907010

# FINAL
# RI/FS REPORT

## PELICAN MANUFACTURING, INC. SITE
City of Jamestown
County of Chautauqua, New York

**Work Assignment Number:**
**D002520-17.0**
**Volume I of III - Text**

August '94

Prepared for

SEP - 2 1994

**SUPERFUND STANDBY PROGRAM**
**New York State**
**Department of Environmental Conservation**
50 Wolf Road
Albany, New York 12233-7010

Prepared by

**Dunn Engineering Company**

12 Metro Park Road
Albany, New York 12205

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## EXECUTIVE SUMMARY

On May 22, 1992, the New York State Department of Environmental Conservation issued DUNN Geoscience Engineering Co., P.C. Work Assignment D002520.17 to perform a remedial investigation and feasibility study of the Pelican Manufacturing, Inc. Site (Site No. 907010) in the City of Jamestown, Chautauqua County, New York.

The Pelican site is located on the west side of the City of Jamestown, between Washington Street and the City of Jamestown Landfill, between 23rd Street and Fluvanna Avenue. The Site consists of approximately 1.3 acres of land upon which is situated a 10,000 square foot building that has been used for various commercial/manufacturing purposes over the past 50 years. The building consists of several sections with different addresses, from 2219-1/2 to 2223 Washington Street.

During the 1970's and until about 1987, the Site was operated as a metal finishing and fabricating business, first by A.M.S. Co. (1971-79) and then by Pelican Manufacturing, Inc.(1979-1987). Pelican reportedly ceased operations at the Site in 1987 and the northern two sections of the building (Nos. 2223 and 2221) have remained essentially vacant since that time. The southern section of the building, consisting of two "bays," (No. 2219-1/2), has been occupied by a waste disposal company and an automobile repair shop.

In the early 1980's, the Department received reports of the illegal storage and/or disposal of hazardous waste on the Site. An investigation of the property by the NYSDEC Bureau of Environmental Conservation Investigations in 1983 revealed evidence of the use, storage and disposal of chlorinated volatile organic compounds, primarily in the form of trichloroethene, at the Site. Soil samples collected by Department personnel indicated the presence of trichloroethene and evidence of improper disposal of hazardous waste on the property. Subsequent sampling by the Department, and by the consulting firm Ecology and Environment, Inc. for Pelican, in 1984 revealed further evidence, and more widespread distribution, of chemicals at the Site. This included storage containers both inside and outside the building, and contamination of surface soil, water and sediment on the north and west sides of the property. Pelican ultimately executed an Order on Consent with the Department and retained Ecology and Environment, Inc. to perform a Site investigation. This study was performed in 1987 and is documented in an "updated" report entitled Pelican Manufacturing, Inc. Final Report in Compliance with Order on Consent. This report was submitted to the Department in early 1988. The report supported the previous findings and revealed the presence of volatile organic compounds in the groundwater underlying the Site. Subsequent sampling of various media by the Department in late 1988 reinforced the previous findings.

As a result of the Site history and the findings of the various studies, DUNN was authorized to proceed with a remedial investigation of the Site. A First Phase RI commenced in June of 1992. The work included a preliminary Site visit and a more extensive field reconnaissance. Historical and background information concerning the Site, the adjacent former Jamestown

City Landfill, and the area in general, was obtained and reviewed. A scope of work was prepared and submitted to the Department for approval and the Site investigation commenced in August with the performance of an active soil gas survey on the exterior of the building. The results of the survey indicated evidence of volatile organic compounds in the soil vapor throughout the north and west sides of the property adjacent to building No. 2233. These results confirmed the previous sampling results and identified trichloroethene as the principal constituent in the soil vapor. The soil gas results also showed widespread distribution of the contamination on this portion of the property.

A soil boring and monitoring well installation program was commenced in September of 1992 and involved the collection of subsurface soil samples for geologic logging, for geotechnical testing and for chemical analysis. An additional environmental sampling program was conducted in October of 1992, with the collection of surface soil samples, "sediment"" samples from both outside and within the buildings, and groundwater samples from both the previously existing (E&E's) and the newly installed monitoring wells.

The results of the sampling program further confirmed the widespread distribution of volatile organic contamination in the surface soils throughout the north and west portions of the Site. Subsurface soil sampling at the new soil boring locations also indicate a vertical distribution of contaminants at the new drilling locations, particularly at the location of the "upgradient" well cluster. The vertical distribution can, in part, be attributed to the vertical migration of contaminants from the surface to subsurface locations.

Samples collected from floor drains within the buildings indicated the presence of additional compounds not previously identified as site contaminants. These compounds include: 1,1,1-trichloroethane, a volatile organic compound known to have been used at the Site but not previously found as a Site contaminant; various pesticides and two PCB aroclors. The latter two constituents had not been previously identified at the Site and were not known to have been used in connection with Pelican Manufacturing, Inc.'s activities at the Site.

Groundwater samples were collected from the three previously existing monitoring wells on the Site and the five new wells installed by DUNN in September, 1992. Both new "upgradient" wells were found to contain some of the contaminants of concern related to the Site. Unfortunately, the locations of the "upgradient" wells were actually on-site due to constraints posed by the Site; i.e., the existence of a sidewalk, utilities and Washington Street to the east of the Site, in the presumed upgradient position. The presence of trichloroethene and high concentrations of two of its known breakdown products, 1,2-dichloroethene and vinyl chloride in well cluster MW-1S/1D, imply a historical disposal of volatile organic compounds at or in close proximity to the well location.

Trichloroethene was also found in existing wells MW-19 and 20 located downgradient (west) of the buildings with the highest levels being found in well MW-19. This is consistent with previous analytical results. DUNN's new downgradient wells were installed at greater depths than the existing wells to monitor vertical head differences and gradients between different aquifers, or different water bearing zones within the same aquifer, and also to determine the water quality in the two zones. Based on water level readings in the shallow and deep wells and the water quality results, it was determined that artesian conditions in the lower water bearing zone create an upward gradient and preclude the migration of site contaminants into the deeper zones of the aquifer in the area of the Site.

Due to the nature of the chemical contamination at the Site, i.e., volatile organic compounds, and the porous/permeable nature of the fill and native soils, it was decided to perform a pilot study to evaluate the practicality of utilizing vapor extraction as a viable remedial alternative. A shallow extraction well and three monitoring probes were installed at the Site during the soil boring activity in September, 1992. The pilot study was performed on September 24 and 25, with air samples of the effluent obtained and analyzed to evaluate the content and withdrawal efficiency of the extraction system.

A First Phase FS was also conducted, in which various technologies were identified and grouped into potential remedial alternatives for preliminary screening.

Upon completion of the First Phase RI/FS and submission of a draft report to the Department, a Second Phase RI was authorized. The Second Phase RI included the collection and analysis surface water and sediment samples from the drainageway located to the west of the Site (by the Department), sampling of organic vapors (headspace analysis) of soil from beneath the building floor slab and chemical analysis of selected soil samples, collection and analysis of an additional round of groundwater samples from selected monitoring wells and the excavation of four test pits to investigate subsurface pipes, potential discharge points and migration pathways.

The results of the Second Phase RI identified potential site-related contaminants in the drainageway, extensive contamination of soils beneath the floor slab, continuing groundwater contamination, and the outlets of two discharge points, one from the floor drain inside the solvent room located at the north end of building No. 2223 and the second from the above-ground septic tank located west of building No. 2221.

The results of the remedial investigation indicate that the volatile organic compounds, the "contaminants of concern" at the Pelican site are found in the soil, groundwater, the floor drains, and the septic tank. The most contaminated soil is found near the surface in several isolated "hot spots". Contaminated soil is also found beneath the floor of the former manufacturing building. The greatest potential for human exposure to the contaminants of concern results from direct contact with the surficial soil and inhalation of organic vapors that may gradually be released from the soil as the contaminants of concern evaporate into the air. The contaminated soil also is a continuing source of groundwater contamination as the organic contaminants present in the soil dissolve into precipitation infiltrating through the soil.

The sediments contained in the floor drains beneath the buildings and the septic tank at the rear (west) of the buildings also are contaminated with volatile organic compounds. Although the potential for human contact and direct exposure to the sediments is remote, the sediments also present a potential source of groundwater contamination.

The contaminants of concern present in groundwater appear to pose little threat to human health or the environment. The groundwater contamination appears limited to the upper, unconfined water bearing zone composed of man placed fill and mixed unsorted glacial sediments. The contaminated zone is limited in areal extent and is partially truncated by a drainageway located between the Pelican site and the former Jamestown City Landfill, located approximately 180 feet west of the former manufacturing buildings. The contaminated groundwater moves from east to west and, when west of the Site, it either discharges into the drainageway, or commingles with the groundwater beneath the landfill. The contaminated groundwater is not currently used, nor is it likely to be used, as a source of potable water. The potential for human exposure to the contaminated groundwater appears limited to that portion that discharges into the drainageway.

The contaminants of concern are amenable to recovery and treatment using readily available and proven remedial technologies. The remedial program recommended for the Pelican site includes the excavation of the contaminated, near surface soil ("hot spots"). The excavated soil will be treated on-site in a treatment cell prepared in one of the former manufacturing buildings. Treatment will be provided by means of vapor extraction. The contaminated sediments will be removed from the floor drains and the septic tank and will be treated on-site along with the contaminated soil. The contaminated soil beneath the floor of the former manufacturing building will be treated in-place using a soil vapor extraction system. It is anticipated that the volatile organics will be removed from the soil and sediment within a period of two years, at which time the soil will be spread on-site.

Based on existing data, the rate at which volatile organics will be removed from the soil and sediment and released into the air will not exceed New York State's allowable emission rates. If during system start-up, emission rates are higher than predicted, activated carbon adsorption units can be added to the vapor extraction systems to control emissions. The costs associated with air pollution controls are included in the final cost estimate presented below.

Once the contaminated soil and sediment are removed, the most significant source of groundwater contamination at the Site will have been removed. Groundwater quality will gradually improve due to natural flushing and degradation of the organic contaminants dissolved in the groundwater.

A comprehensive monitoring program will be a part of the remedial program. Groundwater quality will be monitored to evaluate the effectiveness of the remedy selected for the contaminated soil and sediment. The emissions from the vapor extraction systems will also be monitored to verify that no air pollution controls are required to protect air quality and to determine when the treatment of the soil and sediment appears to be complete.

The total estimated costs associated with the recommended remedial program are $680,504. This includes the costs associated with installing and operating a vapor extraction system for a period of two years. The total cost also includes the cost of a 30 year groundwater monitoring program.

## 1.0 INTRODUCTION

Dunn Engineering Co., (DUNN) has been assigned Work Assignment No. D002520-17 by the New York State Department of Environmental Conservation (the NYSDEC or the Department) under the Superfund Standby Program. The assignment is to conduct a Remedial Investigation/Feasibility Study (RI/FS) at the Pelican Manufacturing, Inc. site ("the Pelican site" or "the Site"), which is located in the City of Jamestown, Chautauqua County, New York (Site No. 907010).

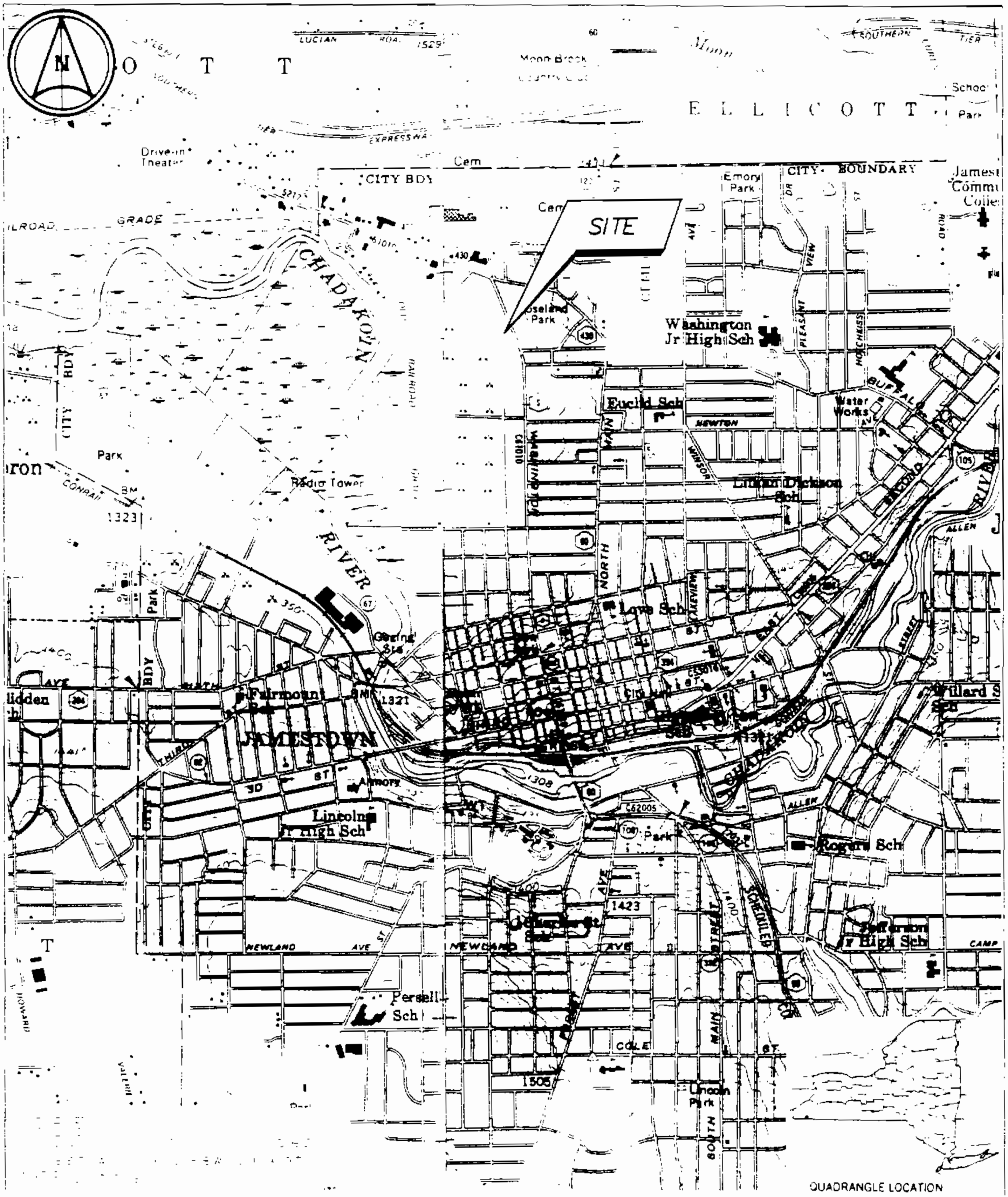
### 1.1 Site Description

The Pelican site consists of approximately 1.3 acres of land, including a 10,000 +/- square foot building that has been used for various commercial and manufacturing activities for at least the past 50 years. The Site is located on the west side of Washington Street, northwest of the intersection of Washington Street and 23rd Street. The Site is bordered on the north (No. 2229), and south (No. 2213), by other commercial or light manufacturing businesses. A portion of the former Jamestown City Landfill (now Chadakoin Park) borders the Site to the west. Refer to Figures 1-1 and 1-2 for the Site Location and Site Map.

The building complex on the Pelican site consists of three sections or buildings with three different street addresses, from north to south, No's. 2223, 2221 and 2219 1/2 Washington Street. The visual appearance of the buildings indicates that No's. 2223 and 2221 were originally part of the same building and that building No. 2219 1/2 was added to the main building at a later date. The earliest available air photos of the Site (1968) show the buildings in their current state. No building records or plans were on file in the City of Jamestown's Planning or Engineering Departments. Therefore, the exact history and details of site development and building construction/expansion could not be determined.

The surface of the Site from Washington Street to the break in slope at the rear (west) of the building is comprised of miscellaneous fill. A drainage swale exists at the base of the fill slope and conveys surface drainage to the south. This swale closely approximates the preexisting grade prior to filling. The former Jamestown City Landfill slope grades to the east and forms the western border of the drainage swale.

The Pelican site lies at an elevation of approximately 1316 to 1326 feet above mean sea level (AMSL) and consists of an eastern portion developed on fill (Elev. 1320 to 1326) and a western portion developed on the former flood plain of the Chadakoin River (Elev 1316-1320). A proglacial and/or post glacial lake formerly existed in this area. The glacial lake occupied a preglacial valley that was blocked to the southeast by a ridge of morainal deposits upon which the City of Jamestown is situated. The Chadakoin River eroded an outlet through the moraine and currently drains Chautauqua lake at an elevation of approximately 1310 AMSL. The current lake elevation is controlled by a dam at Jamestown. This dam maintains a consistent lake level for recreational purposes and prevents further draining of the lake by the natural evolution of the Chadakoin River drainage system.



