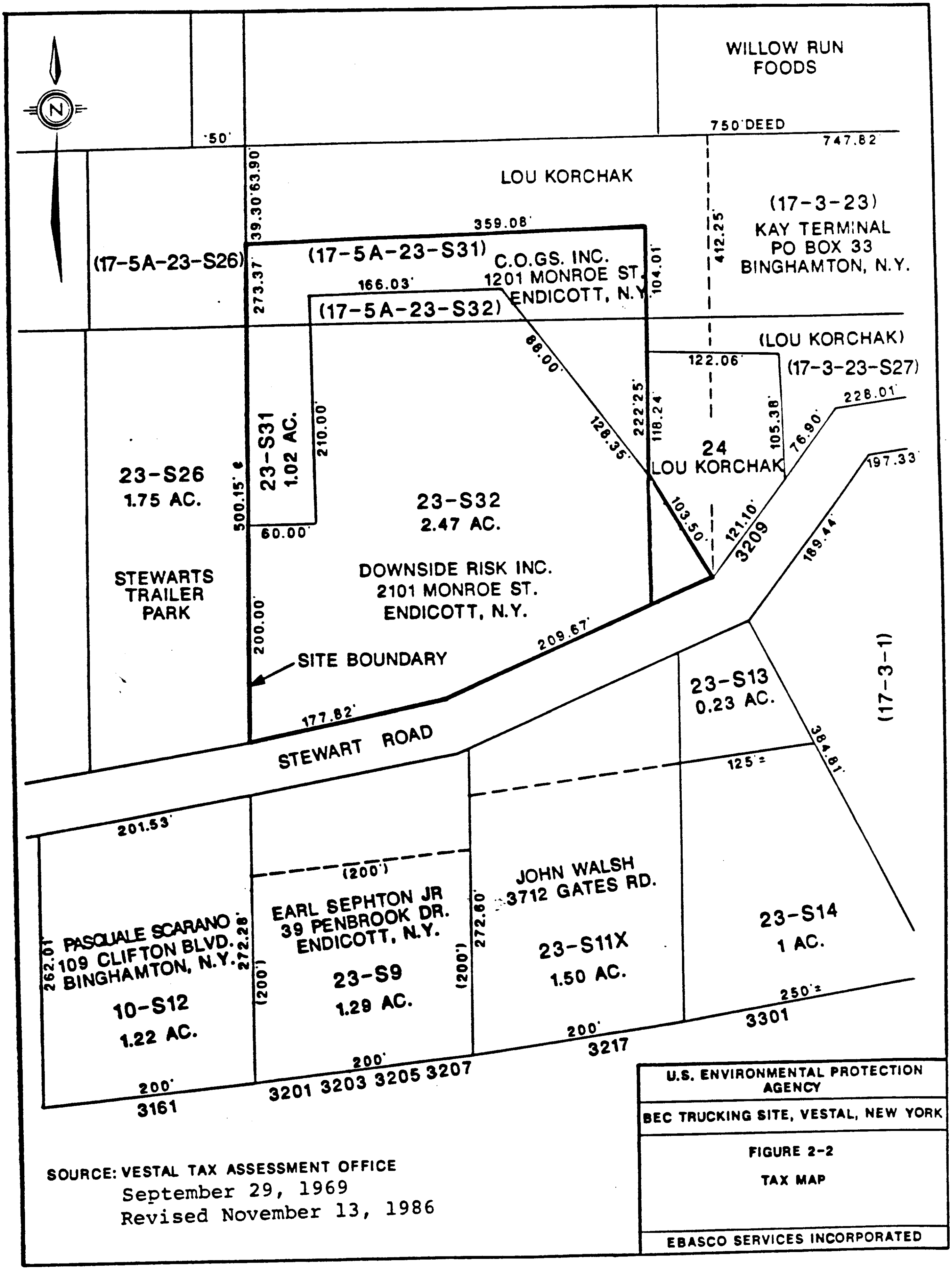
The BEC Trucking Site is an open lot of approximately 3.5 acres located in the Town of Vestal, Broome County, New York (Figure 2-1). The area surrounding the site is primarily suburban and commercial. As shown in Figure 2-2, the site is bordered by: Stewart Road to the south, a petroleum tank farm (Kay Terminals) to the east, other properties (open lots) owned by Lou Korchak to the east and north, and Stewarts Trailer Park to the west.

BEC Trucking is situated within the generally flat lying plain of the glaciated Susquehanna River valley, at an elevation of 850 feet above mean sea level. The study area is located at the base of the steep southern wall of the glacial valley. The top of the valley wall rises approximately 50 feet above the level of the site. The valley floor slopes gently northwest from the site toward the Susquehanna River. The river flows in a westerly direction within a wide meander arching from northeast to northwest of the site. The closest reach of the river is approximately 4400 feet away in a direction north-northwest of the site. Review of the USGS topographic quadrangle maps of the area indicates that there are no direct surface water courses between the site and the Susquehanna River. The site drains into a marshy area located to the north and west of the site and continues flowing to the west behind the Stewart Trailer Park. Field observations show that the western march area also receives surface water runoff from the south side of Stewart Road. Although, not field verified the surface water from the ponded area behind Stewart Trailer Park is reported to eventually discharge into the Susquehanna River. The Town of Vestal Water District No. 4 well field is near the southern bank of the Susquehanna River, about 4,000 feet north-northeast of the site.

2.1.2 Site History

Prior to the mid 1960's the BEC Trucking Site was an unimproved marshland property owned by the Stewart family. A member of the Stewart family (Paul Standish) reported to Ebasco personnel that his father sold the property to Haial Trucking (which later became BEC Trucking) in the mid 1960's. Upon purchase of the property, Haial Trucking proceeded to fill the marsh land with fill material which could be coal ash, possibly supplied by the local power company. Approximately 10 to 15 feet of this


Golf Course
Front Park Ch
Golf Course
Westover
ERIE-LACKAWANNA
Industrial Waste Pond
Substa
Gravel Pit
Gravel Pit
843
CORP BDY
BOLAND
CFJ Memor Bridg
Willow Point
Roundtop Hill
BM 849
Cem
SITE
Willow Point
Vestal Hill Cem
Drive-in Theater
898
STATE
Water Tank
Water Tank
Radio Tower
0 1000 2000 FEET
0 1/4 1/2 MILE
SCALE
U.S. ENVIRONMENTAL PROTECTION AGENCY
BEC TRUCKING SITE, VESTAL, NEW YORK
FIGURE 2-1
SITE LOCATION MAP
SOURCE: U.S. GEOLOGICAL SURVEY, 1976
EBASCO SERVICES INCORPORATED



U.S. ENVIRONMENTAL PROTECTION AGENCY

BEC TRUCKING SITE, VESTAL, NEW YORK

FIGURE 2-2

TAX MAP

EBASCO SERVICES INCORPORATED

SOURCE: VESTAL TAX ASSESSMENT OFFICE
September 29, 1969
Revised November 13, 1986

material was dumped across the site to bring the pre-existing grade up to a level above the marsh. This was then covered with natural imported silt, sand, and gravel fill material that is currently exposed at the surface of the site. A one acre marshland area remains unfilled on the western and northern edge of the property and a surface drainage ditch traverses the eastern and northern perimeter of the site. Haial Trucking used the 3.5 acre site for storing trucks and tankers. BEC Trucking, successor to Haial Trucking, was involved in truck body fabrication and maintenance of large trucks. A property located immediately south of Stewart Road, toward Vestal Parkway, is the site of two industrial buildings which also housed BEC Trucking operations. According to the NYSDEC, BEC Trucking had several municipal contracts for maintenance work with local cities and towns. Large quantities of waste hydraulic oil and waste motor oil were reportedly generated as a result of this operation. BEC Trucking also painted the truck bodies they fabricated and paint thinner was used in this process. According to a former supplier, Autofinishers Finishes and Supply Co. (per NYSDEC report), approximately one drum of enamel reducer per month was sold to the BEC Trucking firm. BEC Trucking routinely stored their drums containing waste engine oil, cutting oil, and other liquid waste materials on the site. On September 1, 1981, Bankruptcy Court took possession of the BEC Trucking property.

Concern for contamination at the 3.5 acre BEC Trucking property began in May 1982 when the Town of Vestal found evidence of on-site illegal dumping of miscellaneous debris and the improper storage of drums containing what appeared to be petroleum and chemical products. The Town of Vestal notified New York State authorities of the situation and expressed a request for the cleanup of the drums and the contaminated soil surrounding the drums. A NYSDEC inspection of the site in May 1982 revealed the presence of approximately fifty 55-gallon surface drums stored on the western side of the property. Approximately twenty of the drums contained liquid waste material, ranging from several inches to almost completely full. The remainder of the drums were empty. Upon visual inspection of the drum contents, the majority of drums appeared to contain waste engine or cutting oil. Several drums contained what appeared to be enamel reducer or paint thinner, at least one drum appeared to contain waste solvent, and several drums could not be opened for examination. Some drums emitted a paint thinner odor and a number of drums were marked with "Hazardous" labels identifying methanol, toluene and petroleum distillates. Although none of the filled drums appeared to be leaking at the time of the DEC inspection, a zone of distinct ground spillage approximately one to two hundred square feet in size was noted in the area of the drums. Four additional drums were found in the marsh on the western side of the property and some small spillage was apparent at the edge of the marsh. One of the drums in the marsh contained liquid of an unknown nature. According to a former owner of the bankrupt Binghamton Equipment Corporation (BEC), the drums investigated by the NYDEC were likely to have belonged to BEC during the time of the company's operation.

An additional unconfirmed claim regarding the site occurred in June 1982 when the Vestal Code Enforcement Office received an anonymous phone call from a person claiming to be a former employee of BEC. This person alleged that BEC disposed of liquid waste in the marsh area and that cleaning effluent from the steam cleaning of chemical tankers, to be worked on by BEC, was commonly discharged to the groundsurface at the site. In January 1983, the NYDEC requested that the site be added to the Superfund list. The Hazard Ranking System (HRS) score for this site is 37.52.

The 3.5 acre site was purchased by COGS, Inc. in February 1983, following a foreclosure auction on the property. A portion of the property was transferred to Downside Risk, Inc. in April 1983, and a small parcel of the property was purchased from COGS in July 1986 by James Walsh, but has subsequently been transferred back to Downside Risk Inc. In November 1986, John E. Walsh, the current site owner, purchased all outstanding stock of COGS, Inc. and Downside Risk Inc.

Remediation at the site to date has consisted of removal of the approximately 50 surface drums and excavation of 4 drums of soil. In August 1983, COGS Inc. contracted with a NYSDEC approved waste oil hauler to remove the on-site drums containing liquid. Other empty drums were removed for disposal to a scrap yard. According to the current site owner, contaminated soil was excavated and placed in four drums which are stored at the site today. The type and extent of any existing groundwater, surface water, soil or sediment contamination has not been characterized to date.

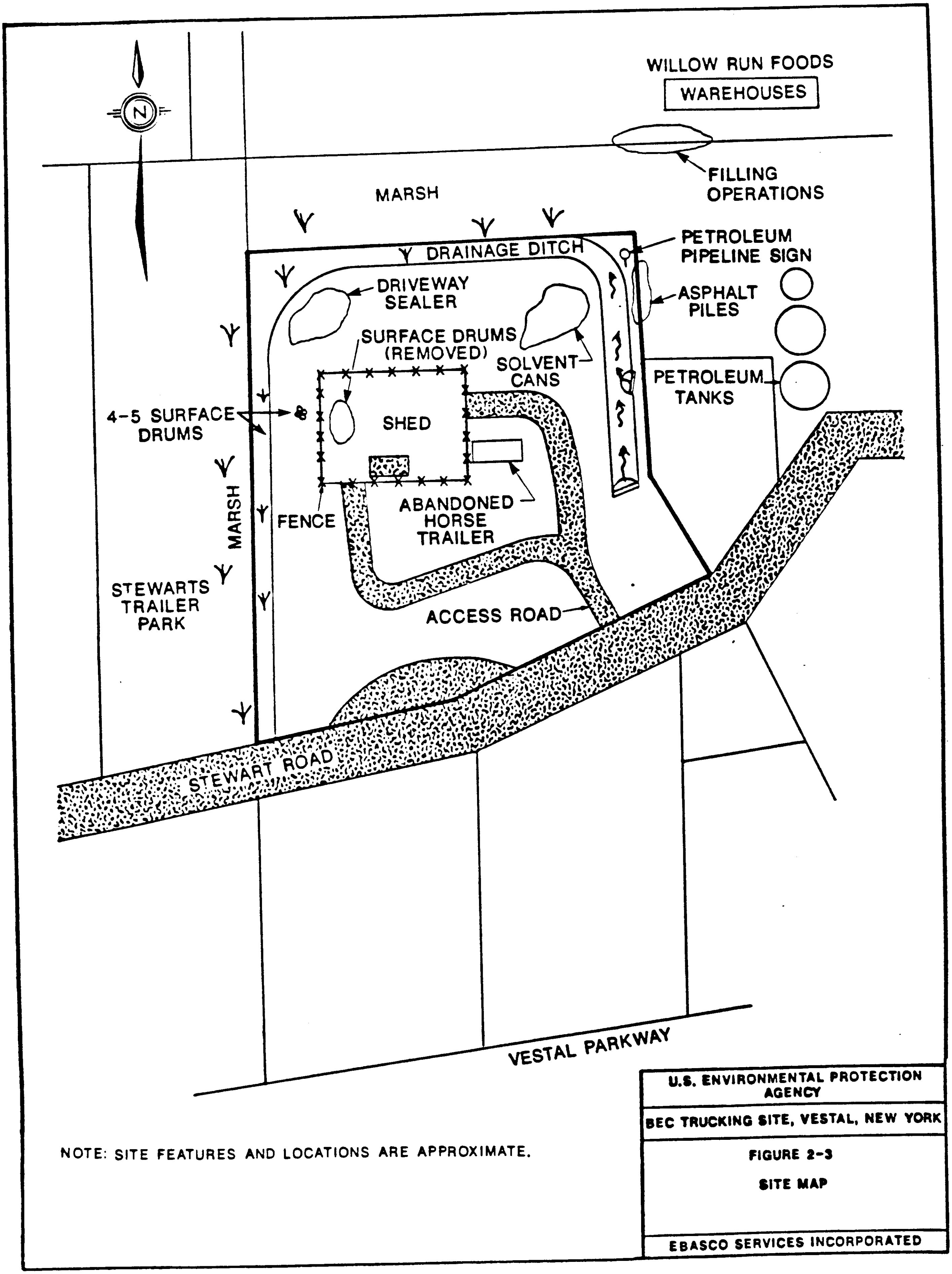
2.1.3 Current Conditions

The project site is predominantly flat-lying and sparsely vegetated and is surrounded by a drainage ditch on the east and north sides and a marsh area on the west and northwest sides. Briars and brush are common along the northwestern area of the site bordering the marsh. Surface water flowing in the perimeter ditch and the marsh discharges at the northwest corner of the site and ultimately flows in a westerly direction behind Stewart's Trailer Park where there it becomes stagnant. The central portion of the site which is surrounded by the drainage ditch and marsh was once former marshland which has been extensively filled. Soils exposed at the surface of the site are imported fill materials composed of medium to dark brown sandy silt with gravel and cobbles. Surface drainage pathways within the flat-lying fill area are not well defined and downward percolation through the porous fill materials appears to be the predominant transport pathway for rainwater infiltration. Neither the presence of leachate nor the presence of stressed vegetation have been observed.

The site is now used as an open storage/dump type facility by the present owner, a construction contractor. A schematic of the current site layout is given in Figure 2-3. Inspections of the property by REM III personnel in October and December, 1987 revealed the presence of miscellaneous contruction debris stockpiles across the site (wooden pallets, cinder blocks, metal beams, railroad ties, fence posts), several large truck and trailer bodies in the eastern and central part of the site, rolls of wire mesh fencing stored within a fenced area in the west central part of the site, and a metal storage shed within the fenced area. Miscellaneous trash debris (tires, shopping carts, empty rusted drums and cans) were noted along the northern and western edge of the fill area and within the marsh. Some of the discarded drums were labeled as driveway sealer. Empty solvent cans were observed in the northeastern part of the site. Additionally, four drums containing contaminated soils excavated from around the former on-site drum storage area were observed on the west side of the fenced area. The drums have no lids and are in poor condition. Ponded rainwater was noted in the top of the drums. Sealing these drums by fitting them with lids would serve as an interim action to reduce the probability of material spilling from these drums. A representative from the NYSDEC who participated in the REM III site visit indicated that the approximate location of the former drum storage area coincides with the area located within the western part of the fenced area, and extends out beyond the west side of the fence. A faint petroleum odor was noted within the fenced area.

Signs indicating that a petroleum pipeline runs beneath the site were noted. Review of the USGS quadrangle map (Figure 2-1) suggests that the main pipeline is oriented in a north-south direction and is located beneath the western part of the site. Another pipeline, branching off of the main pipeline may run in an east-west direction beneath the site.

At the time of the REM III inspection in October 1987, a liquid discharge from Kay Terminals (located adjacent to the eastern side of the property) was observed to enter the eastern drainage ditch. Kay Terminals primarily operates as a petroleum tank farm. The facility has a SPDES permit (NY-010 8740) to the discharge 50 gallons per day of treated storm water from the dike area into the on-site (BEC Trucking) drainage ditch subsequent to oil/water separation. Kay Terminals is prohibited to receive wastes or wastewaters from other facilities for treatment and/or discharge. Currently, the permit specifies that the discharge be monitored and limited by the permittee



NOTE: SITE FEATURES AND LOCATIONS ARE APPROXIMATE.

for flow (monitor only), oil and grease (15 mg/l max.), pH (6.5 - 8.5), benzene (0.001 mg/l max.), toluene (0.050 mg/l max.), and xylene (0.050 mg/l max.). A minimum measurement frequency of monthly is specified. Prior to 1982, the discharge was monitored and limited for only oil and grease. Kay Terminals has utilized a surface water discharge since July 27, 1981, previously a subsurface discharge was employed.

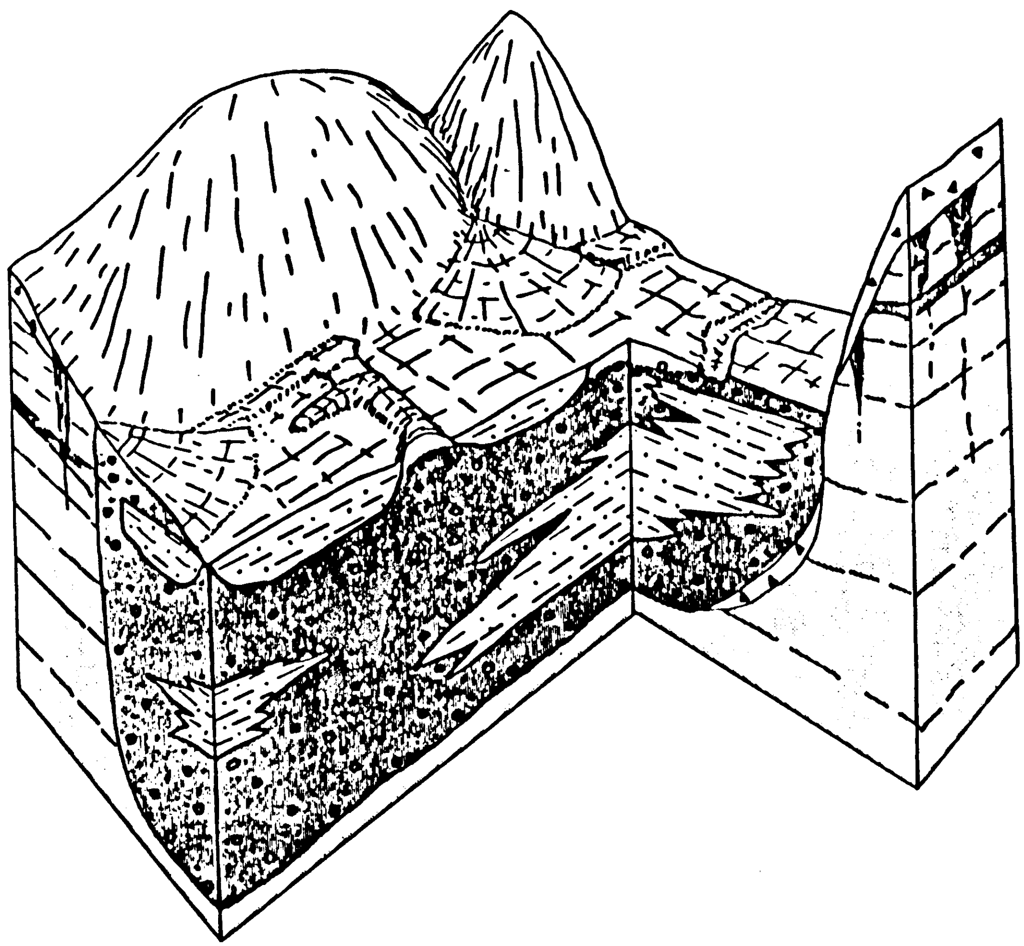
2.2 SITE DESCRIPTION

2.2.1 Geology

The geology of the BEC Trucking Site consists of unconsolidated sand, gravel, silt, and clay deposits overlying shale bedrock. The site is situated in the glaciated Appalachian Plateau Physiographic Province. Topography of the area is characterized by broad valleys that were cut into the bedrock, then partly filled with glacial till and stratified glacial deposits (Figure 2-4 illustrates the geology typical for glacial valley deposits in the area of the site). The valleys are bordered by rounded hills and knolls with flat tops, remnants of the Appalachian Plateaus.

The stratigraphy at the site includes units of broadly disparate chronological extent. Bedrock is mapped by the New York State Geological Survey as the West Falls Group, a late Devonian sedimentary rock unit. The unit, in the vicinity of the site, consists predominantly of gray shale with some interbedded sandstone. Bedding dips slightly to the south. The shale has a well developed, generally vertical joint pattern with a primary north-south orientation and secondary northeast-southwest and northwest-southeast trends. The depth to bedrock at the site is expected to range from 20 to 40 feet.

Blanketing the Late Devonian age bedrock are glacial materials deposited during and subsequent to Wisconsin glaciation of the Pleistocene Epoch. Generally, the material directly above the bedrock is glacial till. Tills are deposited directly by an ice mass without being reworked or re-deposited by meltwater. Therefore, tills are both unsorted and unstratified deposits consisting of clay, silt, sand, and gravel. The deposition mechanism of glacial till creates a densely packed material with low permeability. Overlying the till are stratified and sorted sediments deposited by meltwater. These sediments are broadly classified into ice contact deposits and outwash deposits. Outwash deposits consist of sediments that have been transported by meltwater a considerable distance prior to deposition. Ice contact deposits consist of sediments that were deposited near the edge of a melting glacier. Materials deposited by meltwater exhibit abrupt horizontal and vertical stratigraphic variation. Holecek and Randall (1982) mapped the site as being underlain by outwash or alluvial sand and gravel overlying lacustrine clay,



EXPLANATION

- Sand and gravel
- Lacustrine silts, clay, and very fine sand
- Till
- Bedrock, with fractures
- High-yielding aquifer material
- Low-yielding aquifer material

U.S. ENVIRONMENTAL PROTECTION AGENCY

BEC TRUCKING SITE, VESTAL, NEW YORK

FIGURE 2-4

TYPICAL GEOLOGY OF THE VALLEY FILL AQUIFER

SOURCE: MACNISH AND RANDALL, 1982

EBASCO SERVICES INCORPORATED

silt, and fine sand (ice contact deposit), as illustrated in Figure 2-5. The unconsolidated glacial deposits are expected to range from 10 to 30 feet thick at the site.

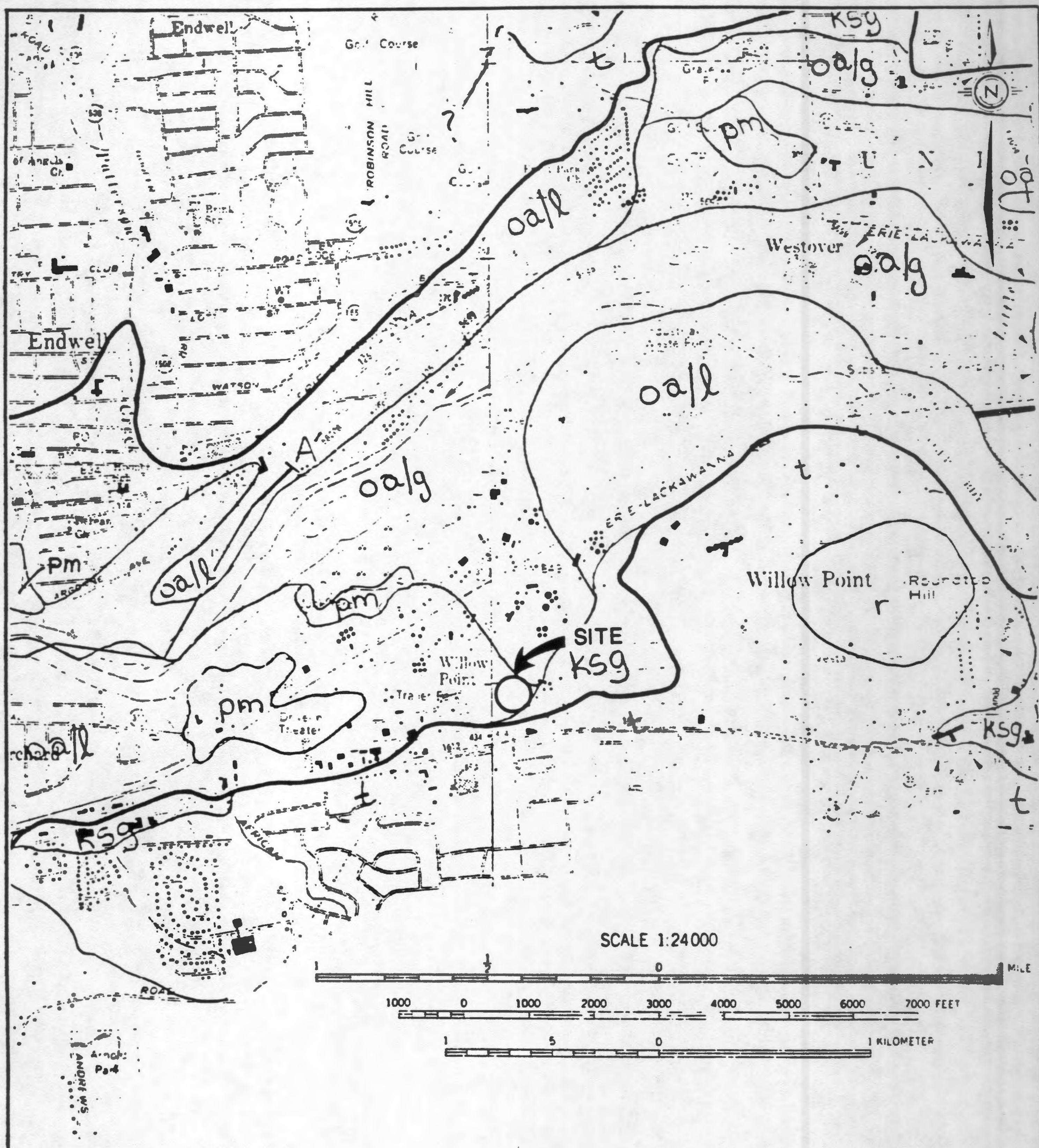
A portion of the site is overlain by an unknown thickness (estimated 15 feet maximum thickness) of fill which is predominantly composed of possibly black coal fly ash overlain by medium to dark brown silty sand with gravel and cobbles.

Original site soils on the southern half of the site are mapped as Volusia channery silt loam, 8 to 15 percent slopes; while soils on the northern half of the site are mapped as Wayland silt loam, 0 to 3 percent slopes. The Volusia soils which are the most extensive in the county, consist of deep, strongly acid, somewhat poorly drained loamy soils that form in glacial till. The soil generally occurs on long foot slopes where excessive runoff from higher areas accumulates.

A typical profile of the Volusia channery silt loam, 8 to 15 percent slope follows:

- 0 to 6 inches, very dark grayish-brown channery silt loam; medium and fine grain, very friable, abundant fine roots, strongly acid.
- 6 to 13 inches, olive-brown channery silt loam; fine and medium grain, distinct yellowish-brown mottles, friable, plentiful fine roots, strongly acid.
- 13 to 17 inches, gray channery silt loam; medium and coarse grain, yellowish-brown mottles, firm, few fine roots, strongly acid.
- 17 to 35 inches, dark grayish-brown channery silt loam; prism and tongue structure, fine grain, dark-brown mottles, extremely firm and brittle, few fine roots in tongues, strongly acid.
- 35 to 54 inches, dark grayish-brown channery silt loam; prism and tongue structure, medium and coarse grain, dark yellowish-brown mottles and common, dark brown to black manganese stains, extremely firm and brittle, no roots, medium acid.
- 54 to 64 inches, olive-brown channery silt loam; some very faint mottles, extremely firm and brittle, no roots, slightly acid.

The Wayland soils are deep, poorly drained to somewhat poorly drained, and form in slightly acid to neutral alluvium on flood plains.



EXPLANATION

pm	PEAT, MUCK, SILT AND CLAY	t	TILL
oa/g	OUTWASH OR ALLURIAL SAND AND GRAVEL OVERLYING ICE CONTACT SAND AND GRAVEL	r	BEDROCK
oa/l	OUTWASH OR ALLURIAL SAND AND GRAVEL OVERLYING LACUSTRINE CLAY, SILT AND FINE SAND	~	GEOLOGIC CONTACT
ksg	KAME AND KAME TERRACE SAND AND GRAVEL	—	AQUIFER BOUNDARY

U.S. ENVIRONMENTAL PROTECTION AGENCY

BEC TRUCKING SITE, VESTAL, NEW YORK

FIGURE 2-5

REGIONAL GEOLOGIC MAP
SOURCE: HOLECEK, RANDULL, BELLI, AND ALLEN (1982)

EBASCO SERVICES INCORPORATED

A typical profile of the Wayland silt loam follows:

- 0 to 8 inches, pale brown silt loam; few distinct dark yellowish-brown mottles, fine grain, very friable, abundant fine and medium roots, slightly acid.
- 8 to 11 inches, pale brown silt loam; many distinct dark yellowish-brown mottles, fine grain, friable, plentiful fine and medium roots, slightly acid.
- 11 to 25 inches, pale brown to grayish brown heavy silt loam; many prominant yellowish-brown mottles, fine and very fine grain, firm, few roots, slightly acid.
- 25 to 40 inches, gray heavy silt loam; many prominant yellowish-brown to light yellowish-brown mottles, fine grain, firm, no roots, neutral.
- 40 to 45 inches, dark gray stratified silt loam; fine sandy loam, and sandy loam, no roots, neutral.

The site soils are bordered to the south by the Chenango and Howard gravelly loams, 15 to 25 percent slopes and to the north by the Chenango and Howard gravelly loams, 5 to 15 percent slopes. The Chenango and Howard series consists of deep well-drained, medium textured gravelly soils that form in glacial outwash.

2.2.2 Hydrogeology

Groundwater in the study area occurs in two aquifers or water bearing zones. The unconsolidated material which overlies the bedrock constitutes the upper aquifer. The permeability of the unconsolidated material varies depending on grain size and shape, level of sorting, and degree of compaction. The permeability is generally low in glacial tills since the material is not sorted and dense. The permeability in the stratified glacial deposits can be low (silt and clay lacustrine deposits) or high (sand and gravel outwash deposit). The sand and gravel outwash deposits are the most prolific water bearing material in the Susquehanna River Basin. Municipal supply wells for the Town of Vestal draw up to 1,000 gallons per minute (gpm) from the outwash deposits.

Vestal's Water District No. 4 Wellfield, which has a well contaminated with trichloroethylene and 1,1,1-trichloroethane, is located approximately 4,000 feet northeast of the site. (See 2.4.1 for a discussion of this wellfield.)

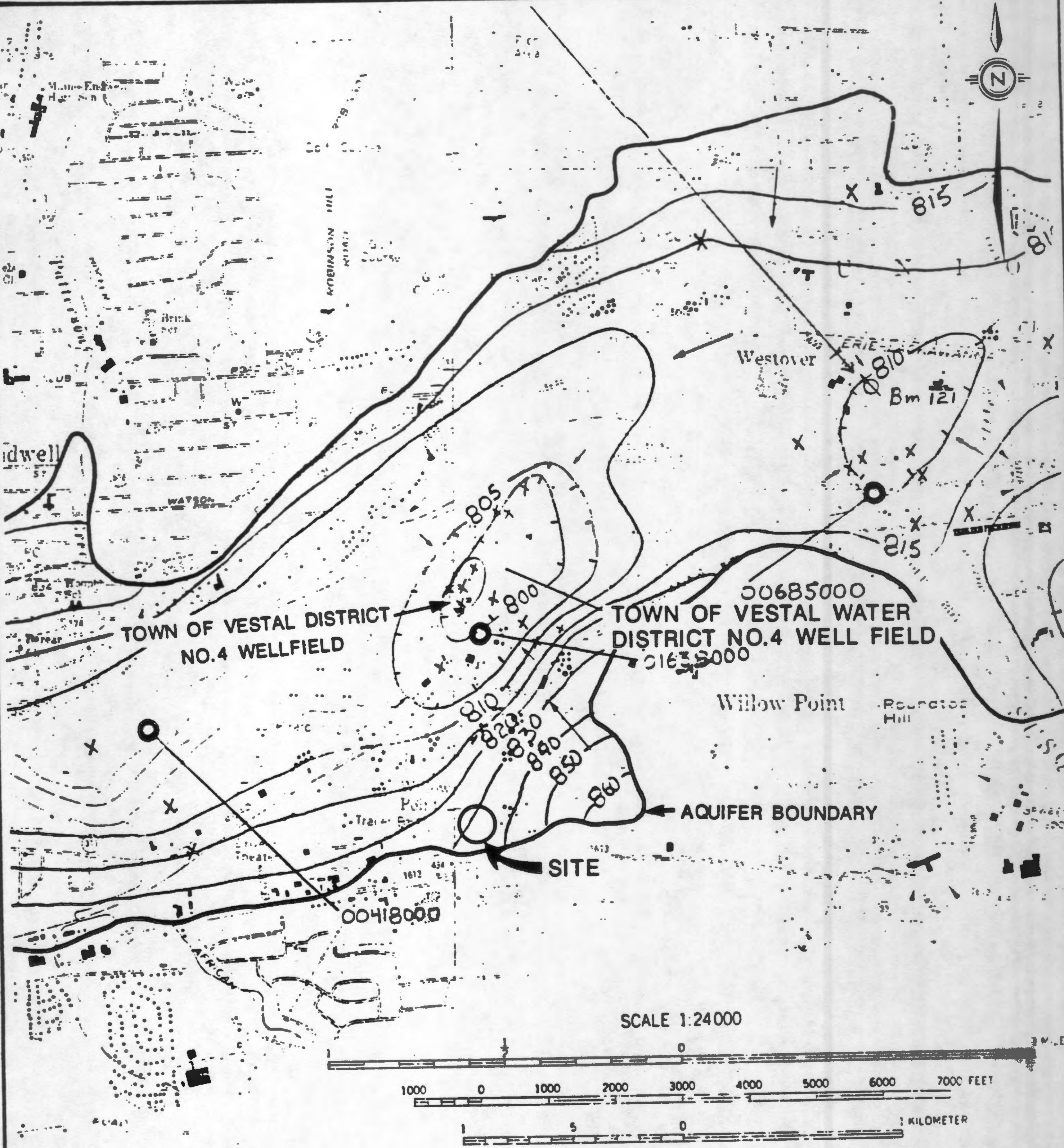
The West Fall Group comprises the lower aquifer in the study area. Groundwater movement and storage occurs predominantly in secondary permeability in shale bedrock. Bedding planes and joints combined to establish a network of interconnected openings through which water is transmitted. Well yields from the shale are adequate for domestic supply ranging from 25 to 50 gpm. Locally, the unconsolidated and bedrock aquifers may be separated by till. If of sufficient thickness, this till may act as an aquiclude hydrogeologically isolating these two flow systems. The nature of the till along with its vertical and horizontal extent at the site is unknown.

The overall regional flow direction in both systems is to the northwest toward the Susquehanna River (see Figure 2-6), which is a regional groundwater discharge point. Recharge to the upper aquifer occurs primarily via the infiltration of precipitation through surficial materials. The vertical hydraulic relationship between the upper aquifer and bedrock aquifer at the site is unknown at this time. The slope of the bedrock at the site is generally toward the northwest. Groundwater flow in the unconsolidated aquifer tends to follow the northwest direction of the bedrock surface slope. The direction of flow in the shale bedrock is primarily controlled by joints and fractures. Groundwater will flow along the bedrock surface until a fracture is encountered thereby entering the fracture network and moving downward through the bedrock. The elevation difference between the site and Bunn Hill to the south and Roundtop Hill to the east will provide a driving force for a northwesterly flow direction of groundwater in the fractured bedrock.

Local variations in regional flow patterns will occur near groundwater pumping centers. One such center exists at the Town of Vestal's Water District No. 4 Wellfield. The extent of influence of the wellfields on local groundwater flow is shown in Figure 2-6 by the limits of the hachured contours.

2.2.3 <u>Climate</u>

The study area has a humid, continental type (atmospheric flow is from continental sources) climate. Summers are pleasantly warm with temperature reaching 90 F only 2 to 4 times per year. The warmest month is July with an average daily maximum temperature of 78F and average daily minimum temperature of 59F. The winters are generally long and cold. The average daily maximum temperature for December, January and February ranges from 30 to 33F while the average daily minimum temperature for the same months ranges from 17 to 21F. The average annual precipitation is 36.84 inches and the mean is 37.03 inches. Precipitation in May through August accounts for over 40 percent of the annual precipitation accumulation. The driest months are November through February; collectively these months account for only 27 percent of the annual precipitation. Average annual runoff is about 22 inches. Almost half of the annual runoff occurs during the period from mid-February thru



EXPLANATION

~ 320 ~ POTENTIOMETRIC CONTOUR HACHURED CONTOURS SURROUND PUMPING CENTER CONTOUR INTERVALS 10 FEET ARROW INDICATES DIRECTION OF GROUNDWATER FLOW

AQUIFER BOUNDARY

O COMMUNITY WATER SYSTEM WELL OR WELL FIELD

X DATA POINT TO DRAW CONTOURS

Bm 121 OBSERVATION WELL

← GROUNDWATER FLOW DIRECTION

U.S. ENVIRONMENTAL PROTECTION AGENCY
BEC TRUCKING SITE, VESTAL, NEW YORK
FIGURE 2-6 POTENTIOMETRIC SURFACE MAP SOURCE: HOLECEK, RANDALL, BELLI, AND ALLEN (1982)
EBASCO SERVICES INCORPORATED

mid-May. Natural stream flow is generally derived from groundwater during the period from July to October. Stream flow characteristics of the Susquehanna River, gaged at the USGS station near Waverly, downstream of Vestal, include an average 7 day, 10 year low flow of 385 cu ft/sec. Average annual stream discharge is 7,580 cu ft/sec, and flow for the 100 year flood is estimated at 139,000 cu ft/sec. Flood control regulation by reservoirs upgradient of Vestal is negligible.

2.2.4 Population & Environmental Resources

The BEC Trucking Site is located in an area composed of industrial and commercial operations, residences, and wetlands. The site is bordered by industrial operations (Kay Terminals and Willow Run Foods) to the north and east, commercial businesses along Vestal Parkway to the south and by marshland to the west. West of and adjacent to the marsh is the Stewart Trailer Park which houses approximately 122 trailers. Recreational facilities are also located within a mile of the site including: an amusement park, drive-in theater, and ball fields. The Susquehanna River, which is also used for recreational purposes such as boating and fishing, is located 4400 feet north-northwest of the site. The Town of Vestal's District No. 4 Wellfield, which serves approximately 3700 people, is located about 4000 feet northeast of the site. The wellfield draws from the Endicott - Johnson City Aquifer. This aquifer covers 21 square miles within the Susquehana and Chenango River valleys. The Endicott - Johnson City Aquifer serves 110,000 people, regionally, and is a designated Safe Drinking Water Act Sole Source Aquifer. The BEC Trucking Site is located in the area designated as this Sole Source Aquifer, as illustrated in Figure 2-6.

2.3 EXISTING SITE CHEMICAL DATA

Very little information is available concerning the nature and magnitude of any existing contamination of the soil, surface water, groundwater, or air at the BEC Trucking Site. However, an inference can be made about contaminants likely to be present at the site based on knowledge of previous site activities and/or visual observations.

As summarized in Sections 2.1.2 and 2.3, previous investigations of the study area indicated that 55-gallon drums labelled as containing toluene, waste oils, and enamel reducer were stored or disposed of at the site. A 100 to 200 square foot area of stained soil was reported to be associated with these on-site drums. There is also the possible presence of benzene and xylene, in addition to toluene, as these compounds are often present in waste oils and paint products. Allegations that disposal of liquid wastes and steam cleaning of chemical tanker trucks took place in the marsh suggest that other contaminants, in addition to those described above, may also be present.

In January 1983, a composite sample was obtained from 8 drums found at the site. Analysis of this waste oil sample revealed a total organic halides (TOX) concentration of 1.4 ppm. The EP Toxicity analysis performed for this sample also indicated concentrations of lead (44.6 ppm) and cadmium (1.14 ppm) which exceeded EPA criteria. However, this information is more qualitative than quantitative. The TOX data do not allow characterization of the nature of the specific halogenated species measured. Furthermore, it is not possible to deduce the magnitude of the resultant contamination, if present, in the receiving media (e.g., soils in the area of the surface drums, surface water, etc.). However, the EP Toxicity results, in conjunction with the possibility that scrap metal disposal may have occurred at the site, suggest that heavy metals may also represent possible contaminants at the site. The potential presence of fly ash fill discussed in Section 2.1.2 could also exacerbate such contamination if it is present. Previous investigators have shown that some trace elements, notably manganese, chromium, and arsenic, are enriched on the surface of fly ash.

Immediately adjacent to the site, Kay Terminals has been discharging water which could contain benzene, toluene, xylene, oil and grease to surface water (the eastern drainage ditch on the BEC Trucking Site) since 1981. Before 1981, these contaminants may have been discharged directly to the subsurface. Although discharge quantities from Kay Terminals are currently controlled, prior to 1982 discharges of benzene, toluene, and xylene were not monitored or limited.

Regionally, the glacial aquifer underlying the site is known to be contaminated at several locations (e.g., Vestal Wellfield 4-2 and Vestal Wellfield 1-1) with volatile organic compounds in concentrations which exceed ARARs. Common contaminants include 1,1,1-trichloroethane, trichloroethylene, and tetrachloroethylene.