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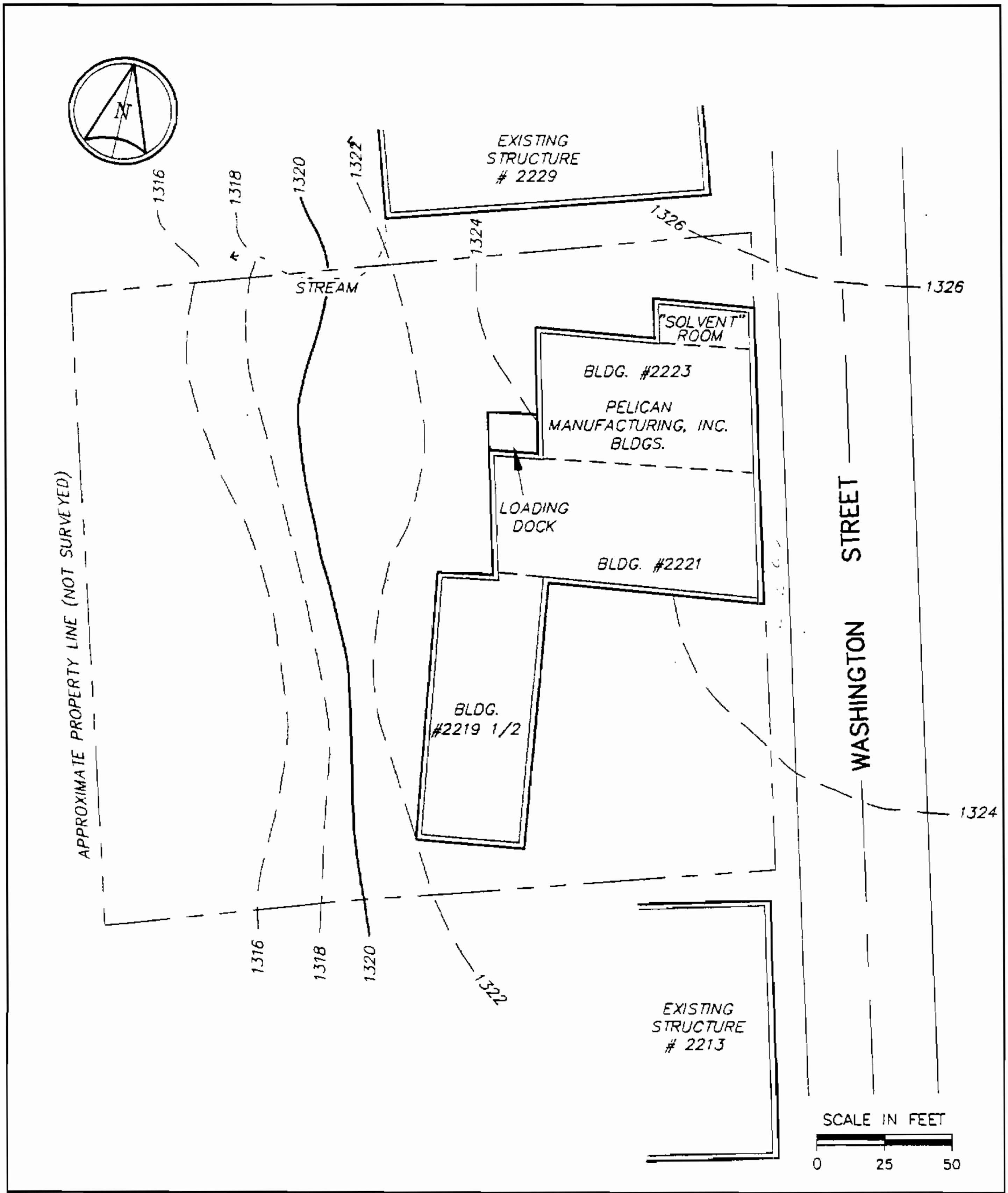
DIVISION OF RUST ENVIRONMENT & INFRASTRUCTURE

SITE LOCATION MAP

PELICAN MANUFACTURING, INC.



**DUNN ENGINEERING COMPANY**

DIVISION OF **RUST** ENVIRONMENT & INFRASTRUCTURE

**SITE MAP**

**PELICAN MANUFACTURING, INC. SITE**

City of Jamestown

Chautauqua Co., NY

| | | | | |
|---|---|---|---|---|
| PROJECT No. 35120.700 | DATE 7/28/94 | DWG. No. 2A9421 | SCALE 1"=50' | FIGURE No. 1-2 |

## 1.2 Site History

In the mid 1940's, the Site was operated as an automobile repair shop under the name of Alton W. Anderson Auto Repairs. Very little historical information about this operation is currently available. From the late-1940's to the late 1960's (1949-1969), the Site was operated as Coverall Service and Supply Co., reportedly a division of American Linen, Inc. Coverall Service reportedly performed cleaning and/or storage services on the Site. Throughout the 1970's and early 1980's, the Site was operated as a metal fabricating and finishing business, first by A.M.S. Co., (1971-1979) and then by Pelican Manufacturing, Inc. (from 1979 into the 1980's). Pelican reportedly ceased operations at the facility in 1987. The Site was under ownership of Mr. Richard Noon dba CYA Realty. Mr. Noon was also the President of Pelican. In 1993, the City of Jamestown foreclosed on the property for non payment of taxes.

The undeveloped property to the rear (west) of the on-site buildings, originally part of the Chadokin River flood plain, was owned by the City of Jamestown and operated as part of the city's landfill. Air photos of this area indicate that landfilling of this parcel occurred in or around 1973, with additional filling and/or capping and grading in 1978.

Building No. 2223 on the Pelican site consists of a large central section with a smaller room (the "solvent room") located along the northernmost end and two offices located along the east side. This building was reportedly used by Pelican for the storage and use of solvents to degrease or clean metal parts prior to their painting and fabrication. Building No. 2221 also consists of a large central section with offices and a lavatory along the east side. The southern extension of the Pelican buildings (No. 2219 1/2) consists of two sections or bays. The north section was leased to Robert Samuelson (Samuelson) who operates a waste disposal company. The south section was leased to Donald Joslyn who operates an automobile repair shop on the premises under the name of L and J Auto Repair (L and J). These businesses were in operation at the time of commencement of the RI (June 1992) but only L and J was in operation at the Site during the performance of the second phase of the RI (February 1994).

## 1.3 Previous Investigations

In 1983-84, the Site and its then current operator (Pelican) came under investigation by the Department's Bureau of Environmental Conservation Investigations (BECI) for the alleged disposal of degreasing solvents on the property. Samples collected on the Site by the Department in 1983 identified the presence of the chlorinated solvent trichloroethene (TCE) in the soil west of the loading dock.

In February of 1984, the NYSDEC (BECI) sampled containers of materials both within and outside of the building. These containers included "vats" located inside the building, 5 gallon pails located on the loading dock on the outside (rear) of building No. 2223, and a 55 gallon drum located on the ground to the rear (west) of the Pelican buildings. The analytical Results indicated that the contents of the containers included virgin solvents (TCE, 1,1,1-TCA and toluene), "tar", paint, and other waste mixtures. Other volatile organic compounds were present in some of the samples but were not identified or quantified.

An "independent study" of the Site was performed for Pelican by Ecology and Environment, Inc. (E & E) in 1984. Soil and water samples collected from various locations on and adjacent to the Site exhibited levels of TCE, 1,1,1-TCA, chloroform, carbon tetrachloride, tetrachloroethene, bromodichloromethane, methylene chloride and various other chlorinated organics. Some of the organics (e.g. chloroform and methylene chloride) are suspected of being laboratory derived.

In addition, Pelican retained E&E to perform a site investigation pursuant to an Order on Consent executed by Pelican and the Department. This investigation was performed in the summer of 1987. Results of this investigation and analyses of aqueous and solid samples for priority pollutants indicated that the groundwater and soil at the Site were contaminated with trichloroethene. Other chlorinated solvents were detected in both on and off-site samples as well. Some of these compounds were reportedly not directly attributable to activities at the Site and some are suspected of being laboratory derived In addition, E&E's analyses documented the presence of a non-priority pollutant chlorinated organic in the groundwater one of the downgradient wells. This compound was not identified. Subsequent sampling by the Department in October, 1988 confirmed the continued presence of solvents in the soil, surface water and groundwater, both at and immediately adjacent to the Site.

Previous record searches relating to investigations at the former Jamestown City Landfill, which borders the Site to the west, have indicated that a minimum of 70 tons of waste paint, waste solvent, degreaser sludge, paint arrestors and paint liquids were accepted for disposal at the landfill. Previous surficial investigations have been performed at the landfill and samples of surface water and sediment have been collected and analyzed. Various compounds such as polychlorinated biphenyls (PCBs); various Target Compound List (TCL) substances; including volatile organic compounds, polynuclear aromatic hydrocarbons (PAHS) and metals have been detected in the samples. Apparently none of the historical sampling locations on the landfill were near the Pelican site.

## 1.4 Objectives

### 1.4.1 Project Objectives

The objectives of the project were to undertake a remedial investigation of the Pelican site; to determine the nature and extent of contamination of soil, sediment, surface water and groundwater attributable to activities performed at the Site; to determine the actual and potential threat to human health and the environment posed by the Site; and to perform a feasibility study of possible remedial alternatives to remediate the Site in a manner that is protective of human health and the environment. As part of this process, the need for interim remedial measures (IRMs) was to be evaluated and recommendations made to the Department relative to a course of action to design and implement such IRMs.

### 1.4.2 Data Quality Objectives

On the basis of information relating to historical Site activities, allegations of waste disposal, and the results of previous investigations, the contaminants of concern (COC) for the

Pelican site were initially determined to be volatile organic compounds (VOCs). Specific VOCs used by Pelican and found at the Site in 1983 consisted of trichloroethene (TCE), 1,1,1-trichloroethane (TCA) and toluene. Additional potential COC consisting of the breakdown products of TCE: dichloroethene (cis and trans) and monochloroethene (vinyl chloride), and tetrachlorethene (due to its demonstrated presence on the Site during previous sampling) were also identified. The breakdown products of TCA were not considered to be COC nor were some of the suspected (common) laboratory contaminants (methylene chloride, acetone, and chloroform) that were reported in results from previous sampling events at the Site. The sources of the volatile compounds carbon tetrachloride and bromo dichloromethane are unknown, although the carbon tet could have been associated with the previous cleaning establishment that operated at the Site. Neither of these compounds were identified as COC for the purposes of the Pelican RI. Semivolatile organic compounds, pesticides/PCBs and Superfund inorganics (metals) were also not initially considered to be COC at the Pelican site.

Data Quality Objectives (DQOs) were established for the contaminants of concern based upon various NYSDEC and NYSDOH regulations, standards, cleanup criteria (e.g. RSCOs) and guidance documents. The DQOs were also evaluated with respect to the potentially impacted media: surface water, groundwater, and soil. On the basis of these evaluations, the following COC and DQOs were established for the RI/FS performed at Site.

| | DQOs | | |
|---|---|---|---|
| COC | Surface Water (1) | Groundwater (2) | Soil (3) |
| TCE | 3ug/l | 5ug/l | 700ug/kg |
| DCE (cis and trans) | 5ug/l | 5ug/l | 300ug/kg |
| VC | 0.3ug/l | 2ug/l | 200ug/kg |
| 1,1,1 TCA | 5ug/l | 5ug/l | 800ug/kg |
| Toluene | 5ug/l | 5ug/l | 1500ug/kg |
| | ug/l=ppb | | ug/kg=ppb |

(1) NYSDEC Surface Water Standards (6NYCRR Part 703), and Technical and Operational Guidance Series (TOGS) 1.1.1..

(2) NYSDEC Class GA Groundwater Standards and Guidance Values, NYSDOH drinking water standards, and USEPA National Primary Drinking Water Standards and Maximum Contaminant Levels (MCLS).

(3) NYSDEC Division of Hazardous Waste Remediation Technical and Administrative Guidance Memorandum (TAGM): HWR 94-4046 (REVISED) Determination of Soil Cleanup Objectives and Cleanup Levels.

Analytical methods were selected and adjusted in order to obtain data of sufficient quality and at reporting levels conducive to the ability to evaluate the results with respect to numerical results and cleanup standards or requirements. As such, all samples were analyzed for various combinations of TCL/TAL parameters in accordance with the NYSDEC CLP, Analytical Services Protocol (ASP), December, 1991.

# 2.0 FIRST PHASE REMEDIAL INVESTIGATION

## 2.1 Site Reconnaissance

### 2.1.1 Introduction

This section describes site details and information obtained during the initial site visit by the NYSDEC and DUNN project managers, during additional site reconnaissance by DUNN's field manager, and during subsequent trips to the Site for the performance of various RI activities.

### 2.1.2 Objectives

The initial objectives of the site reconnaissance were to become familiar with the Pelican site and its environs; to observe physical details of and relationships between the Site, the former Jamestown City Landfill, and other neighboring properties and/or cultural features; and to observe the general environmental setting of the Site and its immediate surroundings. Subsequent objectives were developed relative to assessing site conditions for planning various RI activities, including but not limited to: site accessibility for drilling equipment and sampling activities; determining sampling locations; establishing health and safety procedures; inspecting the interior of the Pelican buildings; planning the VES Pilot Test; and observing site conditions during different seasons of the year.

### 2.1.3 Methods

Reconnaissance activities were performed by conducting walkover surveys of the Site and surrounding properties, along Washington Street from Fluvanna Avenue to 18th Street and on the Jamestown City Landfill property. An inspection of the interior of the on-site buildings was also conducted. Windshield and walkover surveys were performed for the Habitat Based Assessment and Human Health Evaluation. These surveys covered more extensive areas than the immediate area of the Site. The methods and results of the reconnaissance activities performed for those purposes are discussed in their respective sections of this document.

### 2.1.4 Results

The initial site visit and reconnaissance revealed that the Site had apparently not been in use since Pelican went out of business in 1987, with the exception of the southern portion of the on-site buildings (No. 2219 1/2) which housed the offices of a waste disposal service (Samuelson) and an automobile repair shop (L and J). A number of automobiles and parts, a small boat and trailer, and a semi-trailer were stored behind (west) of this portion of the building and behind No. 2221 at the time of the initial inspections of the Site.

Occupants of the property at 2119 Washington Street located south of the Site (the Scutellas) are wildlife rehabilitators and use both surface and subsurface water to maintain ponds and other water impoundments to treat and house various forms of wildlife. The north-south drainageway located to the west of the Pelican site also borders the Scutellas' property on the west. This drainageway has been dammed by the Scutellas to pond the drainage water, which is also augmented by water from their on-site wells on an as needed basis. Ponds located closer to the house are served by water obtained from two wells on the property. These wells reportedly derive water from a zone of subsurface water under artesian pressure. The wells are 60- 70 feet deep and flow at the ground surface all year round.

A complex, combined natural and man-made surface and subsurface drainage system exists within the former Jamestown City Landfill. A north-south portion of this drainage system borders the Pelican site on the west. The drainage in this portion of the system apparently originates from two sources; the first being the result of drainage due to a seasonally high water table, and both pumped and natural discharge of liquids from the properties located to the north of the Site. These properties are located at 2229/2231 Washington Street (Prestige Line Products and Dunnright Construction Company), and at No. 2241 Washington Street (Carpenter and Bacot dry cleaning establishment). The second source is also related to the high water table, in combination with the nearby presence of one of the former east to west drainage ditches or swales that were formerly used to convey storm water from the Washington Street area through the landfill to the Chadakoin River. The remnants of one of these former drainage ditches is located to the northwest of the Pelican site. Natural grades on the landfill, and on the Pelican site and adjacent properties, convey storm water runoff to a north-south drainageway that exists between the Site and the former Jamestown City Landfill. Flow direction in this drainageway may be to the north or south, or both, depending on the season of the year and locally heavy storm events. The normal flow direction in this drainageway appears to be to the south. Storm events could also cause increased flow in the east-west system of ditches, and potential overflow into the north-south drainageway. It is also possible that the drainage from subsurface sanitary and/or internal floor drain systems from properties along Washington Street eventually finds its way into this natural drainage system. For example, a surface outlet for the floor drains located within the Pelican buildings (Nos. 2221 and 2223) was discovered at the northeast corner of the loading dock behind (west of) the building. Also, an above-ground concrete septic tank or cesspool was discovered within the concrete rubble on the west side of building No. 2221, at its juncture with building No. 2219 1/2. The septic tank/cesspool was connected to building No. 2219 1/2 and was still in operation during the sampling event conducted in October 1992.

### 2.1.5 Conclusions

Subsurface hydrogeologic conditions at 2119 Washington Street (Peterson Overhead Door/Scutella) indicate that artesian conditions exist at depth in the general area of the Site. In addition, boring B-21, located at the southeast corner of the Pelican site, also encountered artesian conditions at a depth of approximately 50 feet below the ground surface.

Because of the location and features of the north-south drainageway along the western portion of the Pelican property, and with no visible leachate originating from the Site itself, it was initially concluded that the results of any surface water and/or sediment samples collected from within this drainageway could not be traced to a particular source. Therefore, no samples were collected from this drainageway during the First Phase R.I. However, upon review of the First Phase RI/FS Report, the Department concluded that samples from the drainageway were necessary to address this data gap. Therefore, the Department collected four sets of surface water and sediment samples from points located within the drainageway for assessment in conjunction with the Second Phase R.I. Refer to Sections 3.3 and 3.5 of this report for a discussion and the results of this effort, respectively.

## 2.2 Records and Information Search

### 2.2.1 Introduction

Background information relating to the Site and its environs were obtained and reviewed both prior to and during the conduct of the RI. This information was used to ascertain details of site history, development, and use; the nature and results of previous investigations; building and facility construction details; geologic history of the area; subsurface hydrogeologic details; and wildlife conditions. Details relating to specifics such as the hydrogeology of the area and wildlife conditions are discussed in other sections of this report.

### 2.2.2 Objectives

The objectives of the Records and Information Search were to use the information primarily in the planning and conduct of the RI. Some of the information was also utilized in an attempt to understand the results of the previous (NYSDEC and E&E) and current investigations, to identify contaminants of concern, and to evaluate environmental conditions at and in the vicinity of the Site. Similarly, the collective results of previous and current studies, both on and off site, were used in the Habitat Based Assessment and Human Health Evaluation, and in formulating the preliminary list of remedial alternatives for the various impacted media discovered at the Site.

### 2.2.3 Methods

Most of the initial records and information regarding the Site were obtained from the files in the Central Office and Region 9 office of the NYSDEC. A minor amount of additional information was obtained from the State and County Health Departments. The City of Jamestown Planning and Engineering Departments were contacted and visited to search for records pertaining to building constriction and sanitary facilities. Attempts were also made to locate plans relating to the floor drain system, particularly the drain in the northeast corner of the "solvent room" in building No. 2223. The offices of the New York State Geological Survey and the U. S. Geological Survey were also contacted for file documents and records relating to the geologic history of the area as well as the underlying hydrologic system.

### 2.2.4 Results

A substantial amount of information regarding the history of investigations at the Site, commencing in or around 1983, were contained in the files provided by the NYSDEC. A synopsis of these investigations and summary tables of the analytical data are presented in Appendix A. Several phases of investigation were documented in these files. These files also identified previous owners and uses of the property but provided little useful information relative to specific operations, chemical use or waste disposal practices at the Site. Unfortunately, the City of Jamestown's records provided little useful information relative to building construction details and sanitary facilities. It was discovered that a representative of the city's engineering department had attempted to trace the path of the outlet from the "northeast" floor drain in the solvent room with the use of dye. This attempt had proved unsuccessful. A moderate amount of useful information relative to the geology and hydrology of the area in general was obtained from the NYSDEC and U.S.G.S., however, very little specific information regarding the immediate vicinity of the Site or the Site itself was discovered. The information obtained was used to interpret subsurface conditions in the area of the former Jamestown City Landfill (for a concurrent PSA underway at this site) and the Pelican site.