2.4 OTHER INVESTIGATIONS IN THE VICINITY

2.4.1 Vestal Wellfield District Number 4

The information presented in this subsection was obtained from the following documents: Hydrologic Study of a Portion of the Susquehanna River Valley in the Town of Vestal, Broome County, New York With Emphasis on Chemical Contamination of the Aquifer, Bazarnick and Stegville, NYSDEC, draft dated April 7, 1981; Settlement Agreement - Between State of New York and defendants Monarch Chemicals, Inc., Jones Chemicals, Inc., and Lee Knowles, dated April 6, 1981.

The Town of Vestal District No. 4 Wellfield is located along Prentice Road approximately 4000 feet north-northeast of the BEC

Trucking Site (see Figure 2-7). The wellfield consists of Wells 4-2, 4-3, and 4-4. The three wells are oriented along a northeast-southwest trending line. Well 4-3 is located equidistant (800') from Well 4-2, the southern most well and Well 4-4, the northern most well.

In early 1980, significant levels of trichloroethylene and 1,1,1-trichloroethane were discovered in Well 4-2. With this discovery, Well 4-2 was declared an unsuitable source of potable water. Pumping water from Well 4-2 to waste (the Susquehanna River) was initiated to purge the contaminants from the aquifer and protect Wells 4-3 and 4-4 from possible contamination.

The discovery of the contamination in Well 4-2 also initiated immediate investigations to determine the source of contamination. These investigations have identified Jones Chemicals, Inc., Monarch Chemicals, Inc., and Lee Knowles, Inc., as the parties responsible for the contamination of Well 4-2.

In 1985, the Town of Vestal, Monarch Chemicals, Jones Chemicals, and Lee Knowles signed a settlement agreement awarding the Town of Vestal with funds to construct and maintain an induced draft granular carbon treatment system or a granular activated carbon adsorption system for well 4-2.

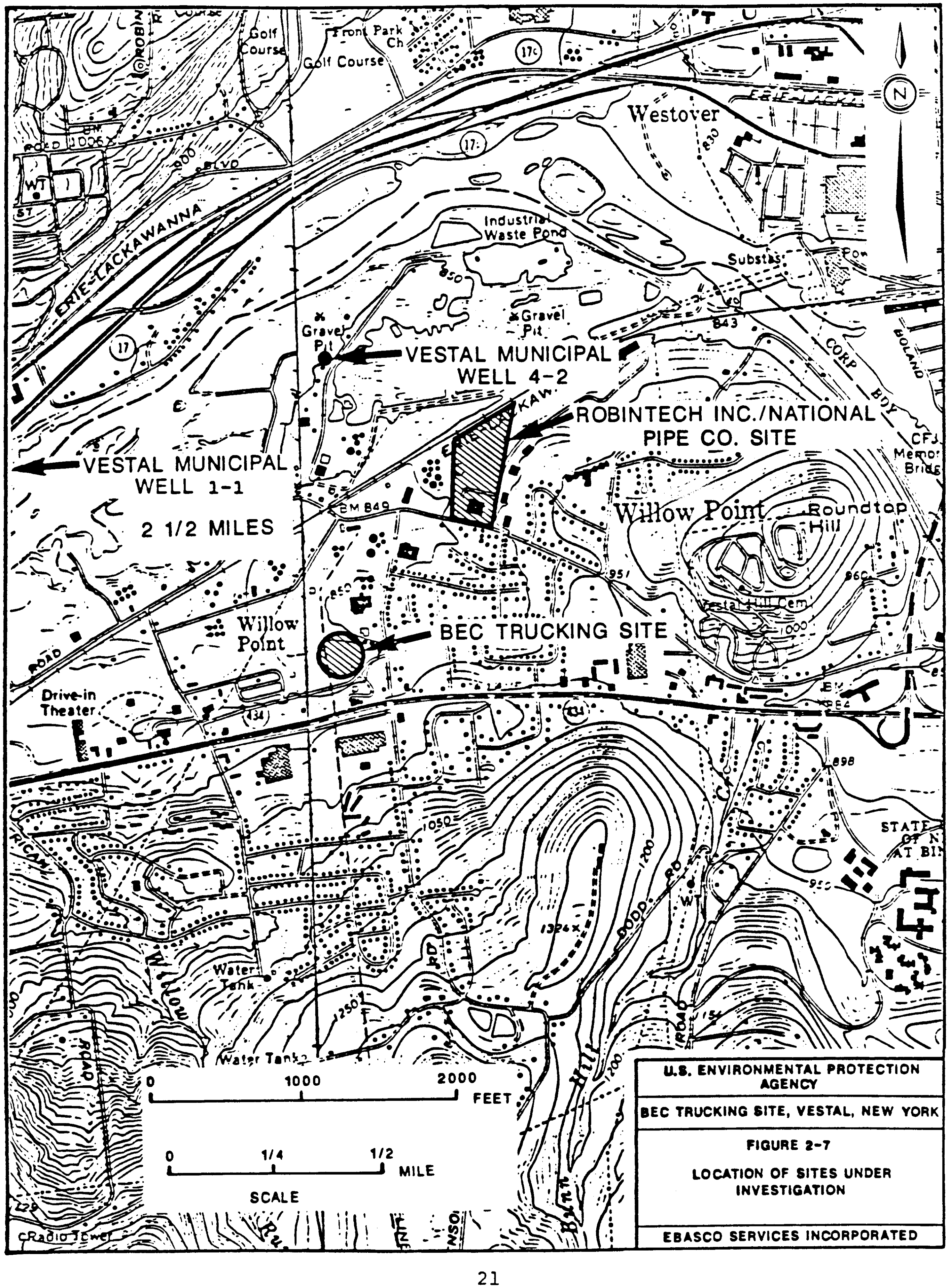
Currently, the Town of Vestal is constructing the water treatment system for Well 4-2. The system is scheduled to go on-line in March of 1988. The pumping of waste water from Well 4-2 to the Susquehanna River has continued to date.

2.4.2 Robintech Inc./National Pipe Co.

The information presented in this subsection was obtained from the Work Plan for the Remedial Investigation/Feasibility Study of the Robintech Inc./National Pipe Co. (RTI/NPC) Site, Vestal, New York, Camp, Dresser & McKee Inc., dated February 10, 1987.

The RTI/NPC Site is located at 3421 Old Vestal Road in the Town of Vestal approximately 2,100 feet northeast of the BEC Trucking Site. Figure 2-7 illustrates the location of the RTI/NPC Site and its geographic relation to the BEC Trucking Site. Both RTI/NPC and the Town of Vestal District 4 wellfield are located generally downgradient of the BEC Trucking Site.

The manufacturing facility at the RTI/NPC Site, which commenced in 1966, historically performed electroplating, PVC pipe extrusion, and assembly of electronic cable, accelerator cables, airplane engine mounts, and circuit boards. Owner/operator reports given during RCRA and CERCLA related investigations conducted by the USEPA indicated that hazardous waste, in the form of toluene, other volatile organics, chromium-contaminated sludge, waste cutting oil, and caustic etching solution, were



U.S. ENVIRONMENTAL PROTECTION AGENCY

BEC TRUCKING SITE, VESTAL, NEW YORK

FIGURE 2-7

LOCATION OF SITES UNDER INVESTIGATION

EBASCO SERVICES INCORPORATED

disposed of on-site in surface impoundments (landfills or lagoons) for a period of six to ten years. The disposal areas have since been filled and paved over and are presently used as staging areas for finished products from the facility. An additional source of contamination, from 1970 to 1986, was a surface discharge of process cooling water from the facility to a settling tank. The settling tank regularly overflowed creating a large pond resulting in waste infiltrating into the aquifer(s). In the spring of 1986 two underground settling tanks were installed to accept the excess flow of process cooling water.

Recent sampling at the RTI/NPC Site, indicates significant groundwater contamination with volatile organics, heavy metals, and arsenic. In addition, volatile organics, arsenic, phthalates, and cyanide have been found in sediment, surface soils, and subsurface soil samples taken on - and off-site. The contaminants found in these various environmental media are commonly associated with the hazardous materials used in the manufacturing activities at RTI/NPC Site.

Subsequent to the initial discovery of groundwater contamination at the RTI/NPC Site, numerous environmental studies have been conducted. Currently, the RTI/NPC Site is ranked in the thirteenth group on the June 1986 National Priority List. A work plan has been prepared to conduct a Remedial Investigation/-Feasibility Study (Work Assignment No. 147-2LG3) at the RTI/NPC Site. Findings of this study are not currently available.

2.4.3 Vestal Water Supply Well 1-1

The information presented in this subsection was obtained from the Draft Work Plan for a Supplemental Remedial Investigation/-Feasibility Study for the Vestal Water Supply Well 1-1, Ebasco Services Incorporated, dated January 21, 1988.

The Vestal Water Supply Well 1-1 Superfund Site, which is part of Vestal Water District 1, is located adjacent to the Susquehanna River immediately west of Route 26 in the Town of Vestal. This site is approximately 2 and 1/2 miles west (downstream) from the BEC Trucking Site. Drinking water for most of the western part of the Town of Vestal is supplied by Water District 1.

The western portion of the Vestal Well site includes the well field and extends north of the Susquehanna River into the Town of Endicott. Choconut Creek borders this portion of the site on the west, N.Y. Route 17 on the south, and North Main Street on the east and the Susquehanna River on the north. The eastern portion of the site contains the Stage Road Industrial Park which has several active facilities. This portion of the site is bordered by North Main Street on the west, N.Y. Route 434

(Vestal Parkway) on the south, and Route 26 on the east and N.Y. Route 17 on the north.

In October, 1979, the water in Well 1-1 was found to contain high concentrations of chlorinated volatile organic compounds and was subsequently removed from the public water supply system. Well 1-1 has been pumped to waste in the Susquehanna River since 1980. In December, 1982, the Vestal Well 1-1 site was placed on the NPL in combination with Vestal Well 4-2. However, these two sites were later listed separately because they were most likely affected by different contaminant sources.

R. J. Martin submitted a report to the Town of Vestal, New York, in January 1983, describing his investigation of the contamination of Well 1-1. Martin's report concluded that the source of the organic chemicals is in the vicinity of Stage Road as shown by the high levels of chemical concentrations found in the groundwater in that area and because groundwater generally flows to the northwest toward Well 1-1. Martin concluded that pumping Well 1-1 to waste at 650 gpm would protect the western part of the aquifer by drawing the contaminated groundwater toward it. He also stated that Well 1-1 is not a satisfactory recovery well and recommended that the suspected source area near Stage Road be investigated further to determine the responsible parties and to determine the feasibility of a recovery system.

Ecology and Environment, Inc. (E&E) performed a remedial investigation study (RI) for the New York State Department of Environmental Conservation (NYDEC) in the spring of 1985. E&E also conducted a Focused Feasibility Study (FFS) for the NYDEC to determine the need for an initial remedial measure.

The E&E RI identified three potential source areas in the Stage Road area which would require further investigations. A public meeting, Responsiveness Summary and Record of Decision (ROD) were subsequently prepared. The ROD prepared by EPA in June 1986, called for two actions:

1) Construction of a packed column air stripping system on Well 1-1, and;

2) Initiation of a supplemental RI/FS to further investigate the extent of soil contamination in suspected source areas and to evaluate possible source control measures.

A draft Work Plan for the Supplemental RI/FS was recently prepared by the EPA.

3.0 SCOPING OF THE REMEDIAL INVESTIGATION/FEASIBILITY STUDY FOR THE BEC TRUCKING SITE

3.1 RI/FS OBJECTIVE

3.1.1 Preliminary Risk Assessment

This section presents a preliminary risk assessment of potential public health and environmental risks associated with the BEC Trucking Site. The results of this assessment will provide the risk based justifications for the sampling and analysis program described in Section 4.3. It is based on information gathered to date relating to site history, hydrogeology, land use, demography, and suspected contaminant type and distribution.

As discussed in Section 2.3, no chemical data are currently available to determine whether contaminants are present at the site and, if so, if they are present at levels of public health or environmental concern. However, if future sampling efforts do reveal areas of contamination, the resident and/or transient population may be subjected to certain public health risks. The nature and magnitude of these risks would be a function of a number of factors, including the toxicological and physiological characteristics of contaminants present, the environmental media in which they are measured, and the probability of exposure to these chemicals via relevant pathways. These factors will be addressed in this Remedial Investigation; the exposure pathways considered to be of potential concern are outlined below.

Soils and Sediments

Exposure to potentially contaminated soils and sediments at the BEC Trucking Site and adjacent offsite areas could occur via a number of scenarios. Based on observations made during initial site visits (October, December, 1987), the most likely receptor locations associated with this pathway include the marsh, which serves as the eastern boundary of Stewart's trailer park and borders the site to the west; the drainage channel, which flows along the eastern and northern perimeters of the site, and the filled area of the site. Exposures could occur through the direct contact and/or ingestion of potentially contaminated surface soils and sediments. For example, a path originating at the northeasterly edge of the trailer park, which is located approximately 500 feet west of the site, winds behind the marsh to an area just north of the site. This path parallels the drainage channel and provides easy access to both the marsh and the site. It appears that this area is utilized as a local dump, since miscellaneous appliances, debris, and scattered toys were observed along the edge of the path. Given the nature of the surrounding area, which is primarily industrial, the marsh and/or site could likely serve as a playground for children living in the adjacent trailer park or other nearby residences.

In this scenario, children could be exposed to potentially contaminated soils and sediments via dermal contact and/or incidental ingestion. Occasional users of the path could also be potentially exposed. In addition, although a portion of the site is surrounded by a chainlink fence, this fence is not secure. Therefore, exposures could also occur during activities conducted by on-site intruders.

Because of the potential health risk from exposure to soils and sediments, Ebasco will investigate the significance of such risk during the Remedial Investigation.

Groundwater

At the present time, Vestal residents obtain water from Wellfield District #4. Although a 185 foot deep (6 inch casing) abandoned but unsealed well exists approximately 1000 feet west of the site in the trailer park, the previous owner of the trailer park indicated to Ebasco personnel that this well has not been used in ten years. Broome County Health Department records from 1974 and 1976 indicate generally elevated turbidity, pH, nitrogen and bacteria content values from this well. Turbidity values consistently exceeded the standard of 5 J.T.U. while pH varied from 8.1 in 1974 to 7.7 in 1976. Significant variations in sodium and total hardness content were also detected. Sodium and total hardness values from 1974 were 94 ppm and 130 ppm respectively, while those from 1976 were 8 ppm and 210 ppm, respectively. No data has been identified to date which indicates that residents in the vicinity of the site are using groundwater from any existing private wells for potable and/or non-potable (e.g., irrigation) purposes.

No site-specific quantitative data are available to determine whether contamination is present in groundwater originating at the BEC Trucking Site. Therefore, groundwater monitoring wells (see Section 4.3.5) will be installed and sampled in conjunction with a possible survey to determine whether any private wells are being used in the area so that this potential exposure route can be evaluated. If technically feasible, the existing (but abandoned) well in the trailer park will also be sampled.

Surface Water

Potential health risks associated with exposure to surface water will be evaluated on the basis of estimates of contaminant transport to both marsh standing water and the drainage channel. Exposures to potentially contaminated surface waters could occur via similar scenarios described above for soils and sediments. For example, children playing in the marsh or drainage channel could accidently ingest contaminated surface water; dermal contact and inhalation of volatilized contaminants represent additional possible exposure scenarios. Surface water, groundwater, soil and sediment sampling results will render estimates of the probability and magnitude of potential human exposures within the site drainage area. Direct contact and incidental ingestion pathways will be evaluated on this basis.

Biota

Due to the fact that the site is situated in a predominantly commercial and industrial area and based on observations made during recent site visits, it appears that there is no nearby habitat sufficient to support significant aquatic or terrestrial wildlife populations. The Susquehanna River, which is used for both industrial and recreational purposes, is located within a mile of the site. However, preliminary examination of the drainage pattern does not indicate a direct water course from the site to this point. Moreover, because many industries in the surrounding area contribute outfall to the Susquehanna River, it would be nearly impossible to delineate the extent to which the BEC Trucking Site represents a potential source. Although no agricultural land is present in the nearby vicinity of the site, residents of the trailer park could have gardens, therefore, the potential for exposure to contaminants into the food chain will be further evaluated in the Remedial Investigation.

Air

There is no current evidence to indicate that this pathway is of potential significance based on the fact that 1) no OVA (Organic Vapor Analyzer) measurements above background were obtained during health and safety monitoring conducted as part of the initial site visit and 2) there have been no complaints of odor or dust from nearby residents and/or individuals who work in the area. As discussed above, previous disposal practices suggest that heavy metal contamination could potentially be present in site soils. Because the wind direction throughout the course of the year is generally towards the west and/or northwest, residents of the trailer park (which lies approximately 500 feet west of the site) could potentially be exposed to contaminated particulate matter. Ebasco will sample and analyze site surface soils to evaluate this pathway during the Remedial Investigation.

3.1.2 Data Gaps

Based on the potential exposure pathways described above, and review of the existing data base, the data gaps for characterizing the nature and magnitude of potential contamination at the BEC Trucking Site are identified below:

Groundwater Pathway

As discussed in Section 3.1.1, no site specific data are available which characterize the nature of the groundwater at the BEC Trucking Site. Therefore, direct confirmatory sampling of groundwater is necessary to determine levels of organic and inorganic constituents present. Saturated subsurface soil samples will also be collected to ascertain the potential for the desorption of contaminants from contaminated saturated soils to act as a source for future groundwater contamination. Similarly, the site will be investigated for the presence of other potential sources of groundwater contamination such as buried drums and contaminated surface soils. In addition, a survey may be warranted to determine whether any private wells are still being used for potable and/or non-potable (e.g., irrigation) purposes.

Direct Ingestion Pathway

No quantitative information is available concerning concentrations of organic or inorganic hazardous substances in surface waters, soils or sediments of the study area. These data are needed both to evaluate the direct ingestion pathway and to estimate the potential for air contamination via the volatilization and/or the suspension of contaminated particulates.

Air Pathway

No data (either actual measurements of modeled estimates) are available which allow an estimation of the level of contamination in the air (volatile or suspended particulates) in the vicinity of the BEC Trucking Site. Evaluation of this pathway will be based on sampling and analysis of surface soils and measurements conducted as part of health and safety monitoring during the field investigation program. Surface soil analytical results may be subjected to resuspension modeling techniques to characterize this pathway.

3.1.3 Scoping of Remedial Alternatives

In order to identify and scope potential remedial alternatives for a site, some information regarding the affected media and type of contamination present is required. As described in previous sections of this Work Plan, no sampling from any media (except for a sample from surface drums that were subsequently removed and a soil sample of unknown origin) have been collected from the BEC Trucking Site. Therefore, the approach taken here has been to develop several contamination scenarios at the site which are based on non-quantitative, non-confirmed and implied information collected from various sources. This information is described in Sections 2.1.2, 2.1.3, and 2.3 of this Work Plan.

The lack of information about the site therefore results in a more general treatment regarding identification of response actions and identification of preliminary remedial alternatives. If the results of the Phase I field investigation reveal a specific situation requiring remediation, the scoping of remedial alternatives will be focused to identify specific data collection needs for the evaluation of alternatives.

Table 3-1 contains a list of potential contamination scenarios, general response actions and potential remedial alternatives. The scope of the Phase I field investigation is consistent with the objective of collecting additional information as well as to screen and evaluate these technologies/remedial alternatives.

The Superfund Amendment and Reauthorization Act (SARA) emphasizes risk reduction through destruction or detoxification of hazardous waste by employing treatment technologies which reduce mobility, toxicity or volume rather than protection that is achieved through prevention of exposure. In addition, SARA emphasizes that remedial alternatives focus on permanent solutions which reduce or eliminate the need for long term management. Resource recovery alternatives should be utilized to the maximum extent practicable. Also, innovative technologies for remediation should be explored and carried through the screening process. Specific remedial alternatives which satisfy the requirements of SARA will be considered once the types and levels of contaminants are identified.

3.2 DETERMINATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

3.2.1 Determination of ARARs

The ARARs preliminarily identified below have been categorized as "applicable or relevant and appropriate," and "to be considered," based upon the Superfund Amendments and Reauthorization Act of 1986 (SARA) interim guidance on development and utilization of ARARs (52 Federal Register 32496, August 27, 1987). Primary consideration will be given to remedial alternatives that attain or exceed the criteria presented by regulations found to be "Applicable or Relevant and Appropriate".

SARA defines ARARs as:

- o any standard, requirement, criterion, or limitation under any federal environmental law; and
- o any promulgated standard, requirement, criterion, or limitation under a state environmental or facility siting law that is more stringent than any federal standard, requirement, criterion, or limitation.

TABLE 3-1
BEC TRUCKING SITE

POTENTIAL CONTAMINATION SCENARIOS,
GENERAL RESPONSE ACTIONS AND REMEDIAL TECHNOLOGIES

POTENTIAL CONTAMINATION SCENARIO	GENERAL RESPONSE ACTIONS	POTENTIAL REMEDIAL TECHNOLOGIES	COMMENTS
o Concentrated sources (e.g., buried drums, tanks) are discovered.	Excavate, Inspect, Sample, Treat or Remove	Recycle: solvents, waste oil, scrap metal. Onsite treatment for large quantities.	Assess the time critical nature of the source
o Soils/Sediments contaminated with solvents, waste oils and/or heavy metals.	Containment	Capping, slurry walls, etc.	Probably not permanent solutions.
	Remove to Landfill	-	SARA discourages.
	Onsite or Offsite Treatment	Physical, chemical, biological, thermal, fixation.	Treatability studies would probably be justifed.
	In-situ Treatment	Physical, chemical, biological, fixation/ stabilization.	Treatability studies (possibly on-site) would probably be justified.
o Groundwater contaminated by volatile organics and/or heavy metals.	Pumping/Onsite Treatment or In-situ Treatment	Physical, chemical, biological	Characterization of the groundwater and the aquifer is required.

The purpose of this definition is to make CERCLA responses consistent with both Federal and State environmental requirements.

ARARs are further segregrated in accordance with the activity they are expected to effect. ARARs that relate to the level of pollutant allowed are called contaminant-specific; ARARs that relate to the presence of a special geographic or archeological area are called location-specific; and ARARs that relate to a method of remedial response are called action-specific.

ARARs are developed by taking into account the following:

- o contaminants suspected or known to be at the site;
- o chemical analyses to be performed;
- o types of media to be sampled;
- o geology and other site characteristics;
- o use of the sites resources;
- o level of exposure and risk;
- o potential transport mechanisms;
- o purpose and application of the potential ARARs; and
- o remedial alternatives to be considered for the site.

3.2.2 Consideration of ARARs During the RI/FS

As the RI/FS process continues, additional ARARs may be considered and developed. Specifically, ARARs will be considered at six key intervals:

1) Task 1 - Project Planning (see Section 4.1): Consider ARARs when determining the data to be collected in the field investigation.

2) Task 6 - Assessment of Risks (see Subsection 4.6): Consider ARARs during the analysis of risk to public health and the environment.

3) Task 9 - Development of Remedial Response Objectives and Response Actions (see Subsection 5.1.1): Compare site data base to ARARs.

4) Task 9 - <u>Identification of Applicable Technologies and Development of Alternatives (see Subsection 5.1.2)</u>: Utilize ARARs specific to site conditions for development of action levels, specific response objectives, and remedial alternatives. Also, identify ARARs that apply to the formulated alternatives.

5) Task 9 - <u>Screening of Remedial Technologies/ Alternatives (see Subsection 5.1.3)</u>: Consider ARARs when assessing the effectiveness of an alternative.

6) Task 10 - <u>Detailed Evaluation of Remedial Alternatives (see Section 5.2)</u>: Evaluate each alternative to the extent it attains or exceeds ARARs.

The conclusions regarding ARARs reached at these intervals will be used as a guide to evaluate the appropriate extent of site cleanup and to aid in screening and evaluating proposed treatment technologies.

3.2.3 Preliminary Identification of ARARs for the BEC Trucking Site

3.2.3.1 Potential Applicable or Relevant and Appropriate requirements

The following Federal, New York and Local regulatory requirements could be potentially applicable or relevant and appropriate to the BEC Trucking Site.

1) Contaminant-Specific

Federal

- RCRA Groundwater Protection Standards (40CFR264, Subpart F)
- Safe Drinking Water Act, National Primary Drinking Water Regulations, Maximum Contaminant Levels (MCLs) (40CFR141.11-141.16)
- Occupational Safety and Health Standards (OSHA) (29CFR Parts 1904 and 1910)
- Health and Safety Standards for Federal Service Contracts (29CFR1926)
- Clean Water Act
- Clean Air Act

State of New York

- New York State Pollutant Discharge Elimination System (SPDES) standards/ limitations (Article 7) of ECL, 6 NYCRR 750-758)
- Actual Standards/Limitations of a New York State Pollutant Discharge Elimination System (SPDES) permit
- New York Drinking Water Standards (Article 7 of ECL, 6 NYCRR 701.3)
- New York Groundwater Quality Standards (Article 7 of ECL, 6 NYCRR 703)
- New York Ambient Surface Water Quality Standards

Local

- Town of Vestal Ordinance: "Non-detect" Limit for Organics in Drinking Water

2) Location-Specific

Federal

- Safe Drinking Water Act: Sole-Source Aquifer Requirements
- Executive Order on Floodplain Management and Wetlands
- Fish and Wildlife Coordination Act
- New York Freshwater Wetlands Law
- New York Floodplain Management Act
- Federal Section 404/10 Requirements
- New York SPDES Groundwater Effluent Standards for Broome County.

3) Action-Specific

Federal

- Occupational Safety and Health Standards (OSHA) (29CFR Parts 1904 and 1910) (All Alternatives)
- Health and Safety Standards for Federal Service Contracts (29CFR1926) (All Alternatives)

- DOT Rules for Hazardous Materials Transport (49CFR107, 171.1-171.500) (Offsite Disposal of Untreated Soil)

- RCRA Treatment Facility Standards (Soil Treatment)

- TSCA, PCB Disposal Requirements (40CFR761) (Disposal of Contaminated Soil)

- Clean Water Act, as amended - NPDES permitting requirements (Discharge of Treated Groundwater to Surface Water Body)

- RCRA Groundwater Monitoring and Protection Standards (40CFR264, Subpart F) (Groundwater Treatment)

- Safe Drinking Water Act Underground Injection Control Requirements (40CFR146) (Reinjection of Treated Groundwater)

- RCRA Subtitle C and Subtitle D, Hazardous and Non-Hazardous Waste Management Standards (40CFRParts 257, 260-270) (Onsite/Offsite Disposal of Soils)

- EPA Effluent Limitation Guidelines for Organic Chemicals (Groundwater Treatment)

State of New York

- New York SPDES Discharge to Groundwater Effluent Standards/Limitations (Reinjection of Treatment Groundwater)

- New York SPDES Stormwater Runoff Requirements (Discharge of Treated Groundwater to Storm Sewer or Surface Water Body)

- New York Hazardous Waste Management Regulations 6 NYCRR 370 (Onsite/Offsite Disposal of Treated Soil)

- New York Air Emission Standards for Hazardous Air Pollantants, including NESHAPs (Discharge of Air from Air Stripper)

As noted above in parentheses, likely remedial alternatives for the BEC Trucking Site are paired with potentially applicable ARARs.

3.2.3.2 Potential "To Be Considered" Requirements

When ARARs do not exist for a particular chemical or when the existing ARARs are not protective of human health or the environment, other promulgated criteria, advisories and guidance may be useful in developing and evaluating remedial alternatives. These criteria, advisories and guidance were developed by EPA, other Federal agencies and the State of New York. The concepts and data underlying these requirements may be used at the site. The following Federal and State of New York regulatory requirements could be considered:

1) <u>Federal</u>

- o Safe Drinking Water Act National Primary Drinking Water Regulations, Maximum Contaminant Level Goals (MCLGs)
- o USEPA Drinking Water Health Advisories
- o USEPA Health Effects Assessment (HEAs)
- o Cancer Assessment Group (National Academy of Science) Guidance
- o TSCA Health Data
- o Waste Load Allocation Procedures
- o Groundwater Classification Guidelines
- o Proposal Maximum Contaminant Levels (50 FR 46902-46933, November 13, 1985)
- o Proposed Maximum Contaminant Level Goals (50 FR 46936-47022, November 13, 1985)
- o PCB Spills Cleanup Policy and PCB Recordkeeping Amendments (see 52 FR 14873 April 27, 1987)

2) <u>State of New York</u>

- o New York State Department of Environmental Conservation Division of Water - Technical and Operational Guidance Series

3.3 DATA QUALITY OBJECTIVE (DQO) DETERMINATION

The Data Quality Objectives for the BEC Trucking Site have been determined based on the goals and needs of the RI/FS. The main goal of the RI/FS is to characterize and estimate the concentration of contaminants in the environmental media (soil, groundwater, surface water, and sediments) in order to collect sufficient data to evaluate the no-action and remedial alternatives.

Data Quality is a measure of the degree of uncertainty in the data with respect to precision, accuracy, reproducibility, comparability, and completeness associated with specific analytical methodologies. The five level analytical approach that may be applicable to achieving the goals of a project is defined as follows:

1) Screening (Level 1): This provides the lowest data quality but the most rapid results. It is often used for health and safety monitoring at the site, preliminary comparison to ARARs, initial site characterization to locate areas for subsequent and more accurate analyses, and for engineering screening of alternatives (bench-scale tests). These types of data include those generated on-site through the use of HNU, pH, conductivity, and other real time monitoring equipment.

2) Field Analyses (Level 2): This provides rapid results and better quality than in Level 1.

3) Engineering (Level 3): This provides an intermediate level of data quality and is used for site characterization. Engineering analyses may include mobile-lab generated data but generally refer to Standard EPA analytical lab methods without the degree of QA/QC provided by CLP analyses.

4) Confirmational (Level 4): This provides the highest level of data quality and is used for purposes of risk assessment, engineering design, and cost recovery documentation. These analyses require full CLP analytical and data validation procedures.

5) Non-Standard (Level 5): This refers to analyses by non-standard protocols, for example, when exacting detection limits, or analysis of an unusual chemical compound. These analyses often require method development or adaptation.

At the BEC Trucking Site, field screening with an HNU, pH and conductivity measurements will be performed to Level 1. The soil gas survey, grain size analyses, bulk densities and moisture content determinations will be performed to Level 2. Analyses conducted in support of the treatability studies will be performed to Level 3. All other chemical analyses of environmental media will be performed to Level 4.

Site specific DQOs and analytical methods with established Precision, Accuracy, Representativeness, Comparability, and Completeness (PARCC) are selected using a four-step general approach. The four-step approach includes the following components:

- o Comparison of Applicable, or Relevant and Appropriate Requirements (ARARs), risk-based criteria, data needs for risk, engineering and modeling purposes to detection limits for available analytical methods.
- o Selection of appropriate methods to allow quantification of parameters at levels sufficiently below ARARs.
- o Evaluation of maximum allowable variability (i.e., maximum precision and accuracy range) based on a comparison of the detection limit to ARARs, and certified analytical methods.
- o Development of a site-specific acceptable variability, based on proposed data uses and method-specific precision and accuracy information.

The acceptable variability, or precision and accuracy "window" established by the analytical method will be used to compare laboratory performance data on a method-by- method basis. This comparison will enable the determination of whether the site specific goals were attained or whether more stringent precision and accuracy requirements will be needed (e.g. additional matrix spikes, etc.).

4.0 TASK PLAN FOR REMEDIAL INVESTIGATION

The BEC Trucking Site RI includes the following eight tasks:

Task 1	Project Planning
Task 2	Community Relations
Task 3	Field Investigation
Task 4	Sample Analysis/Validation
Task 5	Data Evaluation
Task 6	Assessment of Risks
Task 7	Treatability Study/Pilot Testing
Task 8	Remedial Investigation Report

This section describes each of the eight tasks comprising the RI. Section 5.0 of the Work Plan presents the remaining four tasks (Tasks 9 through 12) which in combination with the above eight comprise the RI/FS program for the BEC Trucking Site.

4.1 TASK 1 - PROJECT PLANNING

Task 1 consists of the preparation of this Work Plan and the Work Plan's companion documents: the Field Sampling and Analysis Plan (FSAP), the Health and Safety Plan (HASP) and the Site Management Plan (SMP).

Contents of these companion plans can be summarized as follows:

- FSAP: includes sampling and analytical objectives; the number, type, and location of all samples to be collected; the site-specific quality assurance requirements which will be in accordance with the Quality Assurance Project Plan for the REM III Program; the Brossman Guidance; detailed sampling and analysis procedures; and data management elements.

- HASP: includes site information; a hazard assessment; training requirements; monitoring procedures for site operations; safety considerations during site operations; decontamination and disposal procedures; and other requirements in accordance with the Health and Safety Plan for the REM III Program.

- SMP: includes a site description; an operations plan outlining the site project organization and responsibilities; and the field operations schedule. This plan also addresses site security.

These companion plans will be prepared in accordance with EPA notice-to-proceed, following review of the Work Plan by potential PRP(s).

4.2 TASK 2 - COMMUNITY RELATIONS

REM III community relations staff will assist EPA in preparing and implementing a Community Relations Plan for the BEC Trucking Site. This assistance will be provided as specifically requested by EPA and is expected to include the following:

- Development of a site-specific Draft and Final Community Relations Plan (CRP) for this site. REM III community relations staff will prepare and submit a Draft and Final Community Relations Plan to EPA. The plan will describe site history and identify issues of community concern, and proposed techniques for public participation during the RI/FS. Research for this plan will include interviews with residents and local officials.

- Providing public meeting support and a public meeting summary for the public meeting on the work plan. REM III community relations staff will provide logistical support and attend the public meeting on the RI/FS Work Plan. A public meeting summary for the public meeting on the RI/FS Work Plan will be prepared.

- Provide coordination, planning and management support. REM III community relations staff will provide general planning, management, analytical and coordination support to EPA and REM III technical staff during the community relations activities.

- Preparation of two updates. One update will be prepared following the release of the draft Work Plan and another will be distributed following release of the draft FS report.

- Establish and update the mailing list for this site. REM III community relations staff will establish and update a key contacts list for this site. REM III community relations staff will provide a hard copy of the mailing list to EPA along with a complete set of self-adhesive mailing labels.

4.3 TASK 3 - FIELD INVESTIGATIONS

Ebasco's field investigation has been designed to provide requisite data about the BEC Trucking Site, sufficient to enable determination of the presence of on-site contamination, perform a risk assessment and to complete initial remedial alternative scoping activities. Proposed field activities include: topographic survey and mapping (4.3.2), geophysical surveying (4.3.3), soil gas investigation (4.3.4), hydrogeologic investigation (4.3.5), surface and subsurface soil investigation

(4.3.6) and surface water/sediment investigation (4.3.7). The referenced subsections outline activity objectives and rationales. Details of equipment and methods/materials will be defined in the Field Sampling and Analysis Plan.

4.3.1 Initial Activities

4.3.1.1 Preparation of Bid Specifications and Subcontract Procurement

Under this subtask bid specifications will be prepared and subcontractors procured for surveying and drilling services.

Surveying services will include: preparation of a topographic base map, establishment of the sampling grid, mapping sampling locations and mapping monitoring well locations and elevations.

Drilling services will include site cleanup, decontamination pad construction, installation of monitoring wells, subsurface soil sampling, and packer testing.

4.3.1.2 Mobilization

This subtask will include the mobilization of field personnel and equipment to the site. Prior to mobilization an orientation meeting of all field personnel will be held to review site history and layout, health and safety training, and field procedures.

Rolls of fencing material and other transportable metallic objects will be removed from the site to minimize interferences with geophysical survey measurements.

Equipment mobilization will include the following:

- Field trailer (command post);
- Sampling equipment;
- Equipment decontamination materials, and
- Health and Safety equipment.

Telephone and electrical service will be obtained along with a local water source. All companies (i.e. pipeline, gas, electric, water, and telephone) suspected of having underground lines on site or in the immediate vicinity of the site will be contacted prior to the start of the geologic investigation. Any underground utilities will be staked and flagged for the duration of the investigation. The driller will be responsible for obtaining information on the location of utilities.

4.3.2 Topographical Surveying

The major component of the topographical surveying task is to develop a base map of the site and immediate vicinity for use in subsequent RI/FS tasks. The survey area will include the site proper and extend beyond the perimeter of the site. The scale of the map will be 1 inch to 20 feet and elevation contours will be mapped at 1-foot intervals.

The site survey will include a boundary survey, topographic survey, and a location survey. The boundary survey will conform to state and/or local laws which specify the methodology for determining boundary lines between properties. The topographic survey will consist of establishing: one benchmark, two witness points and a baseline; installing 3 staff gauges in surface water bodies; mapping the physical relief of the survey area; and establishing a 50' x 50' grid on the site. The location survey will map all manmade structures at the site including roads, buildings, and fences.

In addition, following installation of monitoring wells and collection of soil and sediment samples, elevations of the borehole casing, protective casings and ground surface will be taken and recorded. In addition, locations of monitoring wells and sampling locations will be determined and all of this information will be mapped. Surveying guidelines are provided in FT-3.02 (Topographic and Property Line Surveys and Mapping) and FT-3.03 (Sampling Station and Elevation Surveys).

4.3.3 Geophysical Surveying

4.3.3.1 Overview

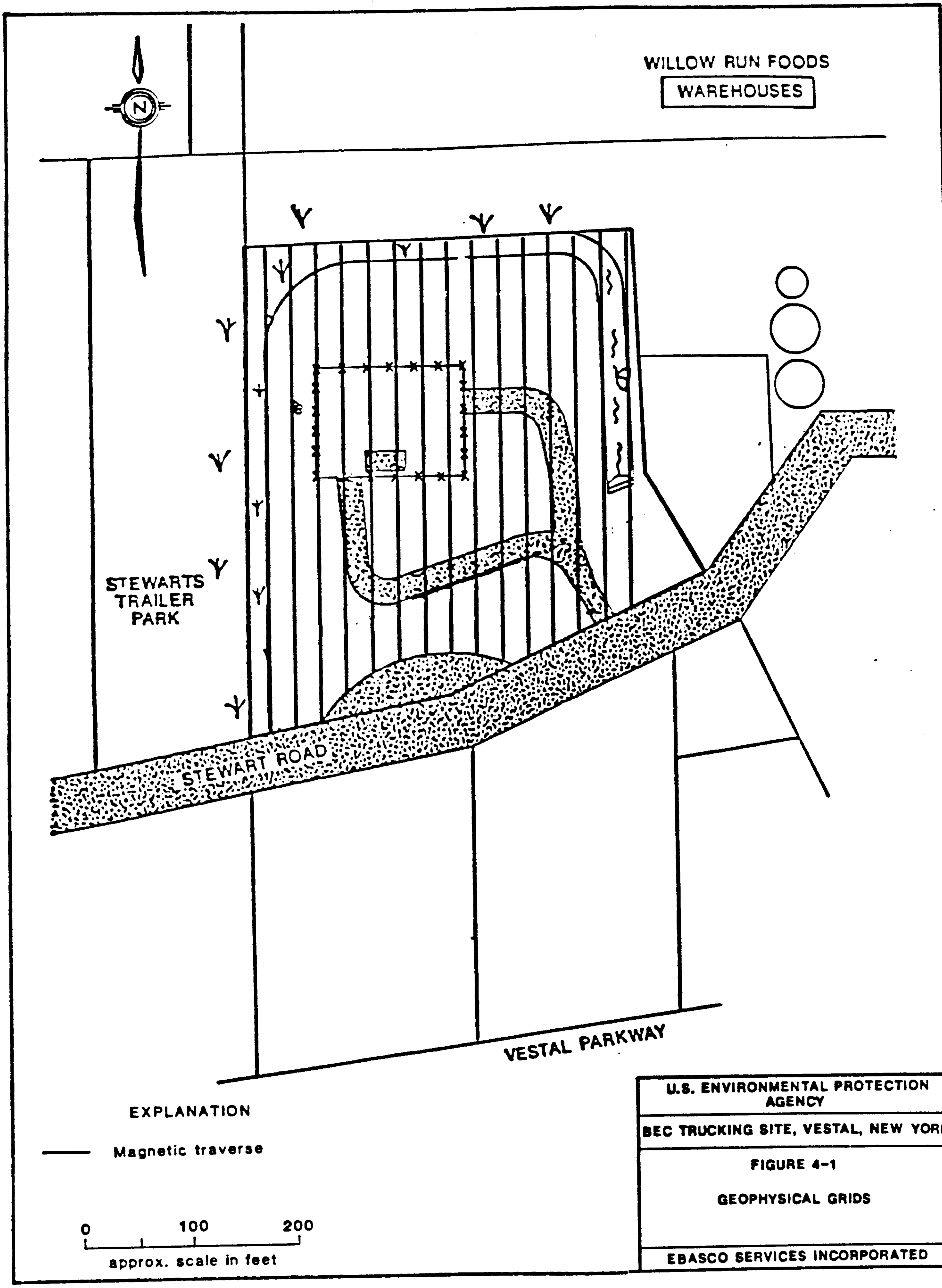
A geophysical investigation utilizing a magnetometer, will be performed at the BEC Trucking Site to locate buried metal objects.

4.3.3.2 Technical Approach

All geophysical field measurements and data interpretation will be performed in accordance with REM III Field Technical Guidelines (FTGs), Revision O. Exceptions to the FTGs are not anticipated, although field conditions may require some modifications to maintain data quality.

4.3.3.3 Magnetometer Survey

Magnetic measurements will be performed along each of the traverses shown on Figure 4-1 primarily to locate buried metal objects. Some surficial metal objects will be moved off-site during the mobilization phase, prior to the geophysical investigation. In particular, rolls of fencing and other



U.S. ENVIRONMENTAL PROTECTION AGENCY

BEC TRUCKING SITE, VESTAL, NEW YORK

FIGURE 4-1

GEOPHYSICAL GRIDS

EBASCO SERVICES INCORPORATED

readily moveable metallic objects will be removed from within the fence-enclosed storage area shown on Figure 4-1. However, the disassembly of fencing that has already been installed may not be required.

A total of approximately 250 magnetometer stations will be occupied using a Geometrics Model G-816 proton precession magnetometer or equivalent. Data will initially be obtained at 25 foot intervals along each line. Additional data will be obtained at closer station spacings and line intervals if needed to delineate anomalies observed by field personnel. The final product will be a magnetic contour map or set of magnetic profiles from which anomalous areas can be identified.

4.3.4 Soil Gas Investigation

4.3.4.1 Objectives

A soil gas program is proposed to investigate the extent of possible soil and groundwater contamination at the BEC Trucking Site. Chemical tanker trucks may have been steam cleaned and drums and solvent cans were apparently stored at the BEC Trucking Site. Also, it is possible that the disposal of liquid waste may have occurred in the marsh located north and west of the site. The presence of gasoline distribution centers near the site, raises the possibility that petroleum hydrocarbon contamination also may be present. Thus, this investigation is designed to detect both halogenated (TCE and PCE) and aromatic (benzene and toluene - fuel contituents) organic compounds.