### 2.2.5 Conclusions

The results of the records and information search provided little useful historical information about predecessor companies and operations prior to Pelican. Pelican performed metal cleaning, fabricating and finishing operations at the Site. No actual records of chemical use, storage or disposal were obtained, other than the descriptions contained in the E&E report. No information relative to the building construction and facility details were available in the City of Jamestown's files and the results of dye testing the northeast floor drain were inconclusive. Regional geologic and hydrologic information provided a general understanding of the geologic history of the area, however, little if any, site-specific or immediate area-specific information was available. The lack of availability of specific information for the Site and its immediate environs prevented a thorough preliminary assessment of subsurface hydrogeologic conditions at and in the vicinity of the Site.

## 2.3 Aerial Photo Interpretation

### 2.3.1 Introduction

As part of the information gathering process, the historical development and operation, or the nature of activities performed at a facility or property, can often be traced through the study and interpretation of aerial photographs. This is particularly true if the facility/property has been in operation for any length of time and has been photographed on multiple occasions during this time period. DUNN has access to an extensive data base and sources of historical aerial photographs through its subsidiary, National Aerial Resources (National). National's data base was reviewed and a series of historical photographs encompassing both the Pelican site and the former Jamestown City Landfill were obtained for study for both the Pelican site and the Jamestown City Landfill projects.

### 2.3.2 Objectives

The objectives of the review and interpretation of the historical aerial photographs of the Pelican site were to: trace the development of the on-site building and the property itself; to identify any exterior features or activities that could be related to or have resulted in contamination of the Site; to identify cultural and environmental features at and in the vicinity of the Site that could influence the scope of the investigation and/or have a bearing on an interpretation of the migration and fate of the contaminants and to identify actual or potential impacted areas.

### 2.3.3 Methods

Historical aerial photographs spanning the period from 1968 to 1989 were identified in DUNN's data base. Six relevant and usable dates of pertinent coverage were obtained from various sources, viewed and interpreted. Five of the six photograph dates were available with stereoscopic coverage and were viewed with a mirror stereoscope. The sixth date of coverage was only available in a single photo and was, therefore, viewed monoscopically.

### 2.3.4 Results

**May 7, 1968**: The property has been backfilled from Washington Street in the past in order to construct one major segmented structure (building) and the parking area that exists to the rear (west) of the property.

The surface of the backfill appears to consist of earth materials, and has the same uniform color and texture of the material in the gravel pit to the west along the Chadakoin River.

Prior to any construction, the area may have been used for agricultural purposes and appears to have been drained by a series of open ditches that bound sections of land within the general area of the Site. The trees on some of the adjacent sections indicate that these parcels have not been farmed in many years. No vegetation is apparent on the backfilled area, possibly indicating that the backfilling had only recently been completed.

There is some evidence of active filling along the northwestern edge of the backfill area, but it is not clear what the material consists of. This material is less uniform in appearance (more mottled) than the main backfilled area and also appears to be coarser in texture.

One truck is parked in the rear of the building and several cars are parked on the street in front (east) of the building. It is not readily apparent what the building is used for.

**May 17,1971**: No appreciable change from the 1968 photos. Several more trucks are parked in the rear of the building.

**1973**: No change is obvious immediately around the building. One van and three larger box trucks are parked behind the building.

It appears that a small amount of debris has been dumped over the bank at the west edge of the parking area; however, it is not clear what it is.

The municipal landfill has begun to encroach on the parcel immediately adjacent to the subject property, to the west.

**October 1975**: Access to the back (west) of the southerly portion of the building has been improved by removing brush and grading. No new backfill material has been added. Two trucks are parked side by side behind that part of the building. Four trucks and a van are parked in the previously described parking to the rear of the northerly portion of the building.

The landfill has filled the parcel previously described (1973 photo) and has been capped.

There is a dark linear feature with no discernable relief i.e., it appears to be a surface feature and not a ditch, that runs from the loading dock portion of the building in a southwesterly direction to the edge of the fill. The area appears to be wet and possibly stained. The feature appears to be related to some type of drainage or release originating at or near the loading dock. However, no standing liquid is obvious either on the parking area surface or in the low area to the west of the fill, at the end of the feature.

**April 1978**: The dark, linear feature previously described (October 1975) is no longer apparent.

There is active dumping of solid material over the back adjacent to the southwest corner of the main portion of the building. It is not clear what the material is.

There are no obvious changes to the building. Cars and trucks continue to park around the building.

Another layer of solid waste is being added to the parcel of the landfill located adjacent to the subject property (the parcel previously capped - October 1975 photo).

**June 8, 1983**: No vehicles are parked behind the building. Vegetation is present on the back where dumping previously appeared (1978 photo).

Stereopairs were not available for this date. Therefore, this coverage was viewed monoscopically.

**May 17, 1989**: No apparent change from 1983 photos. Several automobiles are parked around the building, but no activity is evident on the exterior of the building.

### 2.3.5 Conclusions

The following conclusions can be reached based upon an interpretation of the aerial photographs available for the Site between 1968 and 1989.

- the primary filling and construction of the on-site buildings occurred prior to 1968;
- the area to the rear of the northerly buildings (No's 2223 and 2221) has been used for parking of a few vehicles during the period covered by the photographs;
- additional fill has periodically been added over the west edge of the main fill over time;
- filling of that portion of the Jamestown City Landfill located behind (west of) the Pelican site occurred in the early 1970s (1972-1975);
- there is possible evidence of disposal or release of liquids near the loading dock in the 1975 photo;
- additional filling occurred on the Jamestown City Landfill behind (west of) the Site in 1978; and
- the photos provided little evidence of active use of the flat area behind the building for purposes other than vehicle parking.

## 2.4 Soil Gas Survey

### 2.4.1 Introduction

Soil gas surveys are useful non-invasive or non-destructive investigative methods when site use or site investigations indicate that the contaminants of concern may consist of or include volatile organic compounds (VOCs). The use of such surveys allows a relatively large area of ground to be screened for such compounds and, when combined with a head space analysis of discrete samples, is capable of providing confirmation of contamination by VOCs. The Pelican site history and results of previous investigations made the soil gas survey a viable investigative method for use at the Site.

### 2.4.2 Objectives

The objectives of the soil gas survey performed at the Site were to: reconfirm evidence of surface and/or near-surface gross contamination of on-site soils with VOCs including, but not necessarily limited to, trichloroethene, dichloroethene, tetrachloroethene and 1,1,1-trichloroethane; identify locations for the collection of surface soil samples for chemical analysis; select new monitoring well locations; evaluate the feasibility of performing a Vapor Extraction System (VES) pilot study on the Site; and to provide relevant data and information for use in the preparation of a habitat-based assessment and a health risk assessment.

### 2.4.3 Methods

#### 2.4.3.1 Site Grid and Sampling

In order to determine the areal extent of contamination resulting from former activities at the Pelican site, a soil gas survey was designed and conducted on August 24 through August 28, 1992. The survey was to be performed on both the interior and the exterior of the building. The exterior survey encompassed the north and west sides of the building, originating at the building perimeter and extending perpendicularly away from the building walls at 25-foot intervals. Sampling of the three points of interest inside (beneath) the building was not performed due to access denial by the owner at the time of the survey. Refer to Figure 2-1 for the soil gas sampling locations.

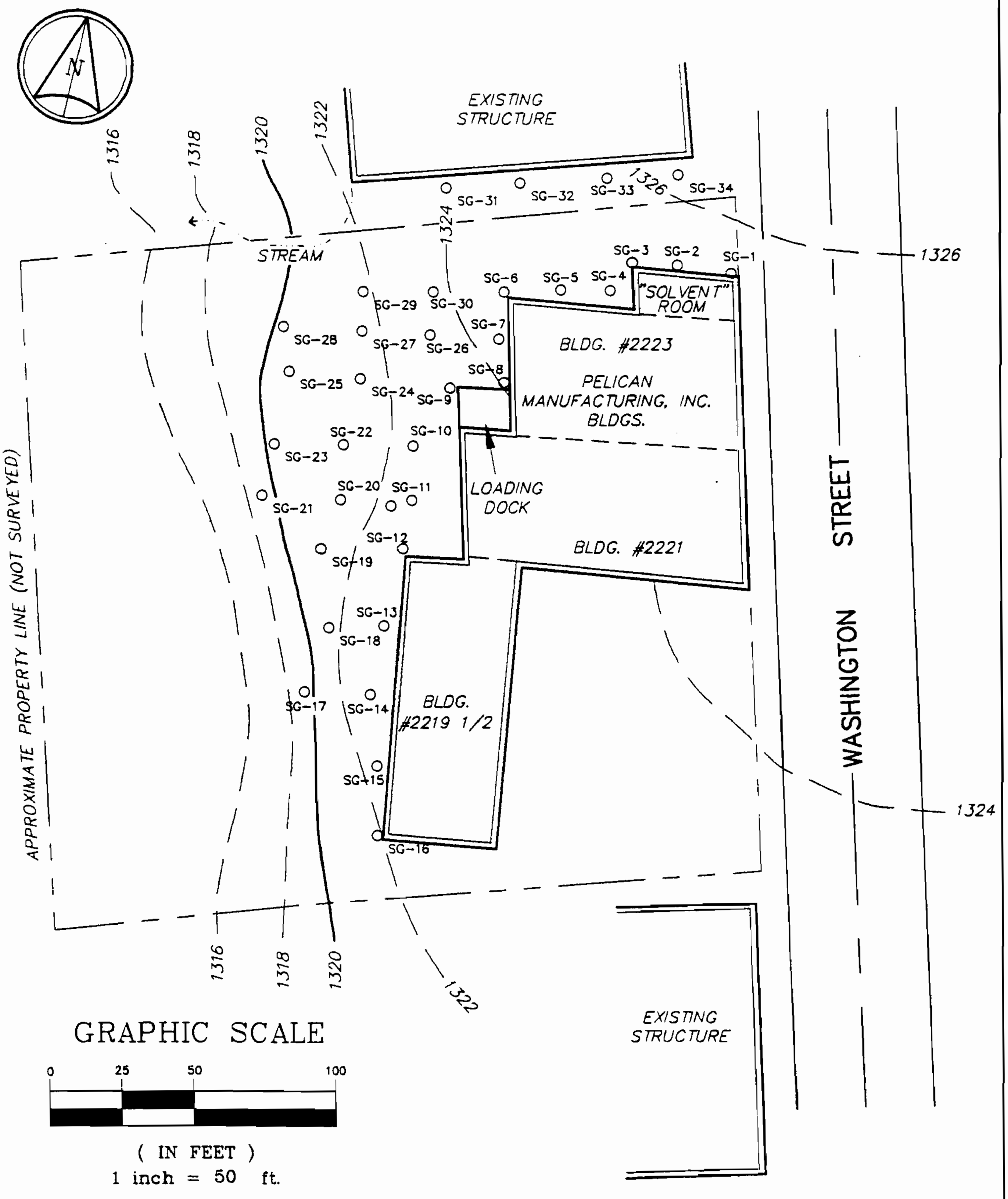
Sampling locations were prepared by using a "slam bar" to drive a 5/8-inch steel rod to a maximum depth of four feet, removing it and inserting a 1/2-inch diameter hollow aluminum tube into the probe hole to maintain the opening in the shallow vadose zone. Care was taken to ensure that the tube was not plugged or inserted into shallow ground water. Surface soil was packed into the annular space around the tube to prevent infiltration of surface air into the probe hole during sampling.

Soil gas samples were collected with 125 milliliter gas sampling bulbs. Each sampling bulb consisted of a wide glass tube with Teflon stopcock valves at either end, and a septa in the center of the glass wall to allow for sample withdrawal. The top of the aluminum tube in the probe was connected with dedicated 1/2-inch polyethylene tubing to a pump with Tygon tubing. The vacuum pump drew soil gas up through the subsurface probe and glass bulb until approximately 2 liters (6 sampling train volumes) of soil gas was purged. Soil gas was contained in the glass bulb by closing the valve nearest the pump (to prevent backflow), shutting off the pump and removing it from the glassware. The other valve (nearest the aluminum tube) was left open to the soil source for approximately one minute to allow the system to come to equilibrium pressure. Following the equilibriation period, the second valve was closed and the sample was collected. Samples were labeled to correspond with the sample location and stored in a cool, dark place until the time of analysis. Analyses were generally performed within one hour of sample collection.

#### 2.4.3.2 Sample Analysis

A Photovac lOS70 gas chromatograph (GC), mobilized to the Site by DUNN, was equipped with a photoionization detector (PID) and an on-board computer with a library programmed to analyze samples for the six target volatile organic compounds (VOCS) consisting of tetrachloroethene, toluene, trichloroethene, 1,1,1-trichloroethane, cis-1,2-dichloroethene and trans-1,2-dichloroethene.

The Photovac GC analyzes gaseous samples and generates quantitative data specific to each compound. After injection into the instrument, the gas sample flows through a chromatographic column prior to the PID. The various VOCs pass through this column at different rates and thus reach the detector at different times after the injection. A strip-chart



**DUNN ENGINEERING COMPANY**

DIVISION OF **RUST** ENVIRONMENT & INFRASTRUCTURE

**EXTERIOR SOIL GAS SAMPLING LOCATIONS**

PELICAN MANUFACTURING, INC. SITE

City of Jamestown

Chautauqua Co., NY

| | | | | |
|---|---|---|---|---|
| PROJECT No. 35120.700 | DATE 7/94 | DWG. No. EC-119_2 | SCALE 1"=50' | FIGURE No. 2-1 |

record of detector response versus time is obtained during each analysis, and the presence of VOCs in the sample is manifested by peaks on this strip-chart record.

The portable GC measures two parameters for each peak observed during the analysis. First, the length of time (known as the retention time) is measured between the initial injection of the sample and the detection of the peak; each VOC has a characteristic retention time by which it is tentatively identified. Second, the portable GC integrates the detector response to measure the area under the peak. The area, measured in millivolt seconds (mv-s), is proportional to the concentration of the compound in the sample.

Prior to the start of field activities, the instrument library was calibrated to recognize retention times and convert peak areas into concentrations for the six target VOCS. Gaseous standards were prepared by withdrawing a measured volume of headspace above a pure compound followed by injection into a one liter glass bulb that had been thoroughly flushed with organic free (ultra zero grade) air. The concentration of the standard was calculated using the room temperature, the Noble gas law and other related equations. Since field conditions can vary dramatically from the initial calibration conditions, influencing both compound retention times and response factors in the library, continuing calibrations were routinely performed.

The continuing calibration was performed by injecting a standard containing trans-1,2-dichloroethene, cis-1,2-dichloroethene, trichloroethene, toluene and tetrachloroethene into the portable GC. Using a keyboard command, the instrument recalibrates the programmed library, updating retention times and response factors for all the target VOCs by linear adjustment relative to the compound selected for continuing calibration. Trichloroethene was the compound selected for continuing calibration since it was the dominant compound tentatively identified in samples collected on the first day of the survey (August 25).

Soil gas analyses were conducted by withdrawing a sample from the sampling bulb with a 500 microliter (ul) syringe and injecting a 250 ul aliquot of the sample vapor into the GC which compared the sample instrument response to that of the calibration standard stored in the GC memory. To document the analysis, the GC prepared a strip-chart report detailing the concentration of the recognized compounds and the raw instrument response of "unknown" compounds detected in the sample. In the event that the sample results were above the linear range of the instrument calibration, a smaller aliquot was injected and the sample results were corrected for the "dilution factor."

### 2.4.3.3 Quality Control/Quality Assurance

Field notebooks were used to record all pertinent information (e.g. odors, visual observations, weather), field measurement and any irregularities or deviations from the prescribed sampling procedure. All entries were initialled for personnel identification. All notebooks were weatherproof and entries were made with black waterproof ink.

The 5/8-inch steel rod used to make the probe holes was cleaned following the preparation of each sampling location. The rod was rinsed with distilled water, washed with a detergent, and then rinsed with distilled water. Each aluminum tube was cleaned prior to mobilization and was dedicated to only one soil probe; therefore, field cleaning was not required. The polyethylene tubing that connected the aluminum probe to the glass sampling bulb was dedicated and discarded following each sample collection.

Samples were initially analyzed within one hour of collection, with the exception of sample SG-9 Dup, SG-10, SG-11, SG-12, SG-25, D-2 and D-3. These samples were collected just prior to leaving the Site and analyzed in the hotel room within four hours of collection.

Initial calibrations were performed daily to update relative response factors which may vary due to column and detector aging. Continuing calibrations were performed generally after every five samples, updating analyte retention times and response factors. Initial and continuing calibration standards are presented in Appendix B along with the sample data; minimum detectable limits (MDLs) for the instrument employed are also presented in Appendix B.

Ambient air blanks were collected and analyzed on a daily basis. These blanks were collected approximately four feet above the ground in the vicinity of daily sampling activities to establish background air quality levels.

Sample bulbs previously used in sampling activities were flushed thoroughly with organic free air and analyzed prior to sample collection to evaluate sample bulb, syringe, and instrument carry-over. Generally, these bulb blanks were analyzed after each standard and sample injection.

Duplicate samples were collected at five locations: SG-9, SG-12, SG-23, SG-34 and D-3. Results expressing sampling and analytical precision in the form of relative percent difference (RPD) data are presented in Table 2-1. Samples SG-12, SG-34 and D-3 all exhibited acceptable sampling and analytical precision between duplicates for field screening activities. Samples SG-9 and SG-23 exhibited poor sampling and analytical precision between respective duplicates, however, the magnitude of the values are confirmed and an average of the duplicates may be appropriate.

### 2.4.4 Results

Field gas chromatography results for soil gas analyses are presented in Tables 2-2 through 2-4. Raw data for bulb blanks, initial and continuing calibrations, and sample runs are presented in sequential order of analysis in Appendix B.

In general, all soil gas sampling locations at the north and west sides of the Pelican site exhibited trichloroethene and related breakdown products. Limited soil gas analyses were performed to the north of the facility due to the proximity of an adjacent building, while none were progressed along the east side due to the presence of a sidewalk, a road (Washington Street), and/or buried utilities. Progressing south down the western side of the building, volatile organic concentrations generally decreased until "nondetect" levels were encountered at the body shop end of the building (No. 2219 1/2). This indicates that the volatile organic contamination is concentrated at the north and northwestern end of the Site.

# TABLE 2-1
# PELICAN MANUFACTURING, INC. SITE
# FIELD DUPLICATE ANALYSIS
# RELATIVE PERCENT DIFFERENCE DATA
# AUGUST 1992

| Parameter | SG-9 | SG-9 DUP | RPD | SG-12 | SG-12 DUP | RPD | SG-23 | SG-23 DUP | RPD | SG-34 | SG-34 DUP | RPD | D-3 | D-3 DUP | RPD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Trans- 1,2-Dichloroethene | 0.18 | 0.08 | 77% | 0.005 | 0.007 | 33% | 0.27 | 0.28 | 3.6% | 0.35 | 0.38 | 8.2% | 0.28 | 0.21 | 29% |
| Cis-1,2-Dichloroethene | 5.1 | 2.4 | 72% | 2.3 | 2.6 | 12% | 20 | 9.6 | 70% | 12 | 14 | 15% | 24 | 18 | 29% |
| Trichloroethene | >500 | >500 | 0% | 5.3 | 3.6 | 38% | 74 | 36 | 69% | 140 | 160 | 13% | 43 | 59 | 31% |
| Toluene | 90 | 51 | 55% | <0.10 | <0.10 | 0% | <0.10 | <0.10 | 0% | <0.10 | <0.10 | 0% | <0.10 | <0.10 | 0% |
| Tetrachloroethene | 2.9 | 0.76 | 117% | <0.10 | 0.041 | 84% | 0.60 | 0.63 | 4.9% | 0.80 | 0.83 | 3.7% | 0.21 | 0.24 | 13% |

All units in parts per million (ppm; Vol/Vol).
RPD = Relative Percent Difference
RPD = (S-D) /(S+D)/2) x 100
Where: S = First Sample Value (Original)
D = Second Sample Value (Duplicate)

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## TABLE 2-2
## PELICAN MANUFACTURING, INC. SITE
## FIELD GAS CHROMATOGRAPHY RESULTS
## SOIL GAS SURVEY
## AUGUST 25, 1992

| Parameter | PQL | Ambient Air Blank | SG-1 | SG-2 | SG-3 | SG-4 | SG-5 | SG-6 | SG-7 | SG-8 | SG-9 | SG-9 DUP | SG-10 | SG-11 | SG-12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Trans- 1,2-Dichloroethene | 0.02 | --- | 0.35 | 0.20 | 0.008J | --- | 0.09 | 0.44 | --- | 0.04 | 0.18 | 0.008J | 0.05 | 0.04 | 0.005J |
| Cis-1,2-Dichloroethene | 0.05 | --- | 15 | 8.2 | 0.18 | --- | 9.8 | 28 | 1.4 | 1.6 | 5.1 | 2.4 | 11 | 14 | 2.3 |
| 1,1,1-Trichloroethane | 5.0 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trichloroethene | 0.05 | --- | 69 | 91 | 24 | 1.5 | 44 | 110 | 4.3 | 61 | >500* | >500* | 22 | 9.2 | 5.3 |
| Toluene | 0.10 | --- | --- | --- | 0.17 | --- | --- | --- | --- | --- | 90 | 51 | --- | --- | --- |
| Tetrachloroethene | 0.10 | --- | 0.38 | 0.92 | 0.47 | 0.14 | 1.1 | 1.1 | --- | 12 | 2.9 | 0.76 | 0.21 | 0.12 | --- |

All values reported in parts per million (ppm; Vol/Vol).
PQL = Practical Quantitation Limit
(---) Denotes not detected at or above the Practical Quantitation Limit
J Denotes an estimated value below the Practical Quantitation Limit but above the Minimum Detectable Limit of the instrument
* Denotes an estimated value due to compound concentrations exceeding the linear range of the instrumentation employed

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# TABLE 2-3
# PELICAN MANUFACTURING, INC. SITE
# FIELD GAS CHROMATOGRAPHY RESULTS
# SOIL GAS SURVEY
# AUGUST 26, 1992

| Parameter | PQL | Ambient Air Blank | SG-13 | SG-14 | SG-15 | SG-16 | SG-17 | SG-18 | SG-19 |
|---|---|---|---|---|---|---|---|---|---|
| Trans- 1,2-Dichloroethene | 0.02 | --- | 0.008J | --- | --- | --- | --- | --- | 0.03 |
| Cis-1,2-Dichloroethene | 0.05 | --- | 0.006J | --- | --- | --- | --- | --- | 3.8 |
| 1,1,1-Trichloroethane | 5.0 | --- | --- | --- | --- | --- | --- | --- | --- |
| Trichloroethene | 0.05 | --- | 1.2 | --- | --- | 0.019J | 0.06 | 0.017J | 12 |
| Toluene | 0.10 | --- | --- | --- | --- | --- | --- | --- | --- |
| Tetrachloroethene | 0.10 | --- | --- | 0.037J | --- | --- | --- | --- | 0.057J |

All values reported in parts per million (ppm; Vol/Vol).
PQL = Practical Quantitation Limit
(---) Denotes not detected at or above the Practical Quantitation Limit
J Denotes an estimated value below the Practical Quantitation Limit but above the Minimum Detectable Limit of the instrument

## TABLE 2-3 (CONTINUED)
## PELICAN MANUFACTURING, INC. SITE
## FIELD GAS CHROMATOGRAPHY RESULTS
## SOIL GAS SURVEY
## AUGUST 26, 1992

| Parameter | PQL | SG-20 | SG-21 | SG-22 | SG-23 | SG-23 DUP | SG-24 | SG-25 | D-2 | D-3 | SG-12 DUP |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Trans- 1,2-Dichloroethene | 0.02 | 0.04 | 0.03 | 0.12 | 0.27 | 0.28 | 0.012J | 0.12 | 0.04 | 0.28 | 0.007J |
| Cis-1,2-Dichloroethene | 0.05 | 10 | 8.9 | 25 | 20 | 9.6 | 0.65 | 36 | 6.9 | 24 | 2.6 |
| 1,1,1-Trichloroethane | 5.0 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trichloroethene | 0.05 | 7.3 | 4.0 | 10 | 74 | 36 | 5.1 | 10 | 5.3 | 43 | 3.6 |
| Toluene | 0.10 | --- | --- | --- | --- | --- | --- | --- | 0.032J | --- | --- |
| Tetrachloroethene | 0.10 | 0.091J | 0.035J | 0.19 | 0.60 | 0.63 | --- | 0.15 | 0.32 | 0.21 | 0.041J |

All values reported in parts per million (ppm; Vol/Vol).
PQL = Practical Quantitation Limit
(---) Denotes not detected at or above the Practical Quantitation Limit
J Denotes an estimated value below the Practical Quantitation Limit but above the Minimum Detectable Limit of the instrument

## TABLE 2-4
## PELICAN MANUFACTURING, INC. SITE
## FIELD GAS CHROMATOGRAPHY RESULTS
## SOIL GAS SURVEY
## AUGUST 27, 1992

| Parameter | PQL | Ambient Air Blank | SG-27 | SG-28 | SG-29 | SG-30 | SG-31 | SG-32 | SG-33 | SG-34 | SG-34 DUP | D-3 DUP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Trans- 1,2-Dichloroethene | 0.02 | --- | 0.07 | 0.08 | 0.007J | 0.15 | --- | 0.51 | 0.05 | 0.35 | 0.38 | 0.21 |
| Cis-1,2-Dichloroethene | 0.05 | --- | 13 | 17 | 0.69 | 18 | --- | 13 | 0.21 | 12 | 14 | 18 |
| 1,1,1-Trichloroethane | 5.0 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trichloroethene | 0.05 | --- | 1.2 | 7.4 | 0.97 | 79 | 0.16 | 33 | 15 | 140 | 160 | 59 |
| Toluene | 0.10 | --- | 0.048J | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Tetrachloroethene | 0.10 | --- | --- | 0.18 | --- | 0.052J | --- | 0.060J | 0.088J | 0.8 | 0.83 | 0.24 |

All values reported in parts per million (ppm; Vol/Vol).
PQL = Practical Quantitation Limit
(---) Denotes not detected at or above the Practical Quantitation Limit
J Denotes an estimated value below the Practical Quantitation Limit but above the Minimum Detectable Limit of the instrument

These results are consistent with reported historical activities and the storage and use of solvents within the buildings.

### 2.4.5 Conclusions

The soil gas data indicate potential patterns of surface or subsurface contamination and/or migration pathways on the Site. Additional sporadic detections of VOCs were present to the north and west of the Pelican buildings. These results could be due to one or a combination of the following:

- discharges beneath the building dispersed differentially through heterogeneous subsurface materials;
- discharges in the building interior, intercepted and dispersed by cracks in the floor and/or through the existing floor drain system and its outlet(s); or
- isolated discharges on the northern and western sides of the building exterior.

The exterior soil gas survey results are presented on Figures 2-2 (Total VOCs) and 2-3 (TCE).

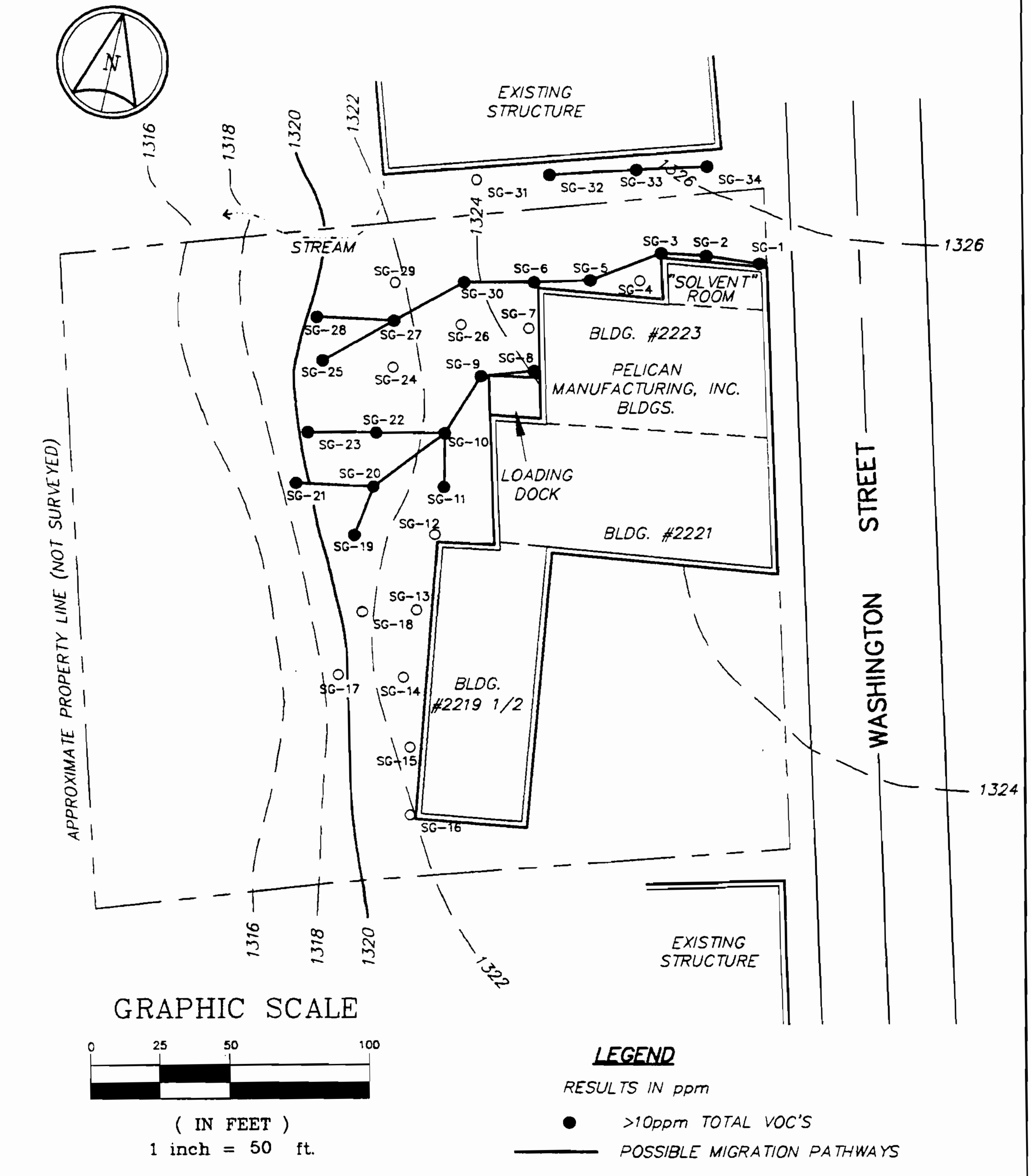
At the time of completion of the First Phase RI, there were not enough reliable records or data to substantiate or discount any of the preceding scenarios, although the exterior outlet of part of the floor drain system was discovered during the investigation. Existing data indicate that discharges likely occurred on both the interior and the exterior of the building. Two locations where isolated exterior discharges may have occurred are in the vicinity of SG-9 (the northwest corner of the loading dock) and SG-23 (west of MW-20) which exhibited elevated concentrations of VOCs. Elevated concentrations of VOCs encountered at building perimeter stations SG-1, SG-2, SG3, SG-5, SG-6 and SG-8 could be the result of discharges on the exterior perimeter (possibly weed control), solvent leakage from tanks known to have been located at the northern end of building No. 2223 or direct discharges from the floor drain system(s), e.g., at SG-1 or 2 and SG-8.

Although the soil gas results near the loading dock (SG-8, 9, and possibly 10) correlate well with the wet or stained (dark, linear) pattern evident on the 1975 air photos, results from additional soil gas points along or near this potential migration pathway (SG-11, 19 through 21 and SG-22, 23) imply such migration but are less conclusive in this regard.

## 2.5 Drilling/Monitoring Well Installation and Development

### 2.5.1 Introduction

Previous subsurface investigations performed at the Pelican site by E&E included six subsurface soil borings and the installation of three monitoring wells; one presumed to be upgradient (MW-22) and two presumed to be downgradient of the facility (MW-19 and MW-20). An initial upgradient soil boring (BH-21) was advanced for E&E in the extreme



**DUNN ENGINEERING COMPANY**

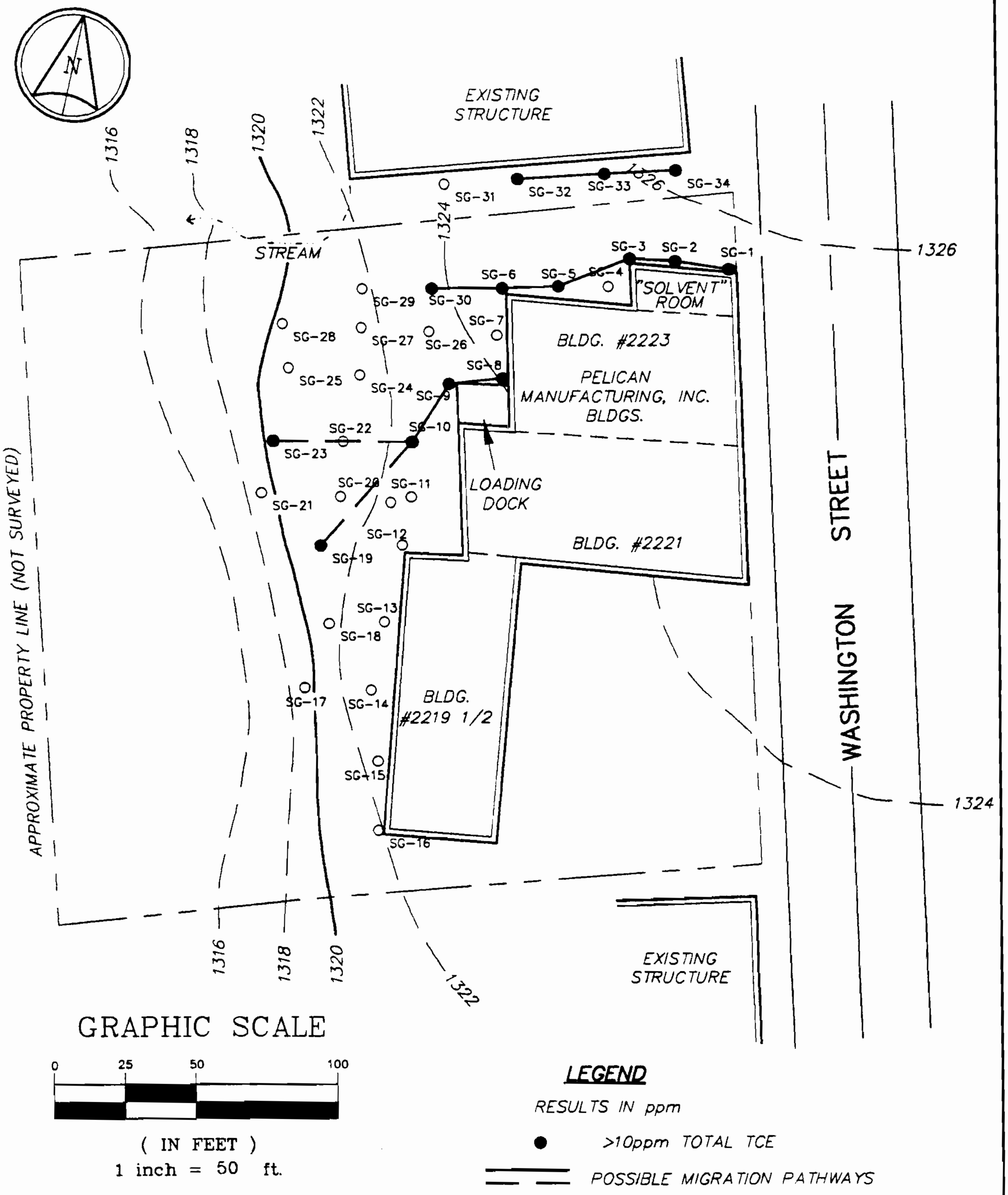
DIVISION OF RUST ENVIRONMENT & INFRASTRUCTURE

**SOIL GAS SAMPLING LOCATIONS**
**TOTAL VOC RESULTS**

PELICAN MANUFACTURING, INC. SITE

City of Jamestown | Chautauqua Co., NY

| | | | | |
|---|---|---|---|---|
| PROJECT No. 35120.700 | DATE 8/94 | DWG. No. 35120-20 | SCALE 1"=50' | FIGURE No. 2-2 |



**DUNN ENGINEERING COMPANY**

DIVISION OF RUST ENVIRONMENT & INFRASTRUCTURE

**SOIL GAS SAMPLING LOCATIONS**
**TRICHLOROETHENE RESULTS**

PELICAN MANUFACTURING, INC. SITE

City of Jamestown — Chautauqua Co., NY

| PROJECT No. 35120.700 | DATE 7/94 | DWG. No. 35120-15 | SCALE 1"=50' | FIGURE No. 2-3 |
|---|---|---|---|---|

southeastern corner of the property. This boring penetrated to a depth of approximately 52 feet and breached an apparent silty clay aquitard between a depth of 36-47 feet below ground surface (BGS). Artesian conditions were encountered in this boring at a depth of approximately 50 feet. Attempts to convert this boring to a monitoring well were unsuccessful and the boring was grouted to the surface and abandoned. A new "upgradient" boring/monitoring well location (BH/MW-22) was established along the south facing wall of 2221 Washington Street. The boring at this location was drilled to a depth of 10 feet and converted to monitoring well MW-22 that was screened from four to nine feet BGS.