Composite sampling at the BEC Trucking Site revealed some elevated concentrations of lead and cadmium. The soil gas method will not directly detect heavy metals, but it will detect the presence of volatiles such as benzene, xylene, and toluene which may be present in oil or degreasing products and may also be associated with heavy metal contamination.

This soil gas investigation will accomplish the following goals:

- It will identify potential sources of contamination at the site;

- It preliminarily will define the boundaries of volatile organic groundwater or soil contamination; and

- It will help in locating the soil borings and monitoring wells to be installed during subsequent field investigation activities.

4.3.4.2 Proposed Program

Initially 65 soil gas samples will be collected and analyzed. Based on the immediately available results of these samples, up to 30 additional samples may be collected to better define the extent of contamination.

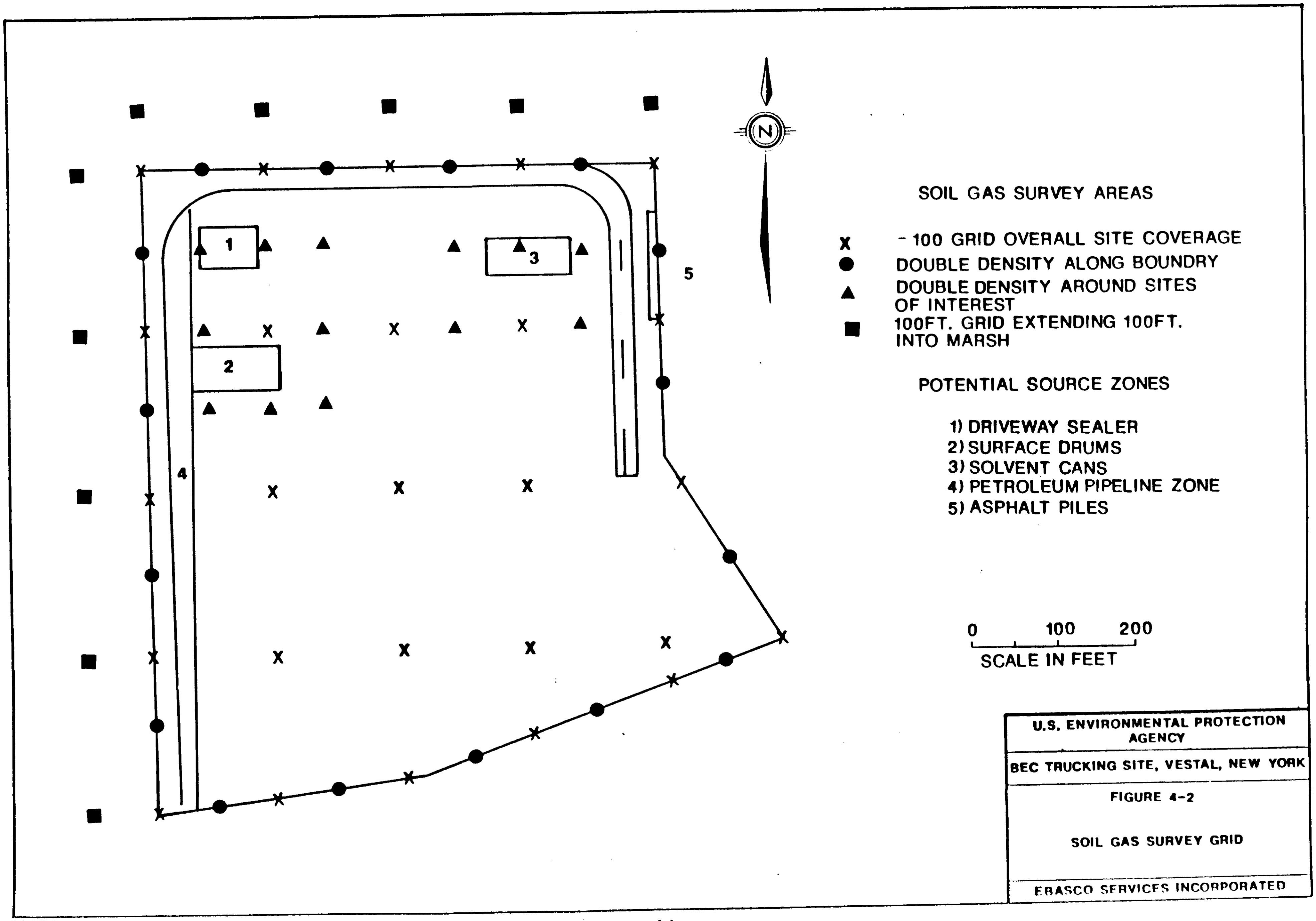
Sampling will be performed on approximately 100 foot (ft) spacings that will encompass the entire areal extent of the filled area and part of the marsh (Figure 4-2). Samples along the perimeter of the site will be collected on approximately 50 ft spacings. These samples will give an initial indication of what areas of the site are contaminated and what areas are relatively free from contamination. In the vicinity of potential spill areas, samples will be collected on approximately 50 ft spacings. Also, samples will be collected in areas where visible staining is present.

Based on the results of the above planned sampling, up to 30 additional samples may be collected to better define the extent of contamination. These samples would be collected from areas of higher contamination to pinpoint source areas or from areas of lower contamination to accurately define the edges of a dissipating plume.

4.3.4.3 Procedures

Sampling Procedure

Soil gas sampling will be accomplished following the procedures outlined in the REM III Guideline, FT-2.04. To collect each sample, a shallow borehole will be pounded or hand augered to the desired depth (2 to 4 ft) and the sampling probe will be placed in the hole. The hole will then be sealed via a packer to exclude ambient air. Several sampler probe volumes of soil gas will be extracted from the probe and a sample will be collected with a gas-tight syringe. The probe will be removed, decontaminated, and placed in the next boring. All pertinent data and observations will be recorded in a field log book. An attempt will be made to complete the borings to equal depths, 2 to 4 ft. This may be impossible where the water table is very shallow, as along the marsh on the north and west boundaries of the site. In areas where the water table is 1.5 ft or less below the ground surface, water or saturated soil samples will be collected. These samples will be analyzed via the headspace technique (modified EPA Method 5020). The same compounds in the soil gas analysis will be included in the water or soil analysis.



N
1
2
3
4
5
SOIL GAS SURVEY AREAS
X - 100 GRID OVERALL SITE COVERAGE
DOUBLE DENSITY ALONG BOUNDRY
DOUBLE DENSITY AROUND SITES OF INTEREST
100FT. GRID EXTENDING 100FT. INTO MARSH
POTENTIAL SOURCE ZONES
1) DRIVEWAY SEALER
2) SURFACE DRUMS
3) SOLVENT CANS
4) PETROLEUM PIPELINE ZONE
5) ASPHALT PILES
0
100
200
SCALE IN FEET
U.S. ENVIRONMENTAL PROTECTION AGENCY
BEC TRUCKING SITE, VESTAL, NEW YORK
FIGURE 4-2
SOIL GAS SURVEY GRID
EBASCO SERVICES INCORPORATED

Analysis Procedure

Sample analysis will be accomplished using a Photovac Model 10S50 portable gas chromatagraph with a photoionization detector. The machine will be calibrated to quantitate TCE, PCE, benzene, and toluene which are, or are indicative of, possible contaminants of concern at the site. Immediately following collection of a sample, the sample will be injected into the instrument. A chromatogram will be produced and the calibrated compounds will be quantified. Any compounds detected but not identified will be reported as unknowns. Sample chromatograms along with appropriate standards, QC/QA chromatograms, and data will be recorded in a log book. This log book will also contain all appropriate machine calibrations and set-up data. The detection limits for TCE and benzene are in the low to mid ppb (nl of analyte per liter air) range. The detection limits for PCE and toluene are in the mid to high ppb range. Initially, standards will be prepared at aproximately 50 ppb, but the working analytical range may be raised or lowered depending on sample concentrations detected.

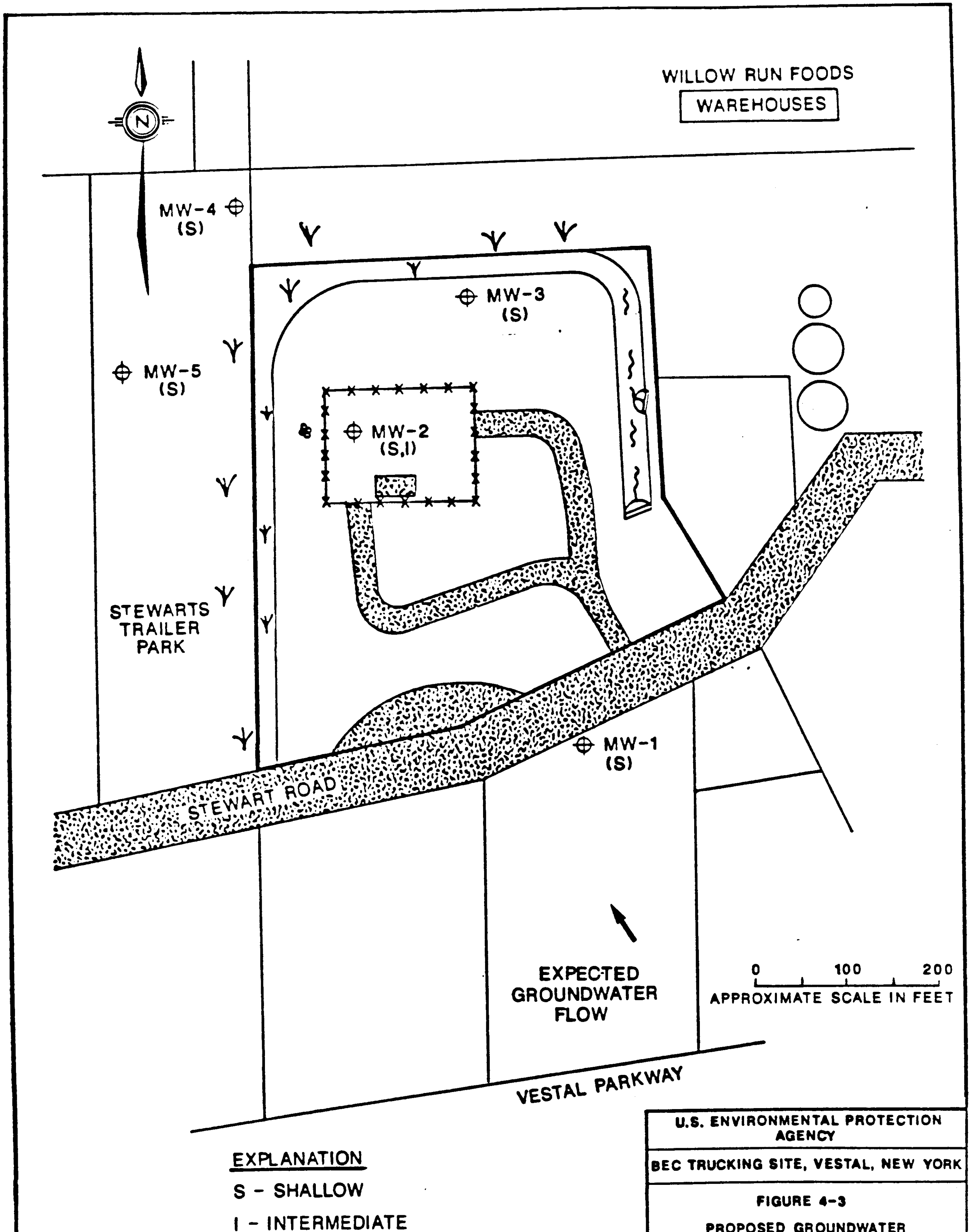
Data Interpretation

The collected data will be tabulated showing the boring number, location, and associated contaminant concentrations. The boring locations will be assigned coordinates and the borings, along with their associated contaminant concentrations, will be plotted and isoconcentration figures will be produced. These figures should indicate any areas of contamination. The soil gas results presented in these fiqures will then be used to help optimize the placement of the soil boring and monitoring wells.

4.3.5 Hydrogeological Investigation

The hydrogeological investigation program will consist of the drilling and installation of six monitoring wells designed to characterize the occurrence of contaminants both vertically and horizontally in the water table at the site and immediately adjacent to the BEC Trucking property. In addition to characterizing groundwater chemistry, the borings will be located to develop a soil chemistry and geotechnical profile of the project area. The predicted pathways and rate of contaminant transport will be characterized supported by: measurements made to determine the lateral head distribution within the water table aquifer, hydraulic conductivity tests, and physical/chemical tests to support modeling of the transport of a contaminant slug.

Figure 4-3 illustrates currently proposed groundwater monitoring well locations. The exact locations of on-site well cluster MW-2 and Well MW-3 will be chosen in the field and will be located at selected "hot spots" based on the findings of the



U.S. ENVIRONMENTAL PROTECTION AGENCY

BEC TRUCKING SITE, VESTAL, NEW YORK

FIGURE 4-3

PROPOSED GROUNDWATER MONITORING WELL LOCATIONS

EBASCO SERVICES INCORPORATED

soil gas survey. Table 4-1, Proposed Groundwater Monitoring Wells presents the purpose and rationale for the selection of monitoring well locations. The exact depth of all wells will be determined in the field. Shallow monitoring wells will be screened to monitor the zone extending from 3 feet above to 7 feet below the water table. The intermediate well will be screened to monitor the bottom 10 feet of the water table aquifer.

4.3.5.1 Monitoring Well Installation

As shown in Figure 4-3, one double well cluster at location MW-2 will be installed in separate boreholes. Single wells will be installed at four locations (MW-1, MW-3, MW-4 and MW-5). Monitoring well construction details for unconsolidated monitoring wells are given in Figure 4-4. At MW-2, the intermediate well will be drilled first.

The bedrock aquifer will not be studied during the initial phase of the RI/FS for the following reasons:

1) The Endicott - Johnson City Aquifer consists of the unconsolidated alluvial and glacial deposits not the shale bedrock, therefore the overburden groundwater at the site is of primary concern.

2) There is currently no confirmed evidence of groundwater contamination in either the overburden or the bedrock at the site.

The shallow and intermediate wells will be installed in accordance with the following procedure:

1) The site geologist will choose well depths based on the stratigraphic log developed from the intermediate well sampling.

2) The well will be advanced to the chosen depth with a 6-inch-I.D. hollow-stem auger.

3) Up to 10 feet of 4" stainless steel screen will be set at the bottom of the borehole with sufficient riser pipe to extend to 2 feet above the ground surface.

4) The annular space will be backfilled from the bottom of the well to 2 feet above the top of the screen with clean sand. A 2-foot bentonite seal will be placed on the sand, and the remaining annular space will be backfilled with bentonite-cement grout.

5) A security casing and lock will be installed for each well.

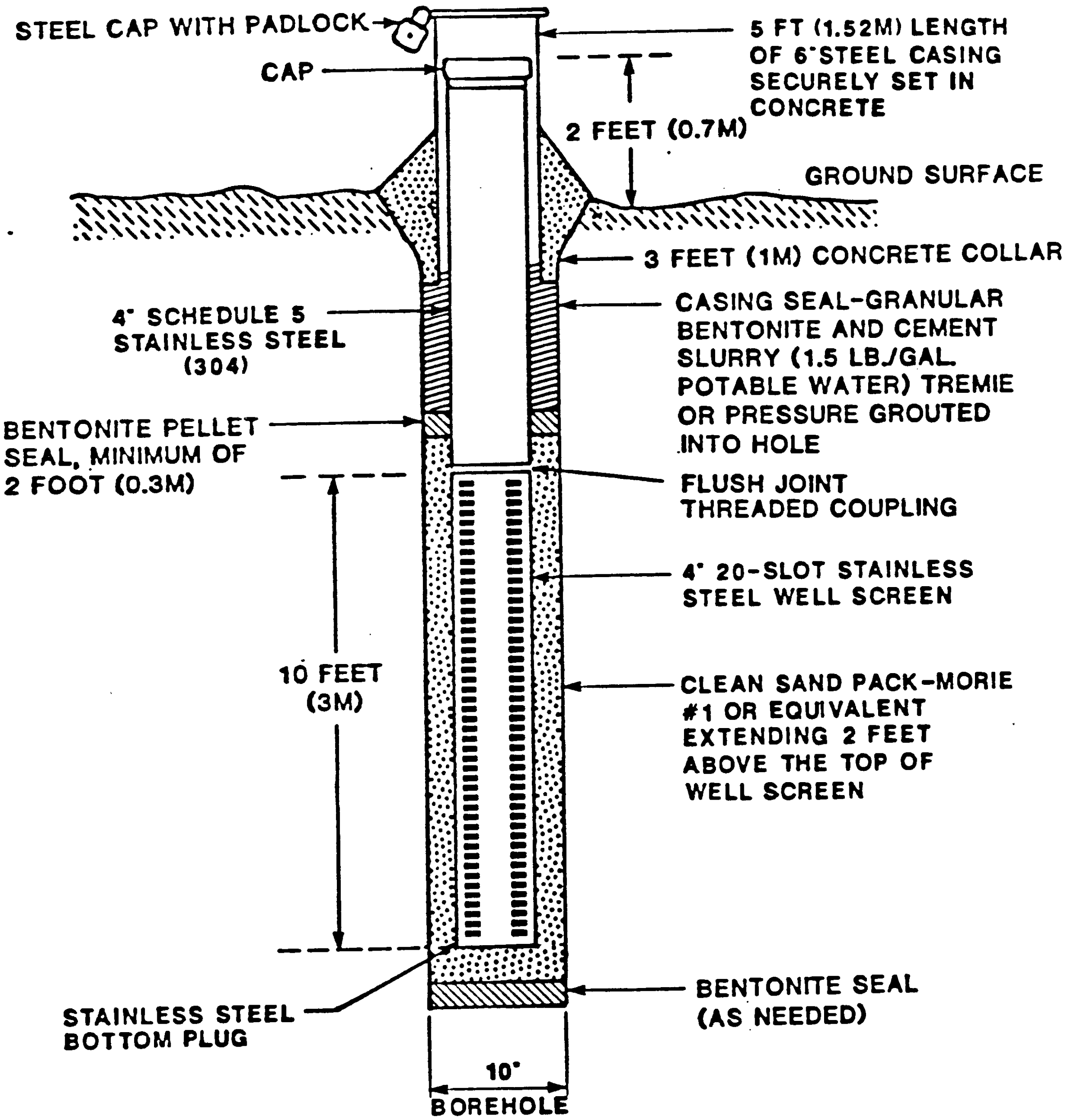
TABLE 4-1

BEC TRUCKING SITE

PROPOSED GROUNDWATER MONITORING WELLS

		PURPOSE			
WELL	DEPTH(S)	Water Delineation	Plume Flow Directions	Groundwater	RATIONALE
1	S	X	X	X	Upgradient of site
2	S, I	X	X	X	Onsite, to evaluate possible source area
3	S	X	X	X	Onsite, to evaluate possible source area
4	S	X	X	X	Downgradient, to evaluate off-site migration
5	S	X	X	X	Downgradient, to evaluate off-site migration

S = Shallow; I = Intermediate



U.S. ENVIRONMENTAL PROTECTION AGENCY

BEC TRUCKING SITE, VESTAL, NEW YORK

FIGURE 4-4

TYPICAL 4" GROUNDWATER MONITORING WELL CONSTRUCTION (OVERBURDEN)

EBASCO SERVICES INCORPORATED

NOT TO SCALE

6) A 3- to 4-foot-diameter cement pad will be installed around the security casing and mounded in such a way a to direct surface runoff from the casing. The security casing will be locked.

The general guidelines concerning monitoring well installation are included in FT-7.01 (Groundwater Monitoring Point Installation). Decontamination procedures for drilling rigs and samplers are presented in FT-6.03.

4.3.5.2 Drilling, Sampling and Well Development

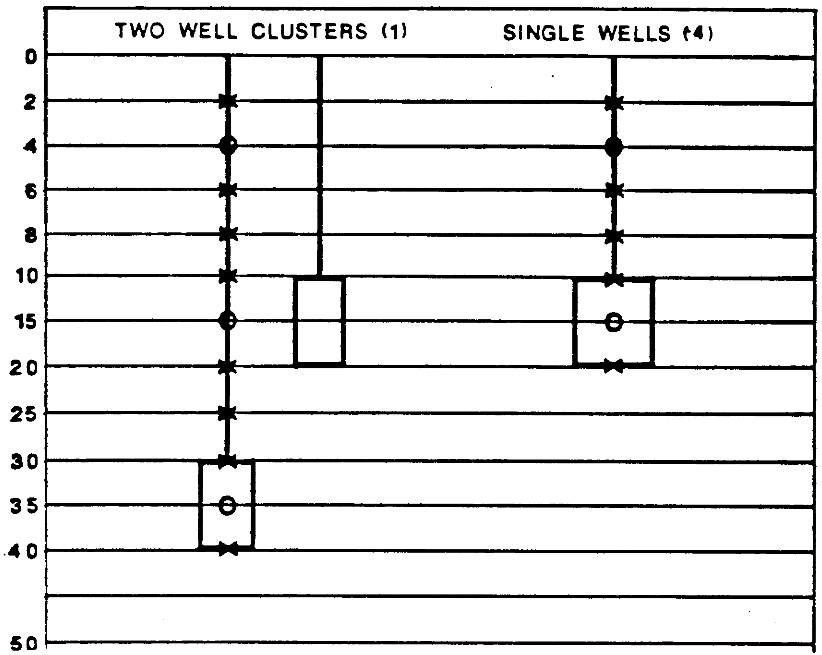
Drilling methods may include hollow stem auger, cable tool, air rotary, and mud rotary drilling techniques. The only acceptable drilling fluid for mud rotary techniques will be potable water or a potable water/pure bentonite mixture. Organic-base additives will not be added to the drilling fluid. If drilling fluid is used, a sample will be collected for analysis. Other drilling methods may be considered, as dictated by subsurface conditions.

Each monitoring well drilled will be lithologically logged by the field geologist. Cuttings, split-spoon samples, and thin wall tube samples will be utilized to construct a well log representative of the subsurface conditions. Well logs will include lithology descriptions, groundwater entry zones, total depth, and other pertinent data.

Monitoring well borings will be of sufficient diameter so that a 4-inch monitoring well can be installed. During drilling operations, Standard Penetrating Tests (ASTM D-1586-84), will be conducted in the deepest well at each well cluster location or in the single well at each single well location. Samples will be taken continuously to the water table and at 5-foot intervals thereafter and continue to the total depth of the well or split-spoon refusal. Figure 4-5 summarizes the soil boring sampling program, indicating schematically the number and location of samples to be taken for chemical analysis (full TCL organics and inorganics) and geologic identification. Each sample will be placed in a laboratory cleaned jar, labelled, and all pertinent information recorded in the field logbook and monitoring well log. The shallower borings at each cluster location may not warrant sampling, however, the field geologist will prepare a log for such borings.

Samples for chemical analysis will be selected according to the following criteria:

1) In the vadose zone (in decending order of preference) - the soil with the highest headspace (HNU) reading or a visibly discolored/stained sample, or a soil representative of the shallowest fine-grained (restricted) layer, or a sample in the middle of the vadose zone;



O SAMPLES FOR TCL ORGANIC AND INORGANIC ANALYSES
✕ SAMPLES FOR GEOLOGIC DESCRIPTION ONLY

U.S. ENVIRONMENTAL PROTECTION AGENCY

BEC TRUCKING SITE, VESTAL, NEW YORK

FIGURE 4-5
BEC TRUCKING SITE
SPLIT-BARREL SAMPLES
FOR ANALYSES

EBASCO SERVICES INCORPORATED

2) at the water table interface (in screened interval of shallow well); and

3) at the bottom of the water table aquifer (in screened interval of intermediate well).

Approximately 8 thin wall tube samples of representative strata will be taken at selected locations during the drilling program. The samples will be analyzed for bulk density, total organic carbon content, grain size analysis, and moisture content.

Monitoring wells will be developed by the subcontractor as soon as practical after the completion of the borehole. Wells will be developed by air lift, bailing, surging, or by pumping to remove fine sediments, drill cuttings and residual drilling fluid from the geologic material adjacent to the screened interval of the monitoring well. The method of development will be determined by the field geologist in accordance with the REM III Guideline FT-7.01, Section 5.3. Purged water generated during development will be contained in drums.

4.3.5.3 Water Level Monitoring and Aquifer Testing

Static water level measurements will be taken in all monitoring wells 24 hours after development of the final well. The purpose of these measurements are to: determine overall vertical and horizontal groundwater flow gradients, identify any anomalous groundwater flow patterns, and indicate potential contaminant migration pathways.

Aquifer testing will consist of falling head and rising head slug tests. The purpose of the slug tests are to determine the permeability of the overburden aquifer at each well location. This information will be necessary to calculate the rate of groundwater flow through the unconsolidated aquifer. The test will be conducted in all on-site and off-site monitoring wells screened in the unconsolidated material.

4.3.5.4 Monitoring Well Sampling

The primary objective of this task is to obtain representative groundwater samples from each monitoring well. To safeguard against collection of non-representative samples three to five times the volume of standing water in each well will be evacuated (purged) prior to each sampling round.

Evacuated water will be collected and contained to prevent additional contamination and/or artificial recharge to the underlying aquifer(s). Methods for purging the well may include bailing or the use of electric pumps. Bailers will be used to collect groundwater samples from the monitoring wells subsequent to purging. All monitoring well samples will be analyzed for priority pollutants, volatile organics, and total metals (filtered and non-filtered). Monitoring well samples will be collected in two rounds: one at least on week after well development, the second approximately one month following the initial sampling.

4.3.6 Surface and Subsurface Soil Investigation

The objective of the soil investigation program is to permit statistical interpretation of matrix and depth variability throughout the site. Data collected during Phase I will be used to determine whether future investigations are necessary and, if so, to determine which locations and/or depths require additional sampling.

The Phase I soil sampling program is comprised of two elements: 1) surface and shallow subsurface cores; and 2) monitoring well borings. A summary of the soil analyses is presented in Table 4-2; the soil sampling locations are shown in Figure 4-6.

As discussed in Section 3.1.2, quantitative data are not available concerning the type and extent of any potentially existing groundwater, surface water, soil or sediment contamination at the BEC Trucking Site. However, information related to previous site activities and observations of current site conditions allows an estimation of potential contamination patterns likely to be present at the site. For example, the areas where surface drums are still present and were previously located can be considered potential "hot spots". Other areas circled or noted in Figure 2-3 (e.g., areas where discarded driveway sealant and solvents cans were observed) are also potential "hot spots". As described in Section 2.1.3, Kay Terminals, located east of the site, represents a potential offsite source of contamination. Therefore, the area between the asphalt piles (just east of the drainage channel) and the petroleum tanks illustrated in Figure 2-3 also represents a potential offsite "hot spot".

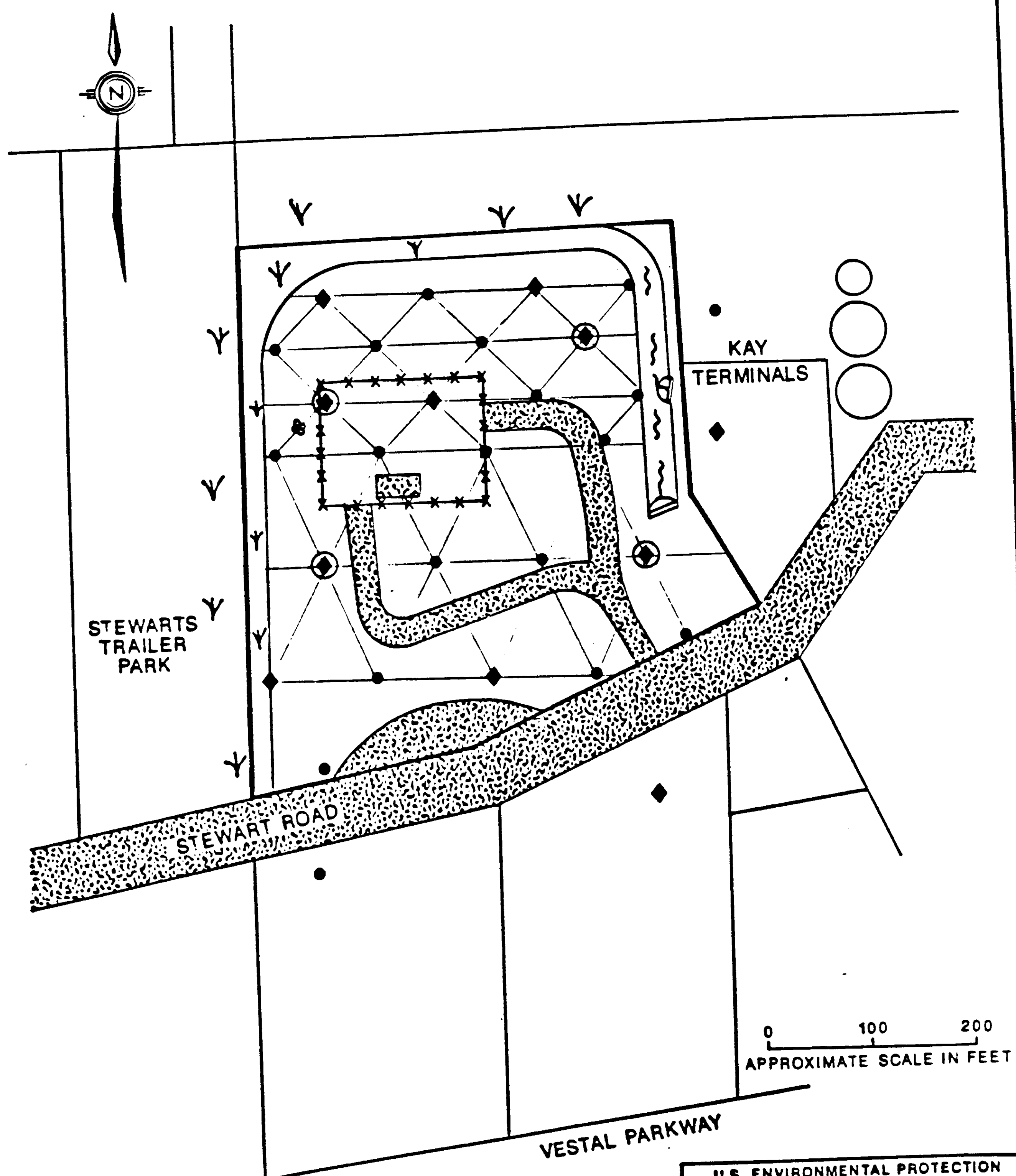
In light of the absence of quantitative data, Ebasco is recommending a targeted sampling approach on the basis of the suspected "hot spots" described above. Ebasco's proposed soil sampling program is designed to provide detailed data of these potential "hot spots" and also to determine whether contamination is present in other on-site and adjacent off-site areas. Particular attention will be focused on the marsh as it is likely that this area could serve as a "sink" (due to its proximity to the water table) for contaminants from any present or previously existing contaminant sources.

Figure 4-6 locates proposed Phase I soil samples at intersections of an extensive onsite triangular grid, with

TABLE 4-2
BEC TRUCKING SITE

CLP SAMPLE AND ANALYSIS SUMMARY

MEDIUM SAMPLED	TOTAL NUMBER OF SAMPLES FOR CLP ANALYSIS	NUMBER OF LOCATIONS	NUMBER OF COLLOCATES	NUMBER OF DUPLICATES	CHEMICAL PARAMETERS			PHYSICAL PARAMETERS			
					TCL ORGANICS	TCL INORGANICS	TCL VOLATILES ONLY	TOC	BULK DENSITY	MOIST. CONT.	GRAIN SIZE
Water:											
Surface	8	6	1	1	7	7	-	-	-	-	-
Groundwater	13	6	-	1	12	12	-	-	-	-	-
Sediment:											
Ditches and Marsh	8	6	1	1	7	7	-	6	-	-	-
Soil:											
On-site(S)	31	26	4	1	15	30		-	-	-	-
On-site(D)	11	9	1	1	5	10		-	-	-	-
Offsite(S)	4	4	-	-	4	4					
Offsite(D)	2	2	-	-	2	2					
Soil Borings	11	5	-	-	11	11	-	8	8	8	8
Field Blanks:	15 (approx)	-	-	-	15	15	-	-	-	-	-
Trip Blanks:	25 (approx)	-	-	-	-	-	25	-	-	-	-



LEGEND

- ● AUGER/SPLIT SPOON (0-1FT)
- ◆ AUGER/SPLIT SPOON (2-3FT)
- ◈ COLLOCATES

U.S. ENVIRONMENTAL PROTECTION AGENCY

BEC TRUCKING SITE, VESTAL, NEW YORK

FIGURE 4-6

PROPOSED SOIL SAMPLING LOCATIONS

EBASCO SERVICES INCORPORATED

100 ft grid spacing in the southern and central portions of the site (areas where contamination is less likely) and more intensive sampling (50′ grid spacing) in suspected hot spots. A triangular grid is chosen since various investigators (e.g., Gilbert, 1986; Parkhurst, 1984) have indicated that this grid configuration provides more information (see discussion in Section 4.3.8) than the more generally applied square grid. Surface soil samples (0-1 ft) will be taken onsite at the 26 grid points illustrated in Figure 4-6. Subsurface soil samples (approximately 2-3 ft depth) will also be collected at 9 of these proposed locations; in general, these deeper samples will be delimited to suspected "hot spot" areas and the periphery of the site. The rationale for this approach is to obtain the most information in areas where the greatest contaminant variability is possible.

Off-site samples will consist of two upgradient ("control") samples and two samples obtained adjacent to Kay Terminals. The two upgradient samples will be obtained south of the site across Stewart Road as indicated in Figure 4-6. Care will be taken during this effort to collect samples as far away from the road or other confounding source (e.g., nearby buildings) to decrease the possibility of obtaining erroneous results (e.g., the potential measurement of elevated polycyclic aromatic hydrocarbon levels due to the proximity of the roadway). In addition, two locations between Kay Terminals and the eastern portion of the drainage channel will be sampled in order to ascertain whether potential contamination in site soils or in the drainage channel is confounded by an off-site source. As summarized in Section 2.1.3, Kay Terminals has potentially pumped liquids containing benzene, toluene, and xylene (BTX) into the drainage channel since 1981. The facility is still required to monitor for these constituents according to current SPDES permit requirements. At two of the proposed off-site locations, shallow sub-surface (approximately 2-3 ft) samples will be obtained (see Figure 4-6) as well as the surface (0-1 ft) samples.

Soil samples will be obtained using either a split spoon or a hand-held auger and will be collected in accordance with FT 7.03, Section 5.2. In areas where samples are to be taken at two depths, samples will be taken in the top and bottom foot of each core. Samples will not be composited over depth, as this could preclude identification of potential contamination trends. To establish the matrix variability of the surface and subsurface soils, collocated samples will be obtained at approximately 10% of the proposed sample locations. Samples will be analyzed for TCL organic and inorganic pollutants as shown in Table 4-3. All samples will be sent for inorganic analyses, however, samples from the 20 locations with the highest potential for contamination based on the soil gas results and/or visual inspection will be sent out for full TCL organic analyses.

TABLE 4-3
BEC TRUCKING SITE

SUMMARY OF FIELD SAMPLING AND ANALYSES

SAMPLE TYPES	NUMBER OF SAMPLES	SAMPLING DEVICE	SAMPLING VOLUME	SAMPLE CONTAINERS	PRESERVATION	ANALYTICAL METHOD	HOLDING TIMES	LAB ANALYSES
Surface Water	8	SS Bucket	Full	(2) 40 ml glass	Cool to 4 C	CLP SOW (10/86)	7 days analyze	Volatiles
			Full	(4) 1-1 amber		CLP SOW (10/86)	5 days extract; 40 days analyze	Extractables
			Full	(1) 1-1 Polyethylene	HNO3 to pH 2; Cool to 4 C	CLP SOW (10/86)	6 months except Hg (26 days)	TCL Inorganics
Groundwater	13	SS Bucket	Full	(2) 40 ml glass	Cool to 4 C	CLP SOW (10/86)	6 days analyze	Volatiles
			Full	(4) 1-1 amber glass	Cool to 4 C	CLP SOW (10/86)	5 days extract; 40 days analyze	Extractables
			Full	(1) 1-1 Polyethylene	HNO 3 to pH 2; Cool to 4 C	CLP SOW (10/86)	6 months except Hg (26 days)	TCL Inorganics
Sediment	8	SS Scoop or Split Spoon	Full	(2) 40 ml glass	Cool to 4 C	CLP SOW (10/86)	10 days analyze	Volatiles
			Full	(1) 8 oz glass	Cool to 4 C	CLP SOW (10/86)	10 days extract; 40 days analyze	Extractables
			Full	(1) 8 oz glass	Cool to 4 C	CLP SOW (10/86)	6 months except Hg (26 days)	TCL Inorganics
Soil (surface)	20 (org) 35 (inorg)	SS Scoop	Full	(2) 40 ml glass	Cool to 4 C	CLP SOW (10/86)	10 days analyze	Volatiles
			Full	(1) 8 oz glass	Cool to 4 C	CLP SOW (10/86)	10 days extract; 40 days analyze	Extractables
			Full	(1) 8 oz glass	Cool to 4 C	CLP SOW (10/86)	6 months except Hg (26 days)	TCL Inorganics

TABLE 4-3 (Cont'd)
BEC TRUCKING SITE

SUMMARY OF FIELD SAMPLING AND ANALYSES

SAMPLE TYPES	NUMBER OF (a) SAMPLES	SAMPLING DEVICE	SAMPLING VOLUME	SAMPLE CONTAINERS	PRESERVATION	ANALYTICAL METHOD	HOLDING TIMES	LAB ANALYSES
Soil (Depth) approx. 2 - 3'	8 (org) 13 (inorg)	SS Auger or Split Spoon	Full	(2) 40 ml glass	Cool to 4 C	CLP SOW (10/86)	10 days analyze	Volatiles
			Full	(1) 8 oz glass	Cool to 4 C	CLP SOW (10/86)	10 days extract; 40 days analyze	Extractables
			Full	(1) 8 oz glass	Cool to 4 C	CLP SOW (10/86)	6 months except Hg (26 days)	TCL Inorganics
Soil Borings	11	Split Spoon	Full	(2) 40 ml glass	Cool to 4 C	CLP SOW (10/86)	10 days analyze	Volatiles
			Full	(1) 8 oz glass	Cool to 4 C	CLP SOW (10/86)	10 days extract; 40 days analyze	Extractables
			Full	(1) 8 oz glass	Cool to 4 C	CLP SOW (10/86)	6 months except Hg (26 days)	TCL Inorganics
Field Blanks (Water and Soil/Sediment)	15 (approx)	NA	Full	(2) 40 ml glass	Cool to 4 C	CLP SOW (10/86)	7 days analyze	Volatiles
			Full	(4) 1-1 amber glass	Cool to 4 C	CLP SOW (10/86)	5 days extract; 40 days analyze	Extractables
			Full	(1) 1-1 polyethylene	HNO3 to pH 2; Cool to 4 C	CLP SOW (10/86)	6 months except Hg (26 days)	TCL Inorganics
Trip Blanks	25 (approx)	NA	Full	(2) 40 ml glass	Cool to 4 C	CLP SOW (10/86)	7 days analyze	Volatiles

Seventeen soil samples will be collected from soil borings during monitoring well installation. As described in Section 4.3.5.2, samples will be collected in the vadose zone, at the water table interface, and at the bottom of the water table aquifer. Samples will be analyzed for TCL organic and inorganic pollutants as shown in Table 4-3.

Table 4-2 presents a breakdown of the total number of proposed samples to be collected and analyzed. It is important to note that the proposed grid spacing and sample numbers for analysis are based on screening results (soil gas and magnetometer surveys) showing no contamination. If results of the soil gas or geophysics survey indicate additional potential areas of contamination, a decision may be reached to tighten the grid spacing and/or relocate initially proposed sample locations. In this event, collocated samples will probably be obtained at a greater frequency (approximately 20%) in order to better characterize the variability associated with potentially contaminated areas.

A discussion of the statistical considerations that entered into the design of this sampling plan is included in Section 4.3.8.

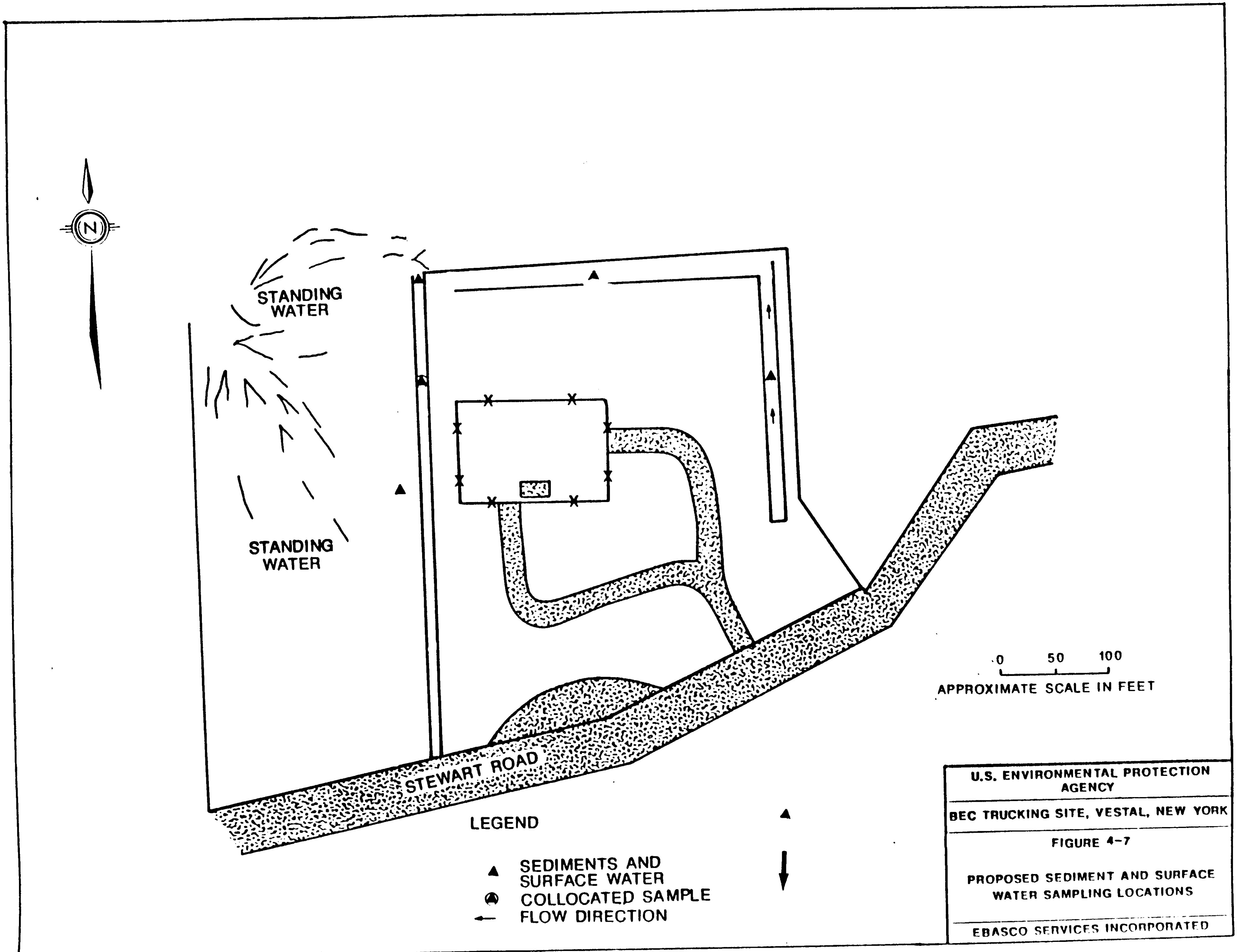
4.3.7 Surface Water/Sediment Investigation

As summarized in Section 2.1.3, a small drainage channel borders the eastern and northern boundaries of the site. This drainage channel receives run-off from Kay Terminals at the northeastern culvert, beyond which it flows behind the site in a northwesterly direction. It eventually terminates into a small stagnant ponded area behind Stewart's trailer park. During the initial and follow-up site visits by Ebasco personnel, standing water was observed in selected portions of the marsh both on-site and off-site.