Two shallow borings were drilled for E&E at locations west of building No. 2223 Washington Street, at what were presumed to be downgradient locations. These locations were subsequently abandoned and two "new" locations were established west of what has been referred to as the "old" locations. Two shallow monitoring wells (MW-19 and MW-20) were installed at the new locations and were screened from approximately four to nine and five to 10 feet BGS, respectively. Refer to Figure 2-4 for the locations of these borings and wells.

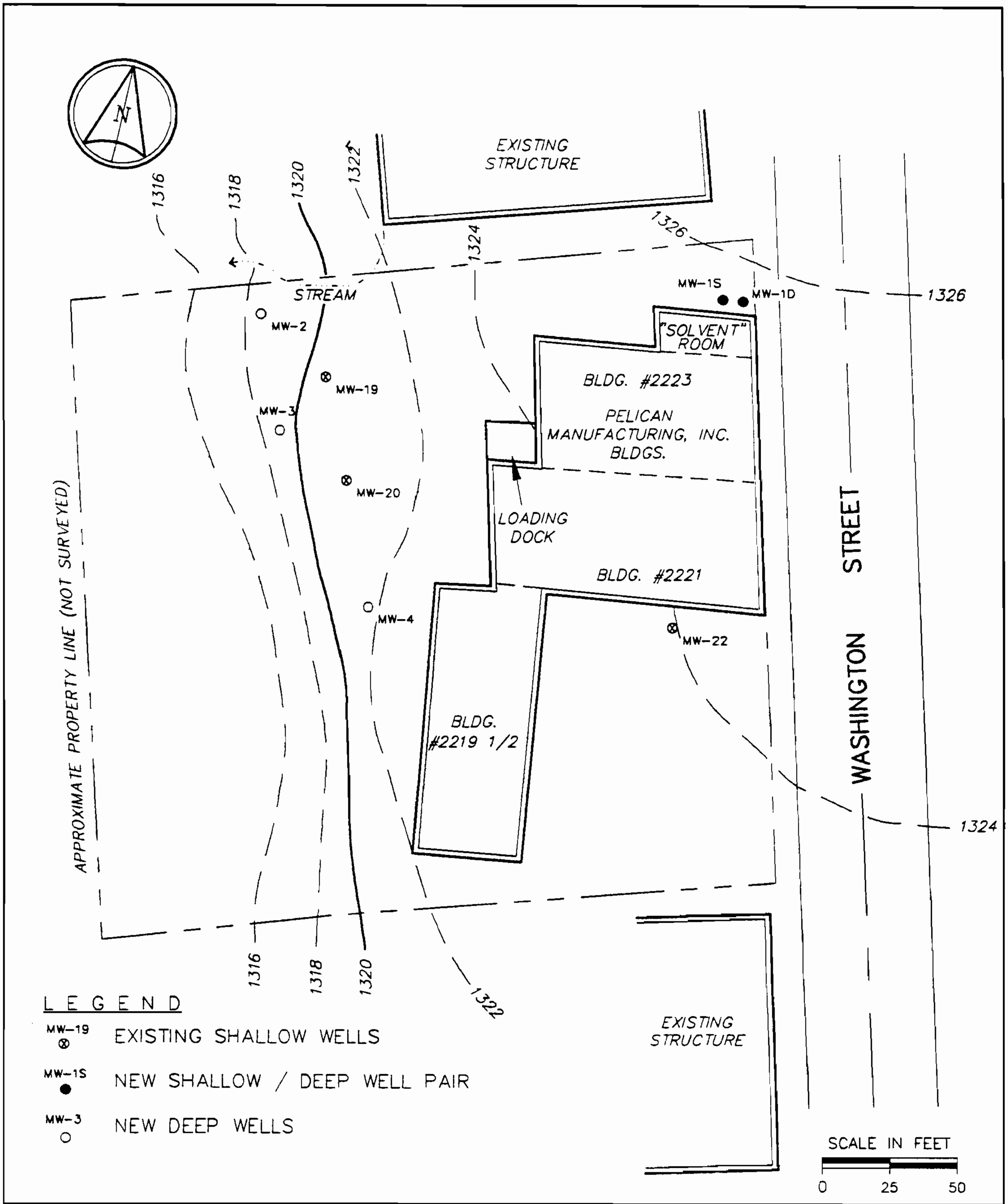
On the basis of the north-south linear trend of the Pelican site; the lack of adequate subsurface hydrogeologic information; and the concern about potential contamination of the Jamestown Aquifer, which may underlie the Site, it was decided to install an "upgradient" well pair at the northeast corner of the property and three deeper downgradient monitoring wells further west on the property. The latter three wells were to be installed on the Pelican fill rather than in the drainage swale or former Jamestown City Landfill that occupy the western portion of the property.

### 2.5.2 Objectives

Exploratory borings were conducted on the Site to determine subsurface geologic conditions, to collect samples for logging purposes and chemical analysis, and to generate boreholes in which to install monitoring wells. Data collected during the drilling process and the logging of split spoon samples were utilized, in conjunction with the results of previous drilling on the Site by E&E, to create geologic profiles and cross-sections of the stratigraphy underlying the Site. The stratigraphy was then utilized to interpret the geology and hydrogeology of the Site. Monitoring wells were installed in the borings to establish additional monitoring points for water levels and groundwater quality, and to determine vertical head differences and groundwater flow direction. The new well locations were correlated with the three existing on-site wells from the E&E study performed in 1987 (Pelican Manufacturing Inc. Final Report, undated) to establish a monitoring network for both the "shallow" and "deep" groundwater regime underlying the Site.

### 2.5.3 Methods

The drilling program was initiated on September 9, 1992 and was completed on September 16,1992. Drilling and monitoring well installation was performed by American Auger and Ditching, Inc. (AA&D) of Constantia, New York. Supervision of the drilling program was performed by a DUNN hydrogeologist/geologist. Five borings were advanced by hollow stem auger methods at four locations on the Site. The drilling locations were established at



**DUNN ENGINEERING COMPANY**

DIVISION OF RUST ENVIRONMENT & INFRASTRUCTURE

**DRILLING/MONITORING WELL LOCATIONS**

PELICAN MANUFACTURING, INC. SITE

City of Jamestown Chautauqua Co., NY

| | | | | |
|---|---|---|---|---|
| PROJECT No. 35120.700 | DATE 10/93 | DWG. No. 2A9421_2 | SCALE 1"=50' | FIGURE No. 2-4 |

presumed upgradient and downgradient locations and numbered sequentially from 1 to 4 based on order of completion. The upgradient drilling location (D-1) consisted of a shallow and a deep boring. The individual borings at this location were further identified by their relative depth; i.e., shallow (D-1S) and deep (D-1D). The boring and coinciding monitoring well locations are shown on Figure 2-4.

A supplementary boring was drilled to a depth of 15 feet, approximately five feet east of D2, for the purpose of obtaining additional soil samples for chemical analyses. Upon completion, this boring was grouted to the ground surface to preclude groundwater and contaminant migration.

Drilling for the monitoring wells was accomplished by utilizing 4 1/4-inch I.D. (inside diameter) hollow stem augers, advanced to depths ranging from 13.7 feet at MW-1S to 44.0 feet at MW-1D. The base of the augers was equipped with a steel center plug to prevent materials from entering the augers, thereby ensuring depth-discrete soil sampling.

Soil samples were obtained during drilling, utilizing a split spoon sampler driven in advance of the augers. Samples were initially collected at continuous two-foot intervals at each boring, to depths from 10 feet in MW-2 to 16 feet in MW-3. The sampling frequency for the remainder of each boring was determined by DUNN's on-site hydrogeologist/geologist. Sampling procedures followed ASTM Standard Method D-1586. The two-inch O.D. (outside diameter) split-barrel sampler consisted of a drive shoe, split-barrel, and drive head which was driven into the subsurface by a 140-pound hammer, falling 30 inches, until 24 inches of soil was penetrated or in excess of 100 blows were administered for six inches of penetration. Blow counts were recorded by the hydrogeologist/geologist and soil samples were examined and described using the Modified Burmister and Unified Soil Classification Systems (see Appendix C). Representative samples were placed in glass jars and retained for future examination. Each sample was also screened for total VOCs using a HN-U-101 photoionization detector. Soil boring logs, describing subsurface materials encountered in each boring, are presented in Appendix D.

A two-inch I.D. well assembly was installed through the augers at each boring following drilling. At MW-2, MW-3, and MW-4, one to four feet of #3 Q-Rock silica sand was installed in the bottom of the boring prior to well installation. The artesian condition at MW-1D was sealed off prior to well installation. A four foot thick cement/bentonite grout layer was tremied into place at the bottom of the boring, followed by two feet of sand, and seven feet of bentonite pellets. Finally, a three-foot bentonite seal was tremied on top to bring the bottom of the boring to a depth of 28 feet BGS. The well assembly was then installed through the augers.

Each well assembly consisted of number 10 slot (0.010 inch), Schedule 40 PVC well screen threaded onto a Schedule 40 PVC riser pipe. Screen lengths ranged from 7.5 feet in MW-1S, 9 feet in MW-2 and 10 feet in MW-1D, MW-3 and MW-4. At MW-2, MW-3, and MW-4, the riser pipes extended approximately two feet above ground. The annulus surrounding each well assembly was packed with #3 Q-Rock silica sand, while raising the augers incrementally as the sand was added. The sand packs extended 1.2 feet (MW-lS) to 2.6 feet (MW-3) above the tops of the screens. Bentonite pellet seals, ranging from 1.9 feet (MW-1S) to 10 feet (MW-1D) in thickness, were installed on top of the sand packs. A cement-bentonite grout was then tremied into each annulus to complete the installation to the ground surface.

At MW-2, MW-3 and MW-4, lockable protective casings were installed over the riser pipes and set in cement collars that were installed at the top of each well installation. At MW1S and MW-1D, the riser pipes were cut off slightly below the ground surface and flush mount steel protective curb boxes were cemented into place. Well construction details are presented in Table 2-5. Well completion logs, including a diagram of each well, materials used, and the elevations of well features are presented in Appendix D.

Upon completion of the monitoring well installations, all monitoring wells, including the existing wells from the E&E investigation (MW-19, 20 and 22), were developed. The wells were developed (or redeveloped) to remove residual drilling water, and to remove formational silts and clays from the well and the sand pack surrounding the screened portion of the well; and, in the existing wells, to remove fines that had entered the screen and settled in the bottom of the well. Development was also utilized to increase the hydraulic conductivity immediately around each well, thereby improving the well yield and accuracy of water level measurements. In addition, well development helped to ensure that the samples collected from the wells were representative of groundwater quality beneath the Site. Development activities commenced on September 22, 1992 and were completed on September 24, 1992.

All eight wells were developed by the repeated removal of water utilizing well-dedicated, bottom-filling PVC bailers, raised and lowered to the bottom of each well with new, dedicated nylon rope. Each well was developed until five well volumes of water were removed. All wells produced a sufficient amount of water such that they were not bailed dry during development. Development water was disposed onto the ground downgradient of each well. Development effectiveness was monitored and recorded at approximately five gallon intervals by measuring field parameters (turbidity, pH, temperature, and specific conductivity). Initial turbidities ranged from 12 NTUs (MW-20) to greater than 200 NTUs (MW-1S, MW-1D, MW-3 and MW-4). Subsequent turbidity measurements in all wells during development were greater than 200 NTUs, but corresponding pH, temperature, and specific conductivity measurements were stable. Well development was discontinued when the turbidity of the discharged water reached 50 NTU or when field parameters stabilized, indicating that additional development would not be cost-effective. Table 2-6 presents well development information.

Based upon the outlined well development criteria, all monitoring wells were sufficiently developed for the collection of groundwater samples, although there was a potential for particulates to influence the inorganic/metals results, due to the high turbidity readings.

All tasks associated with the drilling/monitoring well installation and development program were performed in accordance with the approved QAPjP for the Pelican site, dated September, 1992. Minor deviations from the QAPjP included the additional soil boring at location D-2, installing flush mount road boxes at MW-1S and MW-1D, and some additional continuous split spoon sampling at selected locations. All changes were performed with the prior approval of the on-site NYSDEC representative.

# TABLE 2-5

## PELICAN MANUFACTURING, INC. SITE
## WELL CONSTRUCTION DETAILS
## SEPTEMBER 1992

| Monitoring Well | Ground Elevation | Boring Depth | Screened Interval | Sand Pack Interval | Bentonite Seal |
|---|---|---|---|---|---|
| MW-1S | 1325.3' | 14.5' | 6.2'-13.7' | 4.0'-14.5' | 2.1'-4.0' |
| MW-1D | 1325.5' | 44.0' | 18.0'-28.0' | 17.0'-31.0' | 7.0'-17.0' |
| MW-2 | 1318.7' | 27.0' | 14.0'-23.0' | 12.2'-27.0' | 7.0'-12.2' |
| MW-3 | 1319.7' | 33.0' | 19.5'-29.5' | 17.0'-33.0' | 12.5'-17.0' |
| MW-4 | 1321.5' | 30.0' | 19.0'-29.0' | 17.0'-30.0' | 12.0'-17.0' |
| *MW-19 | 1319.6' | 10.0' | 4.0'-9.0' | NA | NA |
| *MW-20 | 1319.8' | 11.0' | 5.0'-10.0' | NA | NA |
| '*MW-22 | 1324.9' | 10.0' | 4.0'-9.0' | NA | NA |

Measurements are from ground surface

* Data from E & E Report dated July, 1987

NA = Information not available

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## TABLE 2-6

## PELICAN MANUFACTURING, INC. SITE
## WELL DEVELOPMENT INFORMATION
## SEPTEMBER 1992

| Monitoring Well | Well Depth BGS (feet) | Water Level BMP (feet) | Well Volume (gal) | Water Removed (gal) | Turbidity (NTUs) |  | pH (std. units) |  | Specific Conductance (umhos) |  | Temperature (°C) |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  | Initial | Final | Initial | Final | Initial | Final | Initial | Final |
| MW-1S | 13.7 | 5.1 | 1.42 | 20.0 | >200 | >200 | 9.4 | 6.9 | 2070 | 2300 | 16.3 | 13.3 |
| MW-1D | 28.0 | 3.3 | 4.01 | 20.0 | >200 | >200 | 13.1 | 10.0 | 2100 | 342 | 12.1 | 11.1 |
| MW-2 | 23.0 | Artesian | 4.75 | 25.0 | 43 | >200 | 8.9 | 6.6 | 310 | 301 | 16.6 | 13.5 |
| MW-3 | 29.5 | Artesian | 5.29 | 30.0 | >200 | >200 | 7.1 | 6.3 | 360 | 340 | 15.1 | 13.4 |
| MW-4 | 29.0 | 0.5 | 4.97 | 25.0 | >200 | >200 | 8.1 | 7.6 | 320 | 319 | 13.9 | 12.8 |
| MW-19 | *9.0 | 5.5 | 0.97 | 5.0 | 38.0 | >200 | 7.3 | 7.5 | 994 | 1000 | 15.2 | 15.0 |
| MW-20 | *10.0 | 6.7 | 0.86 | 5.0 | 12.0 | >200 | 6.9 | 6.6 | 1090 | 1050 | 14.3 | 13.8 |
| MW-22 | *9.0 | 8.0 | 0.94 | 5.0 | 17.5 | >200 | 7.3 | 7.4 | 271 | 320 | 17.7 | 17.9 |

Data compiled from field reports
* From E & E Report Dated July 1987
BGS = Below Ground Surface
BMP = Below Measuring Point

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### 2.5.4 Results

A total of six soil borings were advanced for DUNN, with five of the borings being converted to monitoring wells. Fifty subsurface soil samples were collected, including three thin-walled tube samples obtained from three drilling locations (D-1D, D-3 and D-4). Soil samples were screened with an HNU photoionization detector, with some of the samples placed in jars and archived and others placed in laboratory supplied containers and shipped to Energy and Environmental Engineering, Inc. (E3I) for chemical analyses. The thin-walled tube samples were shipped to DUNN's geotechnical laboratory in Albany for grain size and permeability testing. Refer to Section 2.6.4 for the results of this testing.

A new shallow monitoring well (MW-1S) was installed in what was presumed to be an upgradient location, at the northeast corner of building No. 2223. This well was installed in the upper, unconfined water bearing zone (at the water table) to supplement previously installed (E&E) downgradient wells MW-19 and MW-20. Wells MW-1D, MW-2, MW-3 and MW-4 were originally intended to be installed in a deeper, confined water bearing zone.

Wells MW-1S and MW-1D are screened at two levels within the upper, unconfined water bearing zone. Well MW-1S is screened from 6.2 to 13.7 feet BGS and screens both fill and native material. Well MW-1D is screened from 18.0 to 28.0 feet BGS and screens only native material. The water levels in these wells indicate that the bottom seal that was emplaced prior to the installation of well MW-1D was effective in eliminating the artesian pressure in this well.

The other newly installed wells (MW-2, 3 and 4) are screened in a deeper, semi-confined water bearing zone in the mixed morainal deposits and/or the glacial till that underlies the morainal deposits.

A complete description of the geology of the Site is presented in Section 4.0.

### 2.5.5 Conclusions

Soil samples collected from the exploratory borings were utilized to further characterize the geology of the Site, to confirm the absence or presence of impacted soil in different subsurface strata and to evaluate the silty clay unit as a potential aquitard (see Section 2.6.5). Based on historical and new information, four depositional units have been identified beneath the Site to an investigated depth of approximately 50 to 55 feet. These units are briefly described as fill, muck, mixed morainal deposits and glacial till.

The newly installed wells (DUNN) together with the previously installed wells (E&E) have established a well network to characterize both the upper and lower water bearing zones encountered during the investigation, and have provided monitoring points to obtain water level measurements and samples for groundwater quality.

## 2.6 Thin-Walled Tube Testing

### 2.6.1 Introduction

Investigations at sites where fine-grained materials are known or suspected of being encountered and/or of importance can be enhanced by the collection and testing of samples of these materials or depositional units. Examples of such units are glaciolacustrine silts and clays and glacial till. Previous investigations at the Pelican site reported the existence of one or more silty clay units underlying the Site. To understand the hydrogeologic system beneath the Site and to answer questions about potential impacts on the Jamestown Primary Aquifer, which might exist at greater depth beneath the Site, "undisturbed" samples of the fine-grained deposits were desirable. It was determined that the thin-walled tube sampling technique designed specifically for this purpose would be appropriate for use at the Pelican site and was included in the drilling and subsurface soil sampling program for the Site.

### 2.6.2 Objectives

Three thin-walled (Shelby) tube samples were collected for geotechnical testing during the drilling program. The samples were to be tested for particle size analysis and hydraulic conductivity in DUNN's laboratory. The results of the testing were to be utilized to evaluate the vertical hydraulic conductivity of the silty clay layer(s) encountered during the drilling program. This information was to be utilized to interpret the geologic and hydrogeologic conditions underlying the Site and to evaluate the ability of the silty clay unit to act as an aquitard or aquiclude relative to the vertical movement of groundwater between the upper, unconfined (water table) zone and the deeper, semi-confined zone underlying the Site. Such relationship is significant with respect to the potential for the migration of contaminants in a vertical direction within the hydrogeologic system beneath the Site.

### 2.6.3 Methods

Sampling points were selected at both upgradient and downgradient drilling locations to obtain an indication of the horizontal continuity of the fine-grained depositional unit(s) underlying the Site and to obtain geotechnical information relative to a potential aquitard/aquiclude underlying the Site. For this purpose, borings D-1D, D-3 and D-4 were selected for the collection of the thin-walled tube samples.

The collection of split spoon samples indicated the possible presence of a silty clay layer of sufficient thickness to act as an aquitard or aquiclude beneath the Site. Based on the information provided by the split spoon samples, several vertical intervals were identified by DUNN's field geologist, in agreement with NYSDEC's on-site representative, for the collection of a thin-walled sample. The thin-walled tubes were collected in accordance with ASTM Method D1587-74, Thin-Walled Tube Sampling of Soils.

Upon receipt of the tubes in DUNN's geotechnical laboratory, the sample containers were prepared for extrusion, logging and testing of the samples. As the samples were extruded, DUNN's lab manager and project manager collaborated in evaluating the extruded samples and in determining which sections of each sample to test. A visual inspection of each sample and sample section was performed, followed by logging of the sample and selection of the sections for testing purposes.

Each selected sample section was subjected to physical analysis for either grain size distribution in accordance with ASTM Methods C136 and D422 or permeability testing with a Flexible Wall Permeameter in accordance with ASTM Method D5084-90.

### 2.6.4 Results

Thin-walled tube samples were collected at a depth of 12-14 feet in boring D-1D, from a depth of 16-18 feet in boring D-3 and from a depth of 14-16 feet in boring D-4. Upon opening the tube collected from boring D-1D, it was discovered that it contained a mixture of sand, silt and clay and no well-defined layer of low permeability. It was concluded that this sample represented either material washed into the borehole ("wash") from the overlying deposits, rather than undisturbed material, or the sample interval was below the silty clay unit encountered in the previous two split spoon samples. As such, no further logging or testing of this sample was performed.

The sample from boring D-3 was subdivided into five sections designated A through E. The top 11 inches of the sample (A-D) consisted of gray silt and gray silt and clay with silt lenses. Section D was selected for permeability testing.

The sample from boring D-4 was subdivided into seven sections designated A through G. The top eight inches of sample consisted of fine to coarse sand with minor amounts of gravel, silt and clay. This material was interpreted to be disturbed material or "wash." The next nine inches of the sample contained gray silt and clay with wood fragments and some fine to medium sand. The majority of this interval consisted of gray clay with thin discrete layers of gray silt. In addition, the wood fragments were significant in that they occupied a vertical interval along the entire length of the three sections (D-F) containing silty clay. It appears that the fragments represent a root or some other source of wood within the boring that was, unfortunately, penetrated and sheared off by the thin-walled tube. The wood fragments created a "disturbance" throughout this sampled interval. The sand was concentrated along and within this "disturbed" zone, thereby producing a vertical area of higher permeability within the sample, as well as within the natural environment at the Site. This zone or other similar zones could create pathways of increased vertical permeability within an aquitard/aquiclude. These pathways could, in effect, "short circuit" otherwise isolated zones of granular material to equalize hydraulic heads and/or to provide conduits for contaminant migration through the natural layer of fine grained sediment.

Section D from boring D-3 was subjected to permeability testing. The results of the testing indicate a vertical permeability of $4.7 \times 10^{-7}$ cm/sec for this sample section. This result is consistent with the visual observation of the sample. However, as noted above, the presence of roots or other woody material could provide vertical conduits within or through the fine grained layer. This, in turn, could compromise the integrity of the unit as an aquitard/aquiclude and as a barrier against the vertical migration of contaminants. In addition, the presence of discrete horizontal silt units within the clay will produce zones of increased hydraulic conductivity and potential zones for the horizontal migration of contaminants.

Section D from boring D-4 was subjected to grain size distribution analysis. Approximately 95% of the material from this section passed the 200 sieve and was classified as silt and clay. The subsequent hydrometer analysis of this section of the sample indicated that approximately 58% of the sample consisted of clay-sized material, with 31% of the sample representing silt-size material.

Section E from boring D-4 was also subjected to grain size distribution analysis. Approximately 88% of this sample passed the 200 sieve and was classified as silt and clay. Subsequent hydrometer analysis of this section of the sample indicated that approximately 57% of the sample consisted of clay-size material, with approximately 31% of the sample representing silt-size material.

It can be seen, both by visual examination of the sample and by testing, that the two sections (D and E) of the 16-18 foot interval of boring D-4 represented the same depositional and physical unit. Based on a visual examination, section F from this interval in boring D-4 represents the same unit as sections D and E.

Refer to Appendix E for the logs, graphs and results of the physical testing performed in DUNN's geotechnical laboratory.

### 2.6.5 Conclusions

Results of the permeability testing of one selected section (16-18") of one of the thin walled tube samples (D-3) indicate that the silty clay unit demonstrates a relatively low permeability of 4.7 x $10^{-7}$ cm/sec. Grain size distributions of representative sections (D and E) from one tube sample (D-4, 14-16 feet) indicate that the material is truly silty clay, with these grain sizes accounting for approximately 88 to 89% of the sample. The predominant grain size of both samples (57-58%) consisted of clay size material.

The results of the visual examination and testing of samples from the silty clay unit lead to the conclusion that, although of low permeability, the horizontal distribution, relatively thin layer and likely penetration of roots or other physical disturbance, preclude the unit from being an aquiclude and compromise the ability of the unit to be an effective aquitard, However, field evidence, i.e., artesian pressure, indicates that the unit does inhibit groundwater movement in a vertical direction and will produce a semi-confined or leaky aquifer relationship between the two water bearing zones encountered at the Site. The glacial till underlying the mixed morainal deposits at the Site was not penetrated and was not sampled by the thinwalled tube method. As such, it is not currently known if the Jamestown Primary Aquifer underlies the Pelican site and how effective the till would be in providing protection to this aquifer. However, based on a visual examination of the samples of the till, their compact and dry condition, as well as previous experience with such materials, and, if sufficiently thick and continuous, it is DUNN's opinion that the till could provide an effective aquitard, if not an aquiclude, between the two water bearing zones screened by the on-site wells and the Jamestown Aquifer, if it exists at the location of the Pelican site.

## 2.7 VES Pilot Study

### 2.7.1 Introduction

Information collected during previous and current investigations indicates that the Site overlies, in part, a terrace consisting of outwash sand and gravel and that a portion of the Site has been filled with construction debris and gravel. Much of the Site has been filled to a depth of from four to eight feet. The fill material appears to be both porous and permeable. Based on the results of chemical analysis of soil samples and soil vapors, volatile organic solvents are present in the fill and in the vapor ("soil vapor") present in the unsaturated pores of the fill. Boring logs for the pilot test vapor extraction well and the three monitoring probes are presented in Appendix F. The principal organic contaminants present at the Site and their physical properties are summarized in Table 2-7. All of the contaminants of concern have a vapor pressure greater than 0.03 atmosphere at 200° C and are considered sufficiently volatile to be amenable to removal from the soil by conventional vapor extraction technology.

Given the permeable nature of the fill and the volatility of wastes disposed at the Site, soil vapor extraction technology may be viable for use in remediating the Site. To better evaluate the feasibility of soil vapor extraction technology, DUNN proposed a pilot test of a vapor extraction system (VES) as part of the RI.

### 2.7.2 Objectives

The objectives of the pilot test were:

- to collect sufficient information to evaluate the feasibility of vapor extraction technology at the Pelican site;
- to collect sufficient information to evaluate the anticipated effectiveness of vapor extraction technology; and,
- to collect site specific information that will be useful in designing a vapor extraction system for the Pelican site in the event vapor extraction technology is selected for use in the remedial program at the Site.

# TABLE 2-7

# PELICAN MANUFACTURING, INC. SITE
## SUMMARY OF PHYSICAL PROPERTIES OF THE PRINCIPAL CONTAMINANTS OF CONCERN

| Compound | Molecular Weight (g/mole) | Boiling Temperature (°C @ 1 atm) | Vapor Pressure (atm) (1) |
|---|---|---|---|
| vinyl chloride | 63 | -13.9 | 3.03 @ 25 C |
| 1,1 - dichloroethene | 97 | 32 | 0.65 @ 25 C |
| trans 1,2 - dichloroethene | 97 | 47.5 | 0.34 @ 25 C |
| trichloroethene | 131 | 87 | 0.08 @ 20 C |
| 1,1,2 - trichloroethane | 133 | 113 | 0.03 @ 20 C |

(1) Mackey and Shiu, Journal of Physical Chemistry, Vol. 10, No. 4, 1981

### 2.7.3 Equipment and Methods

#### 2.7.3.1 Equipment

**Mechanical Equipment**

The equipment used in the pilot test consisted of a 3-horsepower Rotron regenerative blower, Model 6061-XP. The blower unit has a maximum free-air capacity of 200 standard cubic feet per minute (scfm). The influent line was equipped with a valve that allowed ambient air to be drawn into the blower. By adjusting the ambient air valve, the pressure drop and the volume of air taken from the extraction well could be modulated. In addition, a water knockout drum and a particulate filter were installed on the influent line to protect the blower from mechanical damage.

The soil gas evacuated by the blower was discharged through two VentSorb air purifying units manufactured by Calgon Corporation, of Pittsburgh, Pennsylvania. Each VentSorb unit contained 200 pounds of granular activated carbon and the two units were connected in series. The VentSorb units have a throughput capacity of 100 scfm. A schematic of the pilot test equipment is presented in Figure 2-5.

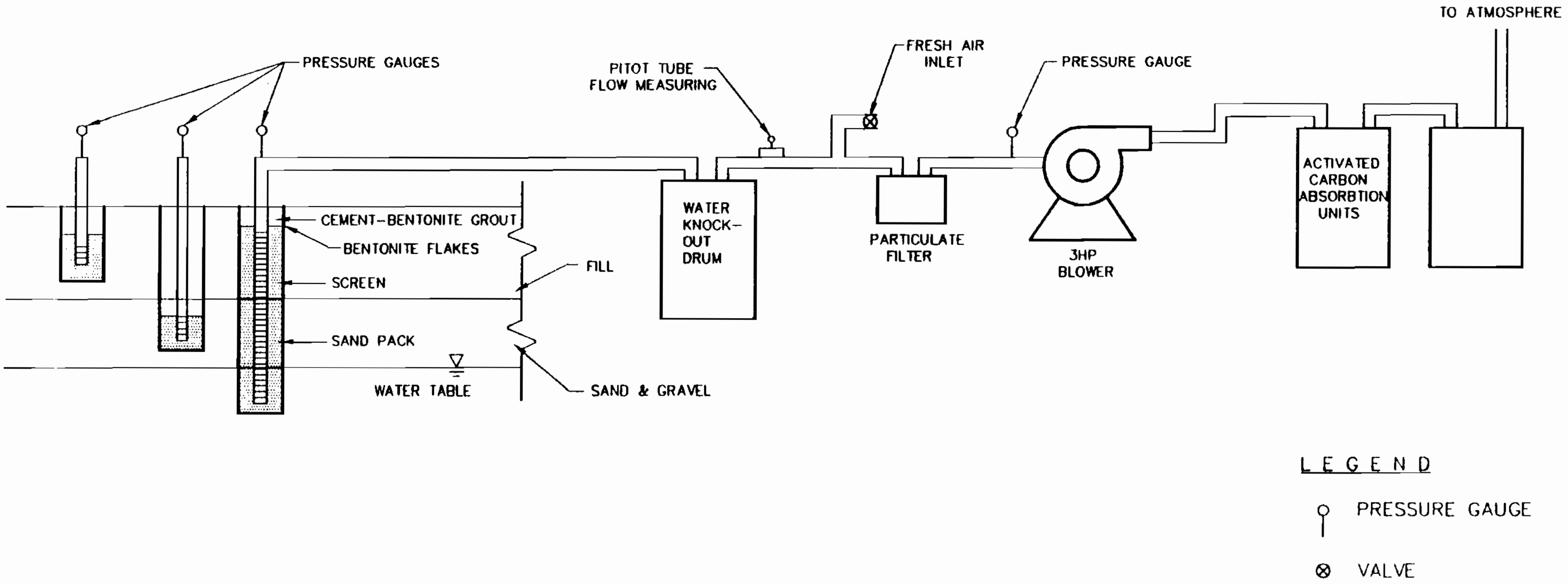
A 5000 watt generator was initially utilized to power the blower motor, but the blower motor would not come to running speed using this generator. Therefore, electrical power was taken from the service panel at No. 2221 Washington Street.

**Extraction Well and Monitoring Probes**

One extraction well was used during the pilot test. The extraction well was constructed of a 5 foot length of 2 inch diameter PVC slotted well screen. The screen extended from 1 foot below grade to approximately 1 foot below the water table. The extraction well was located in the area where high concentrations of volatile organics were measured during DUNN's soil gas survey, approximately 40 feet northwest of the northwest corner of the loading dock. Three monitoring probes were located along a line due south of the extraction well at distances of 10, 15, and 20 feet (see Figure 2-6). Each monitoring probe was constructed of a 2 foot length of 2 inch diameter PVC slotted well screen. The screen was set just above the water table. The screen was connected to solid PVC riser pipe that extended approximately 1.5 feet above grade. The riser pipe was capped and the cap was drilled and threaded to allow connection with a vacuum gauge.

#### 2.7.3.2 Methods

The pilot test of the soil vapor extraction system was performed on September 24 and 25, 1992. The test consisted of adjusting the ambient air valve to modulate the pressure drop and the volume of air taken from the extraction well, and monitoring the effects on soil vapor pressure at the monitoring probes. Samples of the extracted soil vapors were collected at three times during the test to determine if the concentration of the volatile organic compounds in the extracted vapors varied with time. The measured concentrations will also



**DUNN ENGINEERING COMPANY**

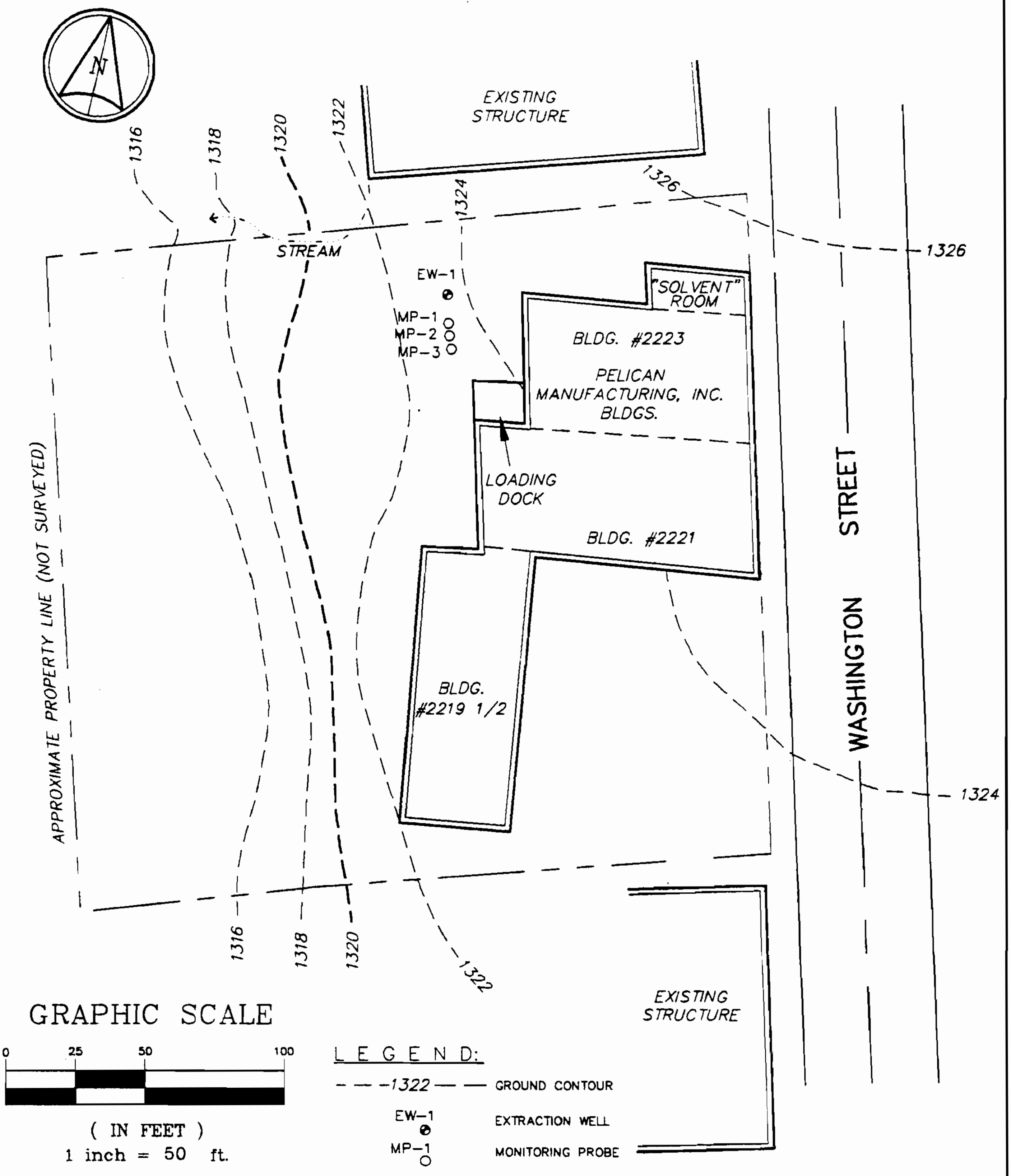
DIVISION OF RUST ENVIRONMENT & INFRASTRUCTURE

**VAPOR EXTRACTION PILOT STUDY**
**VAPOR EXTRACTION WELL/MONITORING PROBES**

PELICAN MANUFACTURING, INC. SITE

City of Jamestown
Chautauqua Co., NY

| | | | | |
|---|---|---|---|---|
| PROJECT No. 35120.700 | DATE 7/94 | DWG. No. 35120-14 | SCALE N.T.S. | FIGURE No. 2-5 |



**DUNN ENGINEERING COMPANY**

DIVISION OF RUST ENVIRONMENT & INFRASTRUCTURE

**VAPOR EXTRACTION WELL/MONITORING PROBE LOCATIONS**

PELICAN MANUFACTURING, INC.