Assuming that standing water is present during the Phase I sampling activities, surface water samples will be taken at 6 locations within the marsh and the drainage channel (see Figure 4-7).

Surface water samples will be obtained with either a stainless steel bucket or glass or teflon beaker and will be analyzed for both TCL organics and inorganics. Grab samples (vs. composite) will be obtained in order to prevent the loss of information due to the dilution effects of sample compositing and to potentially provide a measure of contaminant variability, (if present). Collocated samples will be obtained at one location as indicated in Figure 4-7. Field analyses (pH, DO, and specific conductance) will be conducted on all surface water samples.

Sediment samples will be obtained at each of the 6 surface water sampling locations (see Figure 4-7). These samples will



U.S. ENVIRONMENTAL PROTECTION AGENCY

BEC TRUCKING SITE, VESTAL, NEW YORK

FIGURE 4-7

PROPOSED SEDIMENT AND SURFACE WATER SAMPLING LOCATIONS

EBASCO SERVICES INCORPORATED

complement all surface water sample locations by providing more than just the "snapshot" in time, furnished by surface water samples.

As described above and in Section 3.1, the marsh represents an important potential receptor location due to its proximity to the trailer park and its potential tendency to serve as a contaminant "sink". Therefore, sediment samples will be obtained in the marsh which extends offsite toward the trailer park. Based on field conditions (i.e., drainage discharges from site to marsh, obvious discoloration of sediment), the need for five to ten additional optional samples will be evaluated during the investigation.

Sediments will also be collected at the water sampling locations in the ponded area behind the trailer park and near the culvert which receives drainage from Vestal Parkway.

Sediment samples will be obtained with either a coring device or a stainless steel scoop, in accordance with FT-7.08, Section 5.3.1. One collocated sample will be obtained in order to better define potential variability and test for significance of differences in various portions of the marsh and drainage area.

4.3.8 Statistical Considerations/Sampling Plan Rationale

Optimal Grid Spacing

The primary objective of the sampling program described above is to characterize the defined population of interest (i.e., the site) to a specified level of confidence. To accomplish this objective, sufficient data points are required to provide statistically valid results. These and related considerations are discussed in the paragraphs below.

Determination of the optimal location and numbers of data points requires an evaluation of all previously obtained information on the environmental media of consideration. As discussed in the previous sections, no data are available from prior studies that allow an approximation of the variability, trends, and correlations of contamination likely to be present at the BEC Trucking Site. The targeted sampling approach recommended for the BEC Trucking Site was therefore developed on the basis of potential "hot spots" (areas which have been determined a priori; to more likely contain zone(s) of contamination) described in Sections 4.3.6 and 4.3.7. Questions considered in the development of this sampling plan include the following:

1) What grid spacing is needed to detect a zone of cotamination with specified confidence?

2) For a given grid spacing, what is the probability of hitting a zone of contamination of specified size?

3) What is the probability that a zone of contamination exists if no zones are found by sampling on a grid?

The considerations noted above are especially important for the BEC Trucking Site because evaluation of Phase I sampling results could indicate that little or no contamination is present. In this event, it is imperative that the data obtained are sufficient to evaluate the no action alternative. If contamination is measured, Phase I sampling results should allow determination of whether and to what extent additional information is required. Statistical validity of the results will depend primarily on the size and variability of the sample population. Generally, with increasing variability, increasing numbers of data points are required to define specified confidence limits (e.g., 95%).

In the absence of quantitative information, an initial estimate for required grid spacing can be derived according to methods developed by Liggett (Gilbert, 1986). This method describes the probability of locating a contaminated zone and allows determination of the optimum spacing between sampling points for finding contaminant zones of specified size. This determination requires a definition of the acceptable probability of not finding a hot spot that is actually present. In addition, to define the optimal grid spacing, the shape and size of the contaminated zone must be known known or assumed.

Using the methods described above, one can estimate the minimum size zone of contamination that can be located for a given cost (specified grid spacing) and confidence level. Assuming a confidence level of 95%, the sizes of the zones of contamination that will be detected using various grid spacings are presented in Table 4-4. Results are given for both circular and elliptical zones of contamination. Representative grid spacings of 50′, 100′, and 200′ are tested for suspected cold areas (e.g., the southern portion of the site). Alternately, grid spacings of 25′, 50′, and 100′ are tested for suspected hot spot areas. The 100′ grid spacing proposed for cold areas would (according to the model) "find" a circular target with a radius (L) of 15′ or larger. If the contaminated zone were elliptical in shape, the length of the semi-major axis (L) expected to be detected is 22′ or larger. For suspected hot spot areas, the proposed 50′ grid would detect contaminated zones where L equals 23′ and 34′ for circular and elliptical contaminant zones, respectively.

The results of the above statistical analysis could be stated in the following alternate manner. The implicit results of choosing grid spacings of 50′ and 100′ for hot and cold areas

TABLE 4-4
BEC TRUCKING SITE

ZONES OF CONTAMINATION TO BE DETECTED
WITH GIVEN GRID SPACINGS WITH 95% CONFIDENCE

COLD AREAS

GRID SPACING	ZONES OF CONTAMINATION: CIRCLE RADIUS (L)	ZONES OF CONTAMINATION: ELLIPSE SEMI-MAJOR AXIS (L)
50′	7′	11′
100′	15′	22′
200′	30′	44′

HOT SPOT AREAS

GRID SPACING	ZONES OF CONTAMINATION: CIRCLE RADIUS (L)	ZONES OF CONTAMINATION: ELLIPSE SEMI-MAJOR AXIS (L)
25′	11′	17′
50′	23′	34′
100′	46′	69′

NOTES:

1. Cold areas refer to site areas with no a priori evidence of any potential zones of contamination (5% probability of contamination assumed).

2. Hot spot areas refer to site areas with a limited amount of a priori evidence of potential zones of contamination (25% probability of contamination assumed).

3. Triangular sampling grid is employed.

respectively is that the minimum sized zone of contamination that is important to detect with 95% confidence is a circle of radius 15'-23' or an ellipse with a semi-major axis of 22'-34'.

It is important to note that the above statistical analysis is based on existing size information. As additional information is acquired the parameters incorporated in the model will be better defined. For example, field screening results will be used to refine estimates of suspected hot spots and the final number of samples required will be better established.

Triangular vs Square Grid Configurations

This section demonstrates that triangular grids are preferable to square grids for locating unknown hot spots at hazardous waste sites. The following example has been extracted directly from Optimal Sampling Geometry for Hazardous Waste Sites, by David F. Parkhurst as published in Environmental Science and Technology, Vol 18, No. 7, 1984.

Definitions:

D_{max} = The maximum distance between any point in the overall area and its closest sampling point.

D_{ave} = The average distance between any point in the overall area and its closest sampling point.

NOTE: It is generally desireable to minimize both D_{max} and D_{ave} to a given cost constraint.

Mathematical Comparison:

"To compare the effectiveness of the square and triangular grids, consider 10,000 m^2 of land with a 10 m square grid (100 total sampling points). For this square grid, the resulting distances from any point to the closest sampling point are D_{max} = 7.07 m and D_{ave} = 3.83 m.

A 100 point triangular grid on the same 10,000 m^2 piece of land would have a horizontal distance between sampling points of 10.746 m. For this triangular grid, the resulting distances from any point to the closest sampling point are D_{max} = 6.204 m and D_{ave} = 3.772 m.

An alternate comparison involves adjusting the triangular grid spacing until D_{max} = 7.07 (the value for the square grid). This would require only 77 sampling points for a 23% cost savings. Or, if the triangular grid spacing is adjusted until D_{ave} = 3.83 (the mean distance for the square grid), then 97 sampling points are required. The cost savings is 3%."

Additional (Alternate) Geometric Comparison:

Areas sampled by a square grid are square in shape, while areas sampled by a triangular grid are hexagonal in shape. "The hexagonal area sampled by each point in the triangular grid is more like a circle than is the square sampled by each point in the square grid. With the hexagons, there is less chance that the wastes sought can "hide out" in corners, because there is less corner to hide out in. Put another way, the distance from a sampling point to the boundary of the area it samples varies less with compass direction for the hexagonal areas than for the square ones. These effects make the triangular grid more effective than the squares. Although it might be slightly more difficult to lay out a triangular grid rather than a square one, the cost savings (or gain in coverage) is substantial when maximum distance from an arbitrary point to a sampling point is considered."

4.4 TASK 4 - SAMPLE ANALYSIS/VALIDATION

A summary of the analytical effort for Phase I is shown in Table 4-3; all samples will be sent to CLP laboratories for analysis.

4.4.1 Sample Analyses

As summarized in Table 4-2, soil samples will be collected for full Target Compound List (TCL) analysis. Eight samples obtained as part of the soil boring and monitoring well installation efforts will also be analyzed for grain size, total organic carbon content, bulk density and moisture content. Eight (8) sediment and surface water samples will also be collected for full TCL analyses. Sediment samples will also be analyzed for total organic carbon content. Full TCL and field analyses will be performed on all groundwater samples. As discussed in the previous section, field analyses (pH, DO, and specific conductance) will be conducted on all surface water samples. The planned analyses for each of the soil, sediment, surface water, and groundwater samples proposed for the Phase I investigations are provided in Table 4-3.

4.4.2 Preliminary Data Validation Support

Data validation is performed by the EPA Environmental Service Division. However, Ebasco will provide support to EPA-ESD for data validation up to the extent of 98% of the effort in this task.

4.4.3 Sample Tracking

Ebasco's Regional Laboratory Sample Coordinator (RLSC) will track the samples sent to CLP to assure the continuity and consistency of data and analyses throughout the sampling program. Tracking will include tabulating the dates samples are obtained, dates shipped, analyses performed, holding times, dates extracted or analyzed, and dates validated. The RLSC will notify the site manager in the event of issues or concerns with the sample analyses.

4.5 TASK 5 - DATA EVALUATION

Analytical precision at the BEC Trucking Site will be assessed by comparing split sample analytical results. The accuracy of the analytical program will be assessed by evaluating results for Environmental Monitoring Support Laboratory Performance Evaluation (EMSLPE) samples submitted to the CLP laboratories performing the analyses, and by evaluating matrix spike duplicate, field, and trip blank results. A brief description of the techniques to be used in subsequent evaluation of data for various environmental media is provided below.

Surface and Shallow Subsurface Soils

Quantitative analytical data will be evaluated statistically, using geostatistical methods if applicable, as well as classical methods for calculating point and interval estimates, testing hypotheses, and evaluating correlations among parameters. Kriging, the geostatistical method used to estimate a mean value, will be used to estimate spatial patterns of contamination if present.

Site specific soil and contaminant characteristics will be compiled, mapped, and analyzed. These characteristics will include the concentration of contaminants, soil chemistry, and contaminant profiles. These results will be used to establish baseline soil conditions and will serve as a data base for air, groundwater, and surface water transport models for risk assessment.

Surface Water

Data generated during the surface water program will be examined to determine the contribution of the BEC Trucking Site to surface water contaminant loading in the marsh and drainage channel. If significant surface water contamination is measured in these matrices, contaminant migration will be modeled as described in Section 4-6.

Sediments

Data generated as part of the sediment program will be used to assess the extent of sediment contamination within the marsh and drainage channel. These data will also be used to establish baseline sediment conditions and develop input to surface water risk assessment model(s). Site-specific sediment data to be collected and analyzed include total organic carbon content, and distribution and type/levels of contamination.

Groundwater

Data collected from the groundwater investigation will be analyzed to support an evaluation of the existance of groundwater contamination and its direction and rate of transport. Groundwater contour maps and geologic cross sections will be constructed from stratigraphic logs. Results of the groundwater program will be compiled and analyzed and will provide the raw data necessary to characterize off-site contaminant migration via groundwater.

4.6 TASK 6 - ASSESSMENT OF RISKS

4.6.1 Public Health Evaluation

After the site information has been evaluated and the data base has been established, a semi-quantitative Public Health Risk Assessment will be performed for the BEC Trucking Site. The objective of this assessment is to characterize health and environmental risks that would prevail if no further remedial action is taken.

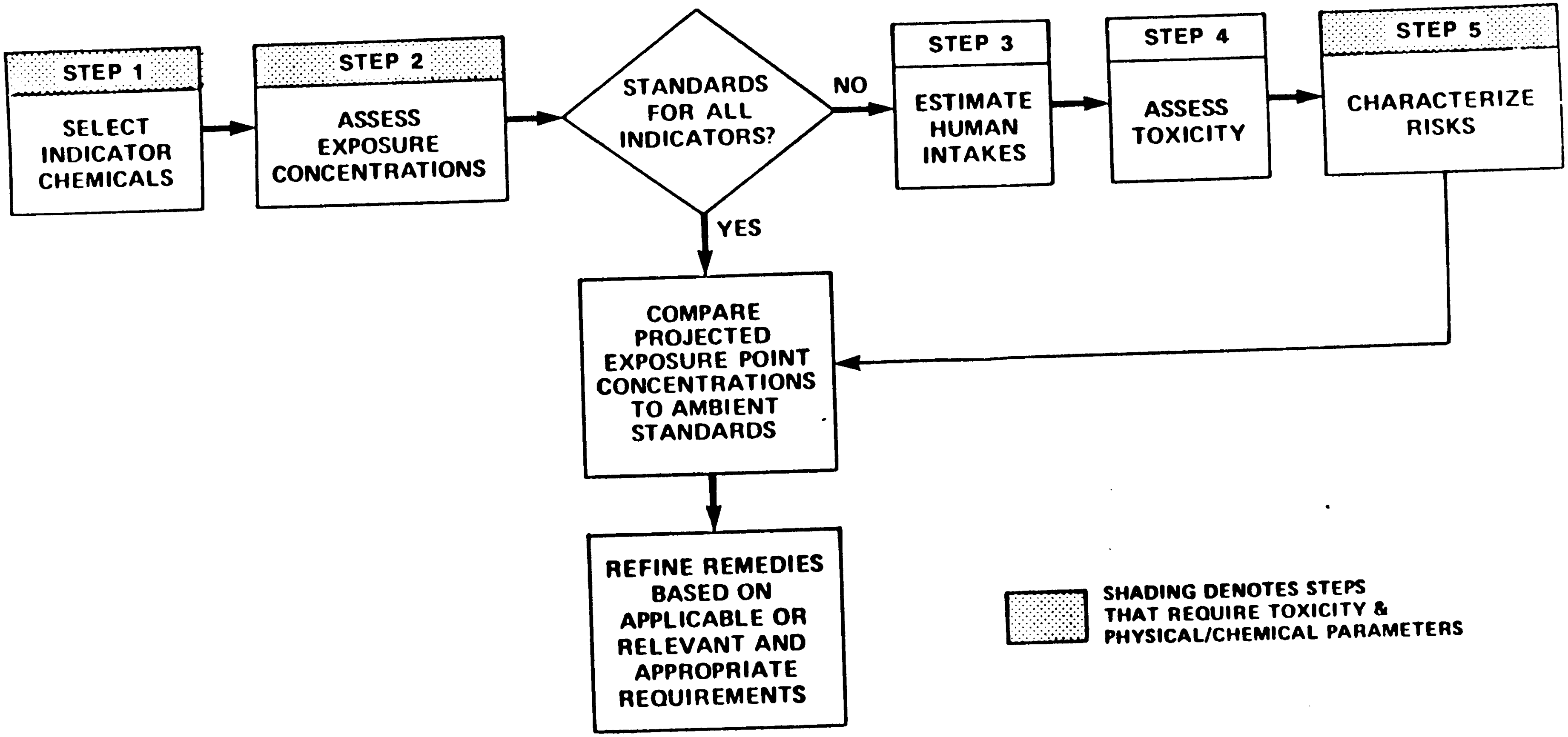
The basic methodology to be employed is summarized in Figure 4-8. This process will be conducted in accordance with the procedures outlines in the EPA Superfund Public Health Evaluation Manual (EPA, 1986).

The first step in the public health evaluation is the selection of indicator chemicals for which quantitative risk analyses will be performed. Indicator chemicals will be selected on the basis of a number of factors including prevalence, measured concentrations, distribution among area matrices, toxicity, and environmental fate. Possible indicator chemicals for this site include benzene, toluene, lead and cadmium as discussed in Section 2.3. However, due to the lack of quantitative data, additional inferences cannot currently be put forth regarding the types of contaminants which may be present at the site and/or their relative magnitude.

The second step in the public health evaluation is the characterization of potential exposure pathways and receptors. A preliminary identification of the potential populations at risk and the most likely exposure routes were presented in Sections 3.1.1 and 3.1.2. These exposure pathways will be the principal areas of focus initially; however, data obtained as part of the Phase I investigation may warrant the inclusion of additional exposure pathways. All applicable exposure routes for the BEC Trucking Site will be addressed in this evaluation.

FIGURE 4-8

BASELINE PUBLIC HEALTH EVALUATION



Concentrations of indicator chemicals in environmental media at relavent exposure points will then be estimated from the analytical data using environmental fate and transport models as appropriate and necessary. The general basis and guidelines for exposure projections will be in accordance with the Draft Superfund Exposure Assessment Manual (EPA, 1986). Environmental chemistry and fate data from the literature will be considered and incorporated where applicable. Estimated concentrations will be compared to applicable or relevant and appropriate standards and criteria which are reviewed in Section 3.2.1. For certain pollutants and critical exposure pathways where concentrations exceed or nearly exceed standards, additional risk analyses will be performed to confirm that the pollutant transport models adequately reflect conditions at the site and to determine additional data needs.

If standards and criteria are not available for all of the indicator chemicals, quantitative analyses will be performed, according to the general procedures outlined in EPA's Endangerment Assessment Handbook (1985) and Superfund Public Health Evaluation Manual (1986). For chemicals (or media-specific contamination) for which no applicable or relevant standards exist, acceptable concentrations in environmental media will be developed based on Acceptable Daily Intakes (for non-carcinogens) or on target risk levels (for known or possible carcinogens). For example, because no standards are available for soil contamination, modeling will be used to specify the level of concern based on the potential route(s) of exposure.

The primary source of toxicological data used in the analysis will be: Appendix C of the Superfund Public Health Evaluation Manual (1986), EPA's Health Effects Assessments (HEAs), and EPA's Air and Water Quality Criteria Documents. Target risk levels for carcinogens will be selected after consultation with EPA. EPA will also be notified if it is determined that toxicity values other than those found in the references cited above should be used. In addition, using the references cited, a summary toxicity profile will be developed for each indicator chemical. This toxicity profile will summarize pertinent information regarding the chemical(s) based on EPA contaminant profiles, health effects advisories, and water quality support documents.

The methods used to characterize risks for the BEC Trucking Site, in conjunction with the level of detail and documentation associated with the risk analysis will be consistent with EPA's Superfund Public Health Evaluation Manual (EPA, 1986) and Endangerment Assessment Handbook (1985).

4.6.2 Public Health Evaluation of Remedial Alternatives

The public health evaluation will be based upon assessing the level of hazard posed by implementing each potential remedial alternative and assessing how well each alternative satisfies the established health objectives. Each alternative will be evaluated with regard to its impacts on present and possible future public health risks at the site. This evaluation will be built around the acceptable contaminant concentrations in environmental media developed in the baseline risk analysis. For non-carcinogens, changes in exposure levels will be noted and concentrations still exceeding chronic and subchronic acceptable levels will be identified. For carcinogenic pollutants, an assessment will be made of whether the remedial alternative under analysis reduces the exposure levels below those corresponding to the target risk levels specified by EPA.

4.6.3 Environmental Assessment

As stated in Section 3.1.3, it does not appear that the environment in the vicinity of the site is sufficient to support any significant aquatic or terrestrial wildlife populations. Although a marsh does border the western perimeter of the site, it is less than one acre in area and thus does not represent a critical wetland habitat.

An environmental assessment will be performed for the BEC Trucking Site, in order to ascertain existing and potential future environmental impacts of the site if no remedial action is taken. The results of this analysis will then be used in the development and evaluation of remedial alternatives.

The primary methodology to be utilized in assessing aquatic environmental impacts is a comparison of site water concentration levels with water quality criteria for the protection of aquatic life. These aquatic life criteria, based primarily on toxicity, are listed in EPA Ambient Water Quality Criteria Documents (USEPA, 1980). Interpretation of these data will be complemented by qualitative observations of the habitat and biota of the adjacent marsh and drainage channel.