City of Jamestown
Chautauqua Co., NY

| | | | | |
|---|---|---|---|---|
| PROJECT No. 35120.700 | DATE 7/94 | DWG. No. EC-119_6 | SCALE 1"=50' | FIGURE No. 2-6 |

be useful in designing any necessary air pollution controls, if VES technology is used in the final remedial program.

### Extraction Rates

The ambient air valve was adjusted and, by varying the amount of ambient air entering the influent line, the pressure drop at the extraction well and the rate at which soil vapors were extracted from the extraction well was modulated. The pressure drop at each of the vapor probes was recorded each time the extraction rate/pressure drop was adjusted. Due to the shallow depth to groundwater, excessive amounts of groundwater were drawn into the system when the extraction rate was in excess of 40 scfm. The amount of groundwater that entered the extraction well, even at the lower extraction rates, prevented the system from being operated continuously. The blower was briefly shut off when it was necessary to empty the water knockout drum, and the system was not allowed to operate unattended during the night.

### Monitoring Pressure Drop

The pressure drops in the influent line and the monitoring probes were measured by use of a series of Magnehelic gauges. Gauges were connected, as needed, to each of the monitoring probes by means of 1/8 inch polyethylene tubing. Readings were taken each time the pressure drop/extraction rate at the influent to the blower was adjusted.

### Monitoring Volumetric Flow Rate

The volumetric flow rate in the extraction line was measured using a pitot tube installed on the influent line upstream of the fresh air bleed valve (see Figure 2-5). A Magnehelic gauge was connected to measure the pressure drop across the pitot tube, and a chart supplied with the blower system was used to convert the measured pressure drop to a volumetric flow rate. The volumetric flow rate was measured each time the pressure in the extraction line was changed.

### Monitoring Chemical Concentrations in the Extracted Gas

At three intervals during the pilot test, samples of the extracted soil gas were collected for chemical analysis. The soil gas samples were collected at a sampling port located on the blower discharge line before any air pollution controls. The soil gas samples were collected in Tedlar bags and shipped under chain of custody to Keystone Lab ( a division of Chester Lab Net), Houston, Texas for analysis. The samples were analyzed for the volatile organic compounds on USEPA's Target Compound List using USEPA Method TO - 1 ("Compendium for Ambient Air Analysis").

### 2.7.4 Results

#### 2.7.4.1 Extraction Rates

The pressure drop at the extraction well was varied between 0.05 - 0.16 atmosphere (20 - 66 inches of water vacuum) and resulted in the volumetric flow rate varying between 35 - 65 standard cubic feet per minute (scfm). Due to the shallow depth to groundwater, excessive amounts of ground water were drawn into the system when the rate of extraction exceeded 40 scfm, and for this reason, the system was operated at a pressure drop of 30 inches of water and an extraction rate of 37 scfm for much of the pilot test. A summary of the field data is presented in Table 2-8.

The amount of groundwater that entered the extraction well, even at the lower extraction rates, prevented the system from being operated continuously. The blower was briefly shut off when it was necessary to empty the water knockout drum, and the system was not allowed to operate unattended during the night.

#### 2.7.4.2 Radius of Influence of the Extraction Well

The soil vapor pressure was measured at each of the vapor monitoring probes after each change in the withdrawal rate. The pressure drop measured at the monitoring probes responded almost immediately after adjustment in the extraction rate. The pressure drop measured in Monitoring Probe #1 averaged 12.7% of that measured at the pump inlet. The pressure drops measured in Monitoring Probes #2 and #3 averaged 5.3% and 1.2 %, respectively, of that measured at the pump inlet (see Table 2-9). For the purpose of the calculations in this report, 15 feet was used as the radius of influence of the vapor extraction well.

#### 2.7.4.3 Soil Permeability to Vapor

Using the method developed by Johnson et al, the intrinsic permeability of the soil/fill at the Pelican site was calculated (see Appendix G). The calculated intrinsic permeability of the soil is $3.8 \times 10^{-2}$ $cm^2$ which is well within the range of permeabilities for which soil vapor extraction technology is considered viable. In calculating the permeability of the soil it was assumed that there was an unsaturated thickness of two feet at the extraction well. The unsaturated thickness may have been less than this due to the rise in the water table caused by the reduction in pressure at the extraction well. Therefore, the intrinsic permeability of the soil may actually be greater than that calculated.

#### 2.7.4.4 Rate of Contaminant Removal

Three samples of the extracted soil vapor were collected and submitted for chemical analysis. Samples were collected from the discharge of the blower before the vapors entered the activated carbon adsorption cannisters.

# TABLE 2-8

## PELICAN MANUFACTURING, INC. SITE
## VAPOR EXTRACTION SYSTEM
## DATA RECORD
## SEPTEMBER 1992

| Inlet (Inches H2O) | Extraction Flow Rate (Ft3/Min) | Monitoring Probe Pressure Drops Inches H2O / % of Drop at Inlet | | | Time |
|---|---|---|---|---|---|
| | | #1 (10') | #2 (15') | #3 (20') | |
| | | | | | 9/24/92 |
| -32 | 37 +/- | -3.8 | -1.4 | -0.4 | 3:20 |
| -28 | 37 +/- | -3.2 | -1.6 | -0.4 | 5:57 |
| -24 | 37 +/- | -3.5 | -1.6 | -0.35 | 6:23 |
| -34 | 50 +/- | -5.5 | -2.15 | -0.6 | 6:32 |
| -28 | 40 +/- | -4.5 | -1.75 | -0.49 | 6:52 |
| -26 | 40 +/- | -4 | -1.4 | -0.4 | 7:35 |
| -20 | 30 +/- | -3 | -1.3 | -0.37 | 7:40 |
| -40 | 35 +/- | -6 | -2.25 | -0.6 | 8:15 |
| | | | | | 9/25/92 |
| -38 | 37 | -5 | -1.9 | -0.49 | 9:05 |
| -50 | 65 | -5.5 | -2.35 | -0.65 | 11:02 |
| -65* | 65 | -8.7 | -3 | -0.75 | 11:05 |
| -38 | 37 | | | | 11:07 |
| -40 | 37 | -4.9 | -1.69 | -0.49 | 11:54 |
| -66* | 65 | -9 | -3 | -0.78 | 11:57 |
| -38 | 37 | | | | 12:00 |

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## TABLE 2-9

## PELICAN MANUFACTURING, INC. SITE
## VES PRESSURE MEASUREMENTS
## SEPTEMBER 25, 1992

| Inlet Pressure Drop (Inches H2O) | Extraction Flow Rate (Ft3/Min) | Monitoring Probe Pressures Drops Inches H20 / % Drop at Inlet | | |
|---|---|---|---|---|
| | | Probe #1 (10') | Probe #2 (15') | Probe #3 (20') |
| -38 | 37 | -5 / 13 | -1.9 / 5.0 | -0.49 / 1.3 |
| -50 | 65 | -5.5 / 11 | -2.35 / 4.7 | -0.65 / 1.3 |
| -65 | 65 | -8.7 / 13.4 | -3.0 / 4.6 | -0.75 / 1.2 |
| -38 | 37 | | | |
| -40 | 37 | -4.9 / 12.3 | -1.69 / 4.2 | -0.49 / 1.2 |
| -66 | 65 | -9.0 / 13.6 | -3.0 / 7.9 | -0.78 / 1.2 |
| -38 | 37 | | | |
| | Average % Drop | 12.7 | 5.3 | 1.2 |

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The first sample was collected on September 24, 1992, after the extraction system had been in operation approximately two and one-half hours. The system was turned off at 8:30 p.m. on September 24. The system was turned on again at 8:45 a.m. on September 25, 1992, and the second sample was collected at 8:57 a.m. at which time the system had been in operation a total of approximately four hours. The third sample was collected on September 25, 1992, at 2:20 p.m. at which time the system had been in operation a total of approximately nine hours.

Samples were collected in Tedlar bags and shipped under chain of custody to Keystone Lab, Houston, Texas. The samples were analyzed for the volatile compounds on the USEPA Target Compound List. The concentrations of the principal volatile organic contaminants of concern are summarized in Table 2-10, and the laboratory report is presented in Appendix H.

For the purpose of calculating the rate at volatile organics will be removed from the soil, the results of the third sample were used (collected after the system had been in operation a total of nine hours). The concentration of the third sample is more likely to be representative of the concentration may be expected during long term operation of an extraction system. The total concentration of volatile organic compounds was measured to be 15.97 micrograms per liter.

Based on an extraction rate of 40 scfm and a total concentration of volatile organics of 15.97 micrograms per liter, the rate at which the volatile organics will be removed from the soil is 0.057 pounds per day (see Appendix I). At this rate of removal it would take 17.5 days to remove one pound of volatile organics, or approximately seven months to remove the equivalent of one gallon of trichloroethene.

### 2.7.5 Conclusions

The permeability of the fill/soil and the volatile nature of the contaminants of concern at the Pelican site are compatible with the use of soil vapor extraction technology. The pilot test demonstrated that the volatile organic contaminants at the Site can be removed from the unsaturated (vadose) portion of the fill/soil column by means of vapor extraction technology. As discussed below, it may be necessary to lower the water table and to install a cover over the Site to increase the rate of contaminant removal.

The shallow depth to groundwater can interfere with the effective application of this technology. If soil vapor extraction is to be used effectively at the Pelican site, it will be necessary to lower the water table. Once the water table is lowered, higher vapor extraction rates will be possible without groundwater entering the system.

The rate of removal of the volatile organics may also increase as the unsaturated thickness of the soil from which vapors can be removed is increased.

Soil vapors may be collected more efficiently by means of horizontal vapor extraction trenches. Trenches may be designed to collect both groundwater and soil vapors.

# TABLE 2-10

## PELICAN MANUFACTURING, INC. SITE
## VOLATILE COMPOUNDS DETECTED
## IN EXTRACTED SOIL VAPOR
## SEPTEMBER 1992

| COMPOUND | Sample 1 9/24/92 6:08PM | Sample 2 9/25/92 8:57AM | Sample 3 9/25/92 2:20PM |
|---|---|---|---|
| | | | |
| Bromochloromethane | | | |
| 1,4-Difluorobenzene | | | |
| Chlorobenzene | | | |
| 1,2-Dichloroethane | | | |
| Toluene | | | |
| Bromofluorobenzene | | | |
| Chloromethane | 236 | | |
| Vinyl Chloride | 6810 | 13897 | 4411 |
| Methylene Chloride | 49 | 134 | 68 |
| Acetone | 74 | 321 | 100 |
| 1,1-Dichloroethene | 913 | 1324 | 282 |
| 1,1-Dichloroethane | 49 | 104 | 40 |
| 1,2-Dichloroethene (Trans) | 1958 | 3066 | 1223 |
| Chloroform | 41 | 51 | 28 |
| 2-Butanone | 255 | | |
| 1,1,1-Trichloroethane | 113 | 72 | 84 |
| Carbon Tetrachloride | 15 | | |

Blank spaces indicate non-detection

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The relatively low concentration of volatile organic compounds may result from fresh air being drawn into the system through the relatively permeable surface of the fill. The fresh air drawn into the system dilutes the concentration of the organics in the soil gas. The efficiency of the vapor extraction system can also be improved if the surface of the area to be treated is covered with a less permeable material. An impermeable cover has the added benefit of reducing recharge in the area of vapor extraction system. By keeping soil moisture to a minimum, the effective porosity of the soil with respect to air flow is maximized, allowing higher flow rates of air through the soil.

## 2.8 Aquifer (Hydraulic Conductivity) Testing

### 2.8.1 Introduction

Hydraulic conductivity (K) tests were conducted on all monitoring wells to calculate the hydraulic conductivity of geologic materials immediately surrounding each well. The tests were performed by a DUNN hydrogeologist during the period of January 6 to January 8, 1993. Slug tests were performed on wells MW-1S, MW-1D and MW-19, MW-20 and MW-22. Bail tests were performed on wells MW-2, MW-3, and MW-4.

### 2.8.2 Objective

The objective of hydraulic conductivity testing was to provide estimates of in-situ permeability values. This data was utilized in conjunction with the hydraulic gradient across the Site to estimate the velocity of groundwater movement at the Site.

### 2.8.3 Methods

Slug tests were conducted by injecting each well with approximately one gallon of distilled water and observing the recovery of the water level to static conditions. Water level recovery was measured using a 10 psi pressure transducer set four to five feet below the static water level, and recorded with an In-Situ Inc. Hermit Model SE 1000 C data logger.

Bail tests were performed on wells MW-2, MW-3 and MW-4 due to the artesian conditions encountered in these wells. The static levels in MW-2 and MW-3 were above the top of the stick up such that the water overflowed the top of the well. Therefore, a section of PVC riser pipe was attached to the stickups of these wells to allow static water level conditions to occur within the well casing. A 10 psi pressure transducer was set within each well, approximately seven to eight feet below the static water level. A five-foot long, one inch ID, PVC bailer was then submerged below the water level and equilibration of static water conditions was achieved. The test commenced upon the withdrawal of the bailer, which displaced approximately one-fifth of a gallon of water from the well. Water level recovery data was recorded with the In-Situ data logger.

Interpretation of water level versus time data from the hydraulic conductivity tests was performed using the Hvorslev method (Hvorslev, 1951) and the Bouwer and Rice method (Bouwer and Rice, 1976). The principle behind Hvorslev's method is that a plot of recovery data (H-h) versus time theoretically follows an exponential decline. If normalized to H-HO, the recovery data follows a straight line on semi-log paper. Horizontal hydraulic conductivity (K) is then calculated as follows:

$$K = \frac{r^2 \ln(L/R)}{2LT_o}$$

where: $K$ = hydraulic conductivity
$r$ = radius of riser in which water level fluctuations occur
$L$ = well screen length
$R$ = radius of well screen
$T_o$ = basic time lag

The basic time lag ($T_o$) is found from the straight-line fit to recovery data and is the time at which $H\text{-}h/H\text{-}H_o = 0.37$ (37%). The computer program used to calculate horizontal hydraulic conductivity by this method utilizes linear regression techniques applied to the recovery data after logarithmic transformation.

$$\ln (H\text{-}h/H\text{-}H_o) = b_o + b_1 t$$

where: $H$ = head at equilibrium
$h$ = head at some time (t)
$H_o$ = head at $t = 0$
$b_o$ = y = intercept
$b_1$ = slope
$t$ = time

This methodology results in a quantitative and objective "forcing" of a straight line to the recovery data. The slope (b,) and y-intercept ($b_o$) can be used to find To and thus K. The accuracy of fit can be accessed using the R-squared (coefficient of determination) and residuals.

The Hvorslev method assumes that the aquifer tested is unconfined, homogeneous and isotopic. This method is most appropriate for shallow wells cased in clean sands below the water table, but it is also applicable to aquifers that are not in strict accordance with the assumption stated above.

The principle behind the Bouwer and Rice method is also based on a straight line relationship between a plot of recovery data (in yt) versus time (t). Horizontal hydraulic conductivity (K) is then calculated as follows:

$$K = \frac{r_c^2 \ln (R_e/r_w)}{2L} \quad \frac{1 \ln}{t} \quad \frac{y_o}{y_t}$$

where: $K$ = hydraulic conductivity
$r_c$ = inside radius of the casing
$R_e$ = the equivalent radial distance over which the head loss y is dissipated in the flow system

$R_W$ = the radius of the borehole
$L$ = well screen length

The computer program used to calculate horizontal hydraulic conductivity by this method utilizes linear regression techniques applied to the recovery data after logarithmic transformation as described above.

### 2.8.4 Results

A summary of hydraulic conductivity test results is presented in Table 2-11. The output of the computer program analyses utilizing the Hvorslev and Bouwer and Rice methods is included in Appendix J. The results of the aquifer testing indicate that the average horizontal hydraulic conductivity of the overburden materials screened by the monitoring wells ranged over 2.5 orders of magnitude, from 0.13 feet/day ($4.56 \times 10^{-5}$ cm/sec) in MW-4, screened in mixed morainal deposits and till, to 33.60 feet/day ($1.18 \times 10^{-2}$ cm/sec) in MW-20, screened in fill and muck. Excluding MW-20, the geometric mean horizontal hydraulic conductivity of the unconfined water bearing zone was approximately 6.46 feet/day ($2.28 \times 10^{-3}$ cm/sec). This value is at the higher range of the permeabilities expected for silty sands and at the lower range expected for clean, well-sorted sands and glacial outwash (Freeze and Cherry, 1979; Fetter, 1980). The geometric mean horizontal hydraulic conductivity of the semi-confined zone was approximately 0.59 feet/day ($2.10 \times 10^{-4}$ cm/sec). This value is at the higher range of the permeabilities expected for tills and at the lower range for silty sands (Freeze and Cherry, 1979; Fetter, 1980).

As discussed in Section 2.6, thin-walled tube samples were obtained from selected soil borings. These samples were analyzed for various physical properties including vertical hydraulic conductivity in boring D-3, from a depth of sixteen to eighteen feet below the ground surface. The vertical permeability of the morainal material was measured as approximately $1.3 \times 10^{-3}$ feet/day ($4.7 \times 10^{-7}$ cm/sec). It should be noted that laboratory tests of vertical permeability may not consider permeability associated with secondary features, such as desiccation cracks and root channels, due to the small volume of material that is tested.

### 2.8.5 Conclusions

The data presented in Table 2-11 exhibit the variability of hydraulic conductivity within the overburden, ranging over 2.5 orders of magnitude. Additionally, the data suggests that the horizontal permeability of the semi-confined water bearing zone is approximately 2.5 orders of magnitude greater than the vertical permeability.

## 2.9 Environmental Sampling and Analysis

### 2.9.1 Introduction

Environmental samples were collected during drilling (subsurface soil) and on October 13 and 14, 1992. This sampling consisted of the collection of eight groundwater samples, 14

# TABLE 2-11

## PELICAN MANUFACTURING, INC. SITE

## SUMMARY OF HYDRAULIC CONDUCTIVITY TESTING

|  |  |  |  | Hydraulic Conductivity |  |  |  | Average Hydraulic Conductivity |  |
|---|---|---|---|---|---|---|---|---|---|
| Monitoring Well | Screened Interval | Stratigraphic Unit Screened | Test Number | Hvorslev Method (cm/sec) | Hvorslev Method (ft/day) | Bouwer & Rice Method (cm/sec) | Bouwer & Rice Method (ft/day) | (cm/sec) | (ft/day) |
| MW-1S | 6.2-13.7' | Fill/Mixed Morainal Deposits | Test 1<br>Test 2 | 1.07E-03<br>1.17E-03 | 3.04<br>3.33 | 6.55E-04<br>7.28E-04 | 1.86<br>2.06 | 9.06E-04 | 2.57 |
| MW-1D | 18-28' | Mixed Morainal Deposits/Till | Test 1<br>Test 3 | 4.61E-03<br>5.42E-03 | 13.08<br>15.36 | 3.42E-03<br>4.15E-03 | 9.69<br>11.77 | 4.40E-03 | 12.48 |
| MW-2 | 14-23' | Mixed Morainal Deposits/Till | Test 1<br>Test 2 | 5.75E-04<br>4.94E-04 | 1.40<br>1.63 | 4.65E-04<br>4.46E-04 | 1.32<br>1.27 | 4.95E-04 | 1.41 |
| MW-3 | 19.6-29.6' | Till | Test 1<br>Test 2 | 4.23E-04<br>4.36E-04 | 1.20<br>1.24 | 3.47E-04<br>3.78E-04 | 0.99<br>1.07 | 3.96E-04 | 1.13 |
| MW-4 | 19-29' | Till | Test 2 | 4.81E-05 | 0.14 | 4.30E-05 | 0.12 | 4.56E-05 | 0.13 |
| MW-19 | 4-9' | Fill/Muck/Mixed Morainal Deposits | Test 1<br>Test 2 | 1.02E-03<br>1.13E-03 | 2.90<br>3.20 | 6.14E-04<br>6.44E-04 | 1.74<br>1.83 | 8.52E-04 | 2.42 |
| MW-20 | 5-10' | Fill/Muck | Test 1<br>Test 2 | 1.26E-02<br>1.73E-02 | 35.71<br>49.11 | 8.96E-03<br>8.52E-03 | 25.40<br>24.16 | 1.18E-02 | 33.60 |
| MW-22 | 4-9' | Fill/Mixed Morainal Deposits | Test 1 | 1.10E-02 | 31.25 | 4.94E-03 | 14.00 | 7.97E-03 | 22.63 |

surface soil samples, 13 subsurface soil samples and four sediment samples, three of which were collected from points located inside the building and one from a point located outside the building. Samples were submitted to E3I for analysis in accordance with the NYSDEC Contract Laboratory Program (CLP), Analytical Services Protocol (ASP) of December 1991. The analyses performed on each sample are outlined in Table 2-12. Groundwater sampling locations are indicated on Figure 2-4. The subsurface soil samples were collected from the borings for the new monitoring wells and are, therefore, also shown on Figure 2-4 as monitoring well locations MW-1S, 1D, 2, 3 and 4. Surface soil and sediment sampling locations are shown on Figure 2-7.

### 2.9.2 Objectives

#### 2.9.2.1 General

Environmental samples were collected for the purpose of confirming results of previous investigations, determining more precisely the location and extent of contamination and determining the presence or absence of contaminants, from which an updated list of contaminants of concern (COC) could be developed. The COC list could also be used to determine the analytical protocol for future samples collected to define the limits of impacted soil, if necessary, and to evaluate the need for and design of the appropriate IRMS, as necessary. Finally, the results will be utilized in the performance of the Feasibility Study to determine what, if any, remedial alternatives will be identified, screened, selected and recommended for implementation at the Site.

#### 2.9.2.2 Groundwater

The groundwater samples were collected and analyzed to determine the presence and extent of contamination in groundwater at the Site. Water levels were collected from the monitoring wells in conjunction with the sampling event to provide information regarding groundwater flow direction and vertical hydraulic gradients at the Site.

#### 2.9.2.3 Surface Soil

The surface soil samples were collected to confirm previous sampling results; to investigate additional potential areas of soil contamination, such as at the location of elevated soil gas results, stains, distressed vegetation, and at the location of the suspected dry well; to further refine and define the lateral extent of surface contamination; to evaluate the need for IRMs and to evaluate various remedial technologies and alternatives during the Feasibility Study.

The analytical results were also utilized to establish a more representative list of contaminants of concern at the Site.

#### 2.9.2.4 Subsurface Soil

The subsurface (split spoon) soil samples were collected to identify and evaluate subsurface geologic materials and depositional units; to determine if chemical contamination from the ground surface had penetrated to greater depths beneath the Site, to provide initial evidence

# TABLE 2-12

## PELICAN MANUFACTURING, INC. SITE
## SUMMARY OF ENVIRONMENTAL SAMPLING AND ANALSIS BY MEDIA

| DATE OF SAMPLING | SAMPLE I.D. | ANALYSES | DATE OF SAMPLING | SAMPLE I.D. | ANALYSES | DATE OF SAMPLING | SAMPLE I.D. | ANALYSES |
|---|---|---|---|---|---|---|---|---|
| 10/13/92 | MW - 1S | CLP* Volatile Organics | 10/14/92 | S - 1 | CLP Volatile Organics<br>CLP Semi-Volatile Organics<br>CLP Pesticides/ PCBs*<br>TAL Metals (total)<br>Cyanide | 10/14/92 | S - 10 | CLP Volatile Organics<br>CLP Semi-Volatile Organics<br>CLP Pesticides/ PCBs<br>TAL Metals (total)<br>Cyanide |
| 10/13/92 | MW - 1D | CLP Volatile Organics<br>CLP Semi-Volatile Organics<br>CLP Pesticides/ PCBs<br>TAL** Metals (total)<br>Cyanide | 10/14/92 | S - 2 | CLP Volatile Organics | 10/14/92 | S - 11 | CLP Volatile Organics |
| 10/13/92 | MW - 22 | CLP Volatile Organics<br>CLP Semi-Volatile Organics<br>CLP Pesticides/ PCBs<br>TAL Metals (total)<br>Cyanide | 10/14/92 | S - 3 | CLP Volatile Organics | 10/14/92 | S - 12 | CLP Volatile Organics |
| 10/13/92 | MW - 3 | CLP Volatile Organics<br>CLP Semi-Volatile Organics<br>CLP Pesticides/ PCBs<br>TAL Metals (total)<br>Cyanide | 10/14/92 | S - 4 | CLP Volatile Organics | 10/14/92 | S - 13 | CLP Volatile Organics<br>CLP Semi-Volatile Organics<br>CLP Pesticides/ PCBs<br>TAL Metals (total)<br>Cyanide |
| 10/13/92 | TRIP BLANK | CLP Volatile Organics | 10/14/92 | S - 5 | CLP Volatile Organics | 10/14/92 | SED - 1 | CLP Volatile Organics<br>CLP Semi-Volatile Organics<br>CLP Pesticides/ PCBs<br>TAL Metals (total)<br>Cyanide |
| 10/13/92 | MW - 2 | CLP Volatile Organics | 10/14/92 | S - 6 | CLP Volatile Organics<br>CLP Semi-Volatile Organics<br>CLP Pesticides/ PCBs*<br>TAL Metals (total)<br>Cyanide | 10/14/92 | SED - 2 | CLP Volatile Organics |
| 10/13/92 | MW - 4 | CLP Volatile Organics | 10/14/92 | S - 7 | CLP Volatile Organics | 10/14/92 | SED - 3 | CLP Volatile Organics<br>CLP Semi-Volatile Organics<br>CLP Pesticides/ PCBs<br>TAL Metals (total)<br>Cyanide |
| 10/13/92 | MW - 20 | CLP Volatile Organics | 10/14/92 | S - 8 | CLP Volatile Organics | 10/14/92 | SED - 4 | CLP Volatile Organics |
| 10/13/92 | MW - 19 | CLP Volatile Organics | 10/14/92 | S - 9 | CLP Volatile Organics |  |  |  |

"MW" designates groundwater samples
"S" designates surface soil samples
"SED" designates sediment samples
CLP = Contract Laboratory Program
TAL = Target Analyte List

* =Not analyzed due to laboratory problem
Aqueous Matrix Spike/Matrix Spike Duplicate (MS/MSD) collected from well MW - 1D
Aqueous Blind Duplicate Sample (X - 1) collected from well MW - 3
Solid Matrix Spike/Matrix Spike Duplicate (MS/MSD) collected from soil location S - 10
Solid Blind Duplicate Sample (X - 1) collected from sediment location SED - 1

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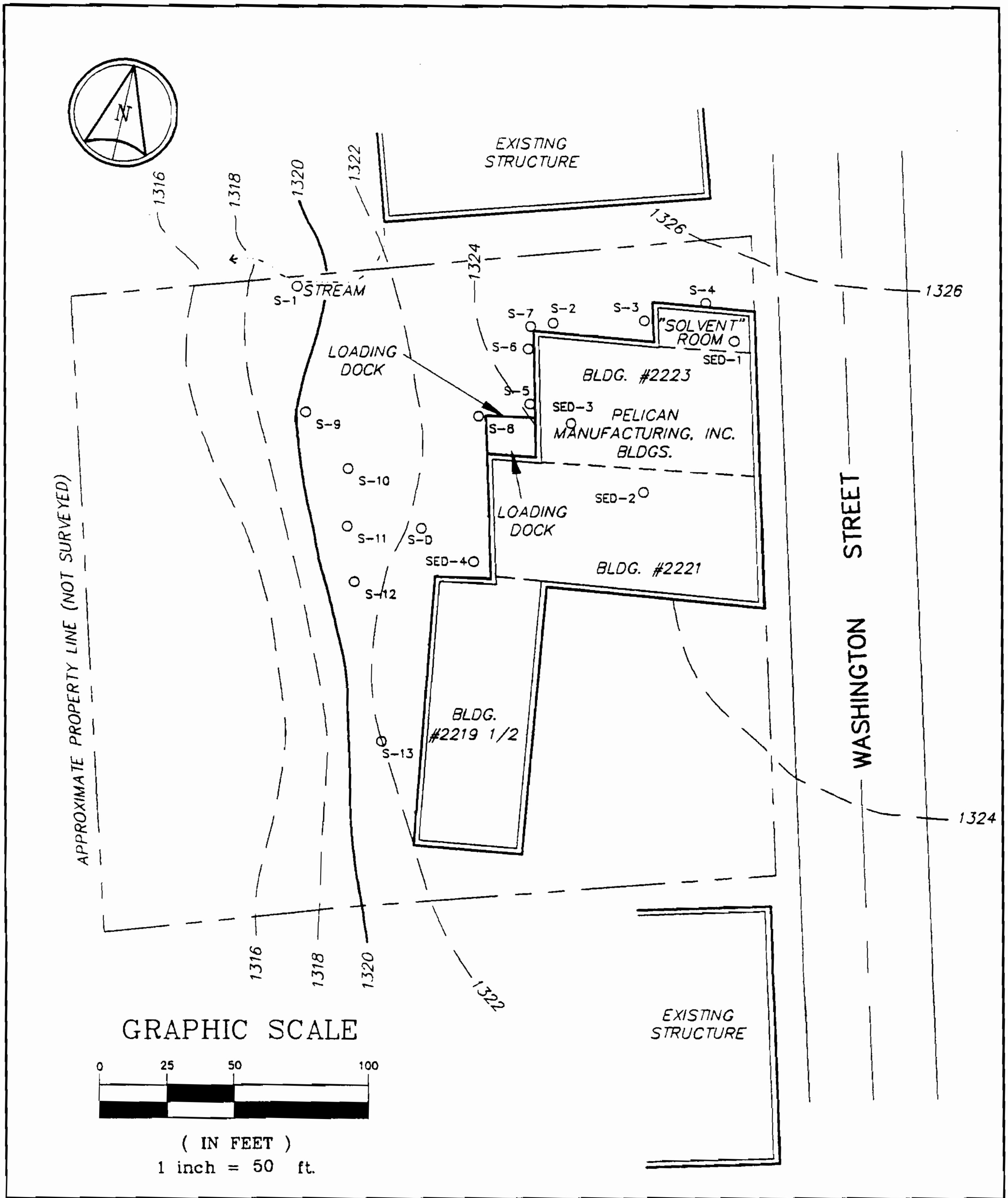
# TABLE 2-12 (CONTINUED)

## PELICAN MANUFACTURING, INC. SITE
## SUMMARY OF ENVIRONMENTAL SAMPLING AND ANALSIS BY MEDIA

| DATE OF SAMPLING | SAMPLE I.D. | BORING I.D. | SAMPLE DEPTH | ANALYSES |
|---|---|---|---|---|
| 9/9/92 | DC 1DS2 | D - 1D | 2' - 4' | CLP Volatile Organics |
| 9/9/92 | DC 1DS5 | D - 1D | 8' - 10' | CLP Volatile Organics<br>CLP Semi-Volatile Organics<br>CLP Pesticides/ PCBs<br>TAL Metals (total)<br>Cyanide |
| 9/9/92 | DC 1DS9 | D - 1D | 24' - 26' | CLP Volatile Organics |
| 9/10/92 | D2S3 | D - 2 | 4' - 6' | CLP Volatile Organics |
| 9/10/92 | D2S5 | D - 2 | 8' - 10' | CLP Volatile Organics |
| 9/10/92 | D3S2 | D - 3 | 2' - 4' | CLP Volatile Organics |
| 9/10/92 | D3S6 | D - 3 | 10' - 12' | CLP Volatile Organics<br>CLP Semi-Volatile Organics<br>CLP Pesticides/ PCBs<br>TAL Metals (total)<br>Cyanide |
| 9/10/92 | D4S2 | D - 4 | 2' - 4' | CLP Volatile Organics |
| 9/10/92 | *D4S6 | D - 4 | 10' - 14' | CLP Volatile Organics<br>CLP Semi-Volatile Organics<br>CLP Pesticides/ PCBs<br>TAL Metals (total)<br>Cyanide |
| 9/10/92 | D4S11 | D - 4 | 20' - 22' | CLP Volatile Organics |
| 9/14/92 | D2S79 | D - 2 | 7' - 9' | CLP Volatile Organics<br>CLP Semi-Volatile Organics<br>CLP Pesticides/ PCBs<br>TAL Metals (total)<br>Cyanide |
| 9/14/92 | D2S1315 | D - 2 | 13' - 15' | CLP Volatile Organics |
| 9/17/92 | PILOT 20 | VES PROBE | 3' * | CLP Volatile Organics |

CLP = Contract Laboratory Program
TAL = Target Analyte List
*Blind Duplicate Sample (X - 1) collected from boring D - 4D, sample S-6 (10' - 14')



**DUNN ENGINEERING COMPANY**

DIVISION OF **RUST** ENVIRONMENT & INFRASTRUCTURE

**SURFACE SOIL/SEDIMENT SAMPLING LOCATIONS**

PELICAN MANUFACTURING, INC. SITE

City of Jamestown
Chautauqua Co., NY

| | | | | |
|---|---|---|---|---|
| PROJECT No. 35120.700 | DATE 7/28/94 | DWG. No. EC-119_3 | SCALE 1"=50' | FIGURE No. 2-7 |

of potential subsurface contamination below the water table and to aid in determining the screened intervals for the installation of monitoring wells.

#### 2.9.2.5 Sediment

The sediment samples were collected to determine if the floor drain system within the Pelican building and the above-ground septic tank on the exterior of the building contained relict contamination and if these facilities were actual or potential sources of contamination to the surface and subsurface soil and the groundwater at the Site. The results of the sediment sampling and analysis were also used to evaluate the need for IRMs at the Site.

### 2.9.3 Methods

#### 2.9.3.1 Groundwater Samples

Groundwater samples were collected from the on-site monitoring wells on October 13,1992, one week after the development of the wells. A blind duplicate groundwater sample, X-1, was collected from MW-3. The samples were submitted to Energy and Environmental Engineering, Inc. (E3I) of Somerville, Massachusetts for analysis. All analyses were conducted in accordance with the NYSDEC ASP, by CLP procedures (December 1991). The analyses for each groundwater sample are summarized in Table 2-12. Additionally, samples were analyzed in the field for pH, temperature, specific conductance and turbidity.

Prior to sampling, the static water level in each of the monitoring wells was measured and the volume of water in each well was determined. Three well volumes of water were removed from each well utilizing well-dedicated, bottom-filling PVC bailers, raised and lowered in the well with new, dedicated nylon rope. After allowing sufficient time for groundwater recharge in the well, samples were collected directly from the bailer and transferred to the appropriate sample containers in a manner that minimized agitation and prevented any physiochemical changes or induced losses by volatilization. All sample containers were filled in the following order:

VOC;
Semi-volatiles;
Pesticides/PCBs; and
Superfund inorganics (Metals and Cyanide).

Sample containers submitted for VOC analysis were completely filled with zero headspace (i.e., so that no air bubbles were present in the containers). Samples submitted for metals