To evaluate terrestrial environmental impacts, published toxicity information concerning the impacts of various chemical constituents to terrestrial organisms will be considered in tandem with qualitative observations. The level of detail and documentation associated with the environmental evaluation will be consistent with EPA's Endangerment Assessment Handbook (1985). It is not expected that a Natural Resources Damage Assessment will be required for the BEC Trucking Site.

4.7 TASK 7 - TREATABILITY STUDY/PILOT TESTING

The preliminary scoping of remedial alternatives (Section 3.1.3) considered certain developed and innovative technologies for treatment of the contaminated soil and groundwater at the site. Assuming that some of these technologies meet remedial response objectives and that they pass the initial screening, treatability studies (laboratory or field) may be needed to evaluate their applicability to the site and to develop cost information for economic comparison among the technologies.

However, in this Work Plan, no specific treatability studies are proposed because of the following reasons:

- The extent of contamination at the site is unknown.
- The ambient groundwater quality at the site is not known.
- Conducting treatability studies for certain technologies can be costly. Therefore, treatability studies should not be conducted for those technologies which cannot pass the initial screening.

Therefore, it is proposed that Ebasco will meet with EPA to discuss the need and suggested scope of the treatability studies to be performed when preliminary analytical results become available. These studies will be performed in order to confirm the applicability and performance of technologies to be used in remedial alternatives. Ebasco will submit to EPA a written proposal (including scope of work, budget and schedule) for the treatability studies for approval. During that time, Ebasco will also commence preparing and issuing necessary bid packages for selecting qualified testing facilities to perform the treatability tests. Of course, the subcontracts will not be awarded until EPA has approved Ebasco's proposal.

The performance of treatability studies has been included in the project schedule, however, the LOE and other associated costs have not been included in the project budget.

4.8 TASK 8 - REMEDIAL INVESTIGATION REPORT

A Remedial Investigation Report will be produced at the conclusion of the RI. This report will summarize the data collected and the conclusions drawn from all investigative areas. The preparation of this report will proceed in parallel with the Feasibility Study.

The introduction to the Draft RI Report will be prepared in accordance with to Section 9.2.2 of the EPA RI Guidance. The first chapter will address four major areas: 1) site background information; 2) the nature and extent of contamination at the site; 3) remedial investigation summary; and 4) an overview of the report's contents.

The second chapter on Site Features Investigation will be prepared in accordance with Section 9.2.3 of the USEPA RI Guidance. It will present site features, data on demography, land use, natural resources, and climatology.

Chapter 3.0, on Hazardous Substances Investigation will be prepared in accordance with Section 9.2.4 of the USEPA RI Guidance based on pertinent references and results of the site investigation. This chapter will address waste quantities, location, components, containment and composition.

Chapters 4.0 and 5.0 will present the information obtained from the site investigation, and other relevant studies. The hydrologic investigation chapter (4.0) will be prepared in accordance with Section 9.2.5 of the USEPA RI Guidance and address 1) all soil data and descriptions that characterize the site and affect decisions on remedial alternatives, 2) reported site geology and subsurface features as well as contaminant levels that may be useful in characterizing site problems and potential impacts and in choosing remedial solutions, 3) direction of groundwater flow, dimensions of contaminant plume, plume migration, and aquifer systems at the site. Chapter 5.0, Sediment and Water Investigation, will be completed in accordance with the Section 9.2.6 of the USEPA RI Guidance and include subsections on 1) surface water bodies, 2) sediments, 3) flood potential, and 4) drainage.

Chapter 7.0 will be prepared according to Section 9.2.9 of the USEPA RI Guidance and include the results of the bench scale tests, if any, which will provide data for the remedial alternatives selection. Specifically, for each of the treatability tests to be conducted, the objectives, description and conclusions will be presented. All of the data and detailed analyses will be assembled in an appendix.

Chapter 8.0 will be prepared according to Section 9.2.10 of the USEPA RI Guidance, based on the results of the risk assessment. Potential receptors will be identified, public health and environmental impacts will be discussed, and the results of the Risk Assessment and environmental assessments will be presented.

5.0 TASK PLAN FOR FEASIBILITY STUDY

The Feasibility Study (FS) for the site will consist of four tasks as follows:

- o Task 9 - Remedial Alternatives Screening
- o Task 10 - Detailed Evaluation of Remedial Alternatives
- o Task 11 - Preparation of Feasibility Study Report
- o Task 12 - Post Remedial Investigation/Feasibility Study Support

These tasks will be preceded by the initial remedial alternatives identification step (included in this Work Plan), as well as performance of treatability studies.

5.1 TASK 9 - REMEDIAL ALTERNATIVES SCREENING

Based on the results of the risk assessment and the established remedial response objectives, the initial screening of remedial alternatives will be performed as recommended in the EPA's "Guidance on Feasibility Studies under CERCLA", and Porter's "Interim Guidance on Superfund Selection of Remedy" (December 1986) and (July 1987).

5.1.1 Development of Remedial Response Objectives and Response Actions

Site-specific concerns requiring remediation at the site will be based on the public health evaluation and environmental assessment, which will identify the potential exposure pathways and receptors of contaminants. The remedial response objectives will be established based on the results of sampling, risk analysis, institutional requirements and community needs. Based on the site problems and the remedial objectives, the potential remedial response alternatives will be developed.

5.1.2 Identification of Applicable Technologies and Development of Alternatives

Preliminary efforts regarding this task have been completed and the results are presented in Section 3.1.3 - Scoping of Remedial Alternatives. This preliminary identification will be updated and finalized based on the results of the RI and the remedial response objectives. A revised list of potential remedial alternatives will be developed.

5.1.3 Screening of Remedial Technologies/Alternatives

The final list of potential remedial technologies/alternatives will be screened. The objective of this effort is to eliminate alternatives principally on the basis of effectiveness and implementability. Cost, as indicated in Porter's (1986) memo, plays little or no role in initial screening unless the last criterion presented below clearly applies. Alternatives will be eliminated, as described in the National Contingency Plan (NCP) Section 300.68 (g), that:

- May have significant adverse impact during implementation.
- Do not adequately protect the environment and public health.
- Have technical feasibility which is either difficult or not proven.
- Have costs an order of magnitude greater than other alternative(s) but do not provide greater environmental or public health benefits or greater reliability.

The Superfund Amendments and Reauthorization Act (SARA) addresses the cleanup standards for Superfund remedial actions and requires that the selected remedy should utilize permanent solutions and alternative treatment technologies, or resource recovery technologies to the maximum extent practicable. In addition, SARA requires that volume reduction of waste and contaminated soil should be considered in addition to the reduction of toxicity and/or mobility. These applicable provisions of SARA will be applied during the screening of remedial technologies and alternatives.

In accordance with the above NCP screening criteria and SARA requirements, the initial screening of remedial alternatives will identify alternatives as acceptable/ unacceptable based on the following screening factors:

Engineering Feasibility Screening

The overall reliability and implementability of components of the alternatives, as well as complete alternatives, will be assessed. The scientific, engineering and construction judgement of Ebasco will be utilized, along with published information and other sources, to make these evaluations.

Environmental Impact Screening

Alternatives will be evaluated for impacts on the environment and on public health. The evaluation process will include environmental impacts during and following implementation. The degree of achievement of adequate control of the source waste material relative to the environment and public health for source control remedial actions will be assessed.

Institutional factors will be considered as part of this factor. Included will be on-site and off-site permit and regulatory requirements; worker safety and health requirements; and other federal, state and local regulatory requirements.

Cost Evaluation Screening

Conceptual cost estimates (order of magnitude) which have an accuracy of +100% to -50% will be used for cost evaluation. These estimates are normally used to roughly determine economic feasibility for comparative purposes.

For capital costs, Ebasco will use published cost information such as the "Remedial Action Cost Compendium" and Ebasco in-house files, adjusted to site-specific conditions. Operation and maintenance (O&M) cost estimates will be based on published information. When phasing of operable units and extended O&M costs are forecast, discounting of all expenditures to present worth value will be performed using historical trends of interest rates (standard practice for Superfund sites has been 10%).

5.2 TASK 10 - DETAILED EVALUATION OF REMEDIAL ALTERNATIVES

The remedial alternatives which pass the initial screening will be evaluated in further detail. The evaluation will conform to the requirements of the NCP, in particular, Section 300.68 (h), Subpart F, and will consist of a technical, environmental and cost evaluation as well as an analysis of other factors, as appropriate. As specified in the EPA Guidance on Feasibility Studies under CERCLA, and updated in J. W. Porter's December 1986 and July 1987 Memorandum on "Interim Guidance on Superfund Selection of Remedy" the criteria for the detailed evaluation include:

- Compliance with ARARs;
- Reduction of toxicity, mobility or volume;
- Short-term effectiveness;
- Long-term effectiveness/permanence;
- Implementability;
- Cost;
- Community acceptance
- State acceptance; and
- Overall protection of human health and the environment.

Factors which might be considered when applying each of the above criteria will be those delineated in Porter's Memorandum of July 24, 1987 (OSWER 9355.0-21).

5.3 TASK 11 - PREPARATION OF FEASIBILITY STUDY REPORT

A Feasibility Study (FS) report will be prepared to summarize the activities performed and to present the results and associated conclusions. The report will include a summary of any laboratory treatability findings, a description of the initial screening process, and the detailed technical, environmental, regulatory, public health and cost evaluations of the remedial alternatives studied. The FS report will be prepared and presented in the following format as specified in the EPA "Guidance on Feasibility Studies under CERCLA" (EPA's FS Guidance).

Preparation of the Executive Summary, and Introduction will be in accordance with Sections 9.1, and 9.2 respectively, of the EPA FS Guidance. The executive summary will be a brief overview of the study and the analysis underlying the remedial actions which were evaluated. The introduction to the FS Report (Chapter 1) will briefly characterize the site in terms relevant to the analysis of remedial action strategies in three subsections: site background information; the nature and extent of contamination problems at the site; and objectives of the remedial action will be summarized and the results of the detailed evaluation will be presented.

The screening process used to identify the feasible remedial alternatives for the site will be presented in Chapters 2 and 3. Chapter 2 (Screening of Remedial Action Technologies) will present the feasible technologies identified for the general response actions, the technical criteria including site and waste characteristics that were used in the technology selection process, and results of the remedial technology screening as described in Section 2.3 of EPA's FS Guidance. Chapter 3 (Remedial Action Alternatives) will present the remedial action alternatives developed from the applicable technologies identified in the initial screening. This discussion details the cost and non-cost features of each remedial action alternative.

The details of the cost analysis and noncost criteria analyses of each alternative will be presented in Chapter 4. A detailed analysis of the remedial action alternatives will also be presented. Chapter 5 of the feasibility study report will summarize the remedial alternatives and present the results of the analysis. Ebasco's FS Report will clearly establish the basis for EPA to select the preferred remedial alternative in Chapter 6.

5.4 TASK 12 - POST REMEDIAL INVESTIGATION/FEASIBILITY STUDY SUPPORT

Ebasco will provide support to the EPA for any requested assistance for activities which occur after the RI/FS is complete.

The scope for this task currently includes the following:

- Prepare a Responsiveness Summary for the public comment period on the draft FS report. REM III community relations staff will prepare a Responsiveness Summary for the public comment period on the draft FS report. The responsiveness summary will provide a record for the EPA of all issues identified during the public comment period on the draft FS report.

6.0 PROJECT MANAGEMENT APPROACH

The project schedule and project organization for the BEC Trucking Site RI/FS are presented in Figures 6-1 and 6-2 respectively.

6.1 ORGANIZATION AND APPROACH

As depicted in the project organization (Figure 6-2), the Regional Manager (RM), Dr. Dev R. Sachdev is responsible for the quality of all REM III work performed in Region II. He monitors the progress of each work assignment to ensure adequate resources are available. The RM's review concentrates on the technical quality, schedule, and cost for all work assignments.

The Site Manager (SM), Mr. John F. Gorgol, has primary responsibility and authority for implementing and executing the RI/FS. Supporting the SM are the Field Operations Leader (FOL), RI Leader, and other staff. The FOL is responsible for on-site management for the duration of all activities at the site. The RI Leader is responsible for the RI and for the preparation of the RI Report.

The task numbering system for the RI/FS effort is a continuation of the task numbering system used for the interim tasks and activities described in the Work Plan Memorandum. The Tasks are numbered as follows:

Task 1 - Project Planning

Task 2 - Community Relations

Task 3 - Field Investigation

Task 4 - Sample Analyses/Validation

Task 5 - Data Evaluation

Task 6 - Assessment Of Risks

Task 7 - Treatability Study/Pilot Testing

Task 8 - Remedial Investigation Reports

Task 9 - Remedial Alternatives Screening

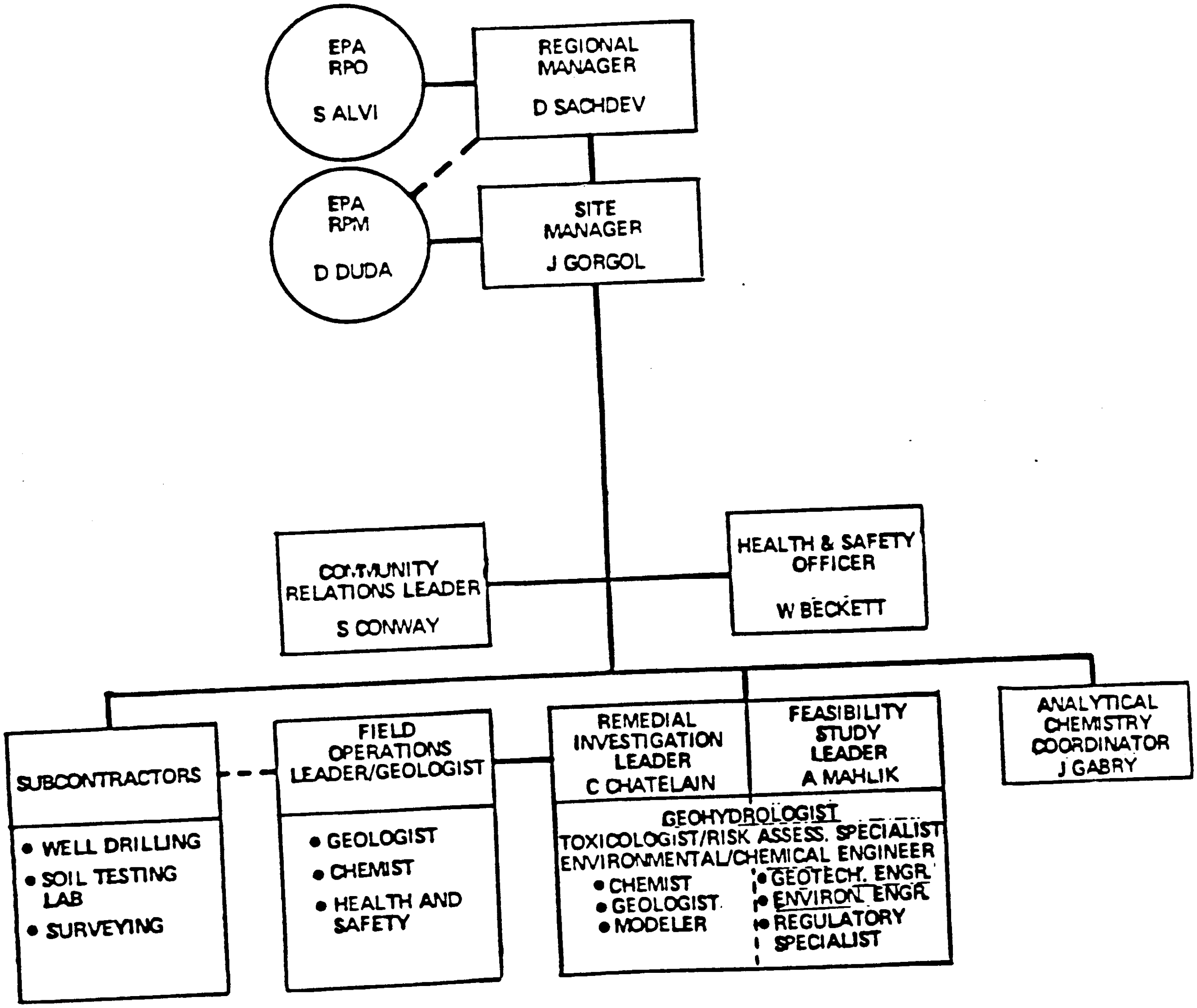
Task 10 - Remedial Alternatives Evaluation

Task 11 - Feasibility Study Report

Task 12 - Post RI/FS Support

FIGURE 6-2

BEC TRUCKING SITE PROJECT ORGANIZATION



The task list, project schedule, and budget comprise the baseline plans which form an integrated management information system against which work assignment progress is measured. The baseline plans are a precise description of how the Work Assignment will be executed in terms of work scope, schedule, staffing and cost. The project schedule and the detailed cost estimate are presented in Sections 6.3 and 6.4, respectively.

Each of the RI/FS Tasks (Tasks 1 through 12) will be scheduled, budgeted and tracked separately during the course of the RI/FS work. Monthly progress reports will be prepared and submitted to EPA. Project progress review meetings will be held to evaluate project status, discuss current items of interest, and to review project staffing.

6.2 QUALITY ASSURANCE AND DATA MANAGEMENT

The site specific quality assurance requirements will be in accordance with the Quality Assurance Project Plan for the REM III Program, as approved by EPA, and in accordance with the Brossman Guidance.

Data Management aspects of the program pertain to controlling and filing documents. Ebasco has developed a program filing system (Administrative Guideline PA-5) that conforms to the requirements of the Environmental Protection Agency and the REM III Program to ensure that the documents are properly stored and filed. This guideline will be implemented to control and file all documents associated with the Site RI/FS. The system includes document receipt control procedures, a file review and inspection system, and security measures.

6.3 PROJECT SCHEDULE

The project schedule is shown on Figure 6-1 (in the pocket at the end of this Work Plan). This figure shows the tasks and activities for the RI/FS. The critical path has been highlighted and key deliverables have been identified. If a Phase II field investigation is not required, and the 8 weeks allotted for the PRP review of the Work Plan is not included, the overall schedule for completion of the RI/FS and signing a ROD is approximately 18 months.

The schedule assumes ready access to the site and surrounding properties for the drilling of monitoring wells and the collection of samples. The schedule also assumes that the health and safety personnel protective requirements are Level D.

6.4 ESTIMATED PROJECT COSTS

The estimated cost for the site RI/FS is $685,815. These costs do not include the cost for a Phase II Field Investigation or for the CLP analyses and they assume that a limited effort will be required for screening and evaluation of Remedial Alternatives. The costs do not include an estimate for planning or performing treatability studies.

These costs include all workhours, other direct costs and subcontract costs for the initial tasks and the tasks described in this Work Plan. The cost estimate is based on the assumption that health and safely personnel protective equipment requirements are Level D. If the level of protection has to be upgraded, increased costs will be incurred.

Tabulations of the estimated hours for the RI/FS by labor category apportioned by task are shown on Table 6-1. The estimated dollar costs for the RI/FS delineated by task as well as by labor, travel, equipment, computers, reports, miscellaneous and subcontractors are shown on Table 6-2. These tables are provided under separate cover with the Optional Form 60.

REFERENCES

Camp Dresser & McKee Inc. REM II. Work Plan For The Remedial Investigation/Feasibility Study Of The Robintech Inc./National Pipe Co. Site Vestal, New York. Document Control No. 250-WPI-WP-DYBA-1. February 10, 1987.

Ebasco - REM III. Draft Work Plan - Supplemental Remedial Investigation/Feasibility Study - Vestal Water Supply Well 1-1. W.A. No. 199-2L38, January, 1988.

Ecological Analysts, Inc. Preliminary Investigation of the BEC Trucking Site, Town of Vestal, Broome County, New York. Phase I Summary Report, September 1984.

EPA Guidance on Data Quality Objectives under CERCLA, October 1986.

EPA Guidance on Data Quality Objectives for the RI/FS Process, March 1987.

EPA Guidance on Feasibility Studies under CERCLA, June 1985.

EPA Guidance on Remedial Investigation under CERCLA, June 1985.

EPA Superfund Public Health Evaluation Manual. Office of Emerging and Remedial Response, October, 1986.

Gilbert, Richard O., 1987. <u>Statistical Methods for Environmental Pollution Monitoring</u>, pp. 119 - 131, Van Nostrand Reinhold Co., New York.

Holecek, T. J., A.D. Randall, J. L. Belli, and R. V. Allen. Department of the Interior, United States Geological Survey. Geohydrology of the Valley-Fill Aquifer in the Endicott-Johnson City Area, Broome County, New York. Open-File Report 82-268, 1982.

Holecek, T. J., U.S. Geological Survey. Atlas of Eleven Selected Aquifers in New York. Water-Resources Investigation Open-File Report 82-553. 1982.

MacNish, Robert D., and Allen D. Randall. United States Department of the Interior, Geological Survey. Stratified-Drift Aquifers In The Susquehanna River Basin, New York. Bulletin 75. 1982.

REFERENCES (continued)

Martin, R. J., Consultant to Town of Vestal. Town of Vestal, Water District No. 4 Groundwater Exploration. April 1983.

National Oceanographic and Atmospheric Association - Local Climatological Data Annual Summary. Binghamton, New York. 1986.

Parkhurst, David F., Environmental Science and Technology. Optimal Sampling Geometry for Hazardous Waste Sites. Vol. 18, No. 7, 1984.

J. W. Porter's December 1986 and July 1987 memoranda on "Interim Guidance on Superfund Selection of Remedy".

The "Superfund Amendments and Reauthorization Act" requirements (particularly as related to remedial alternatives and ARARs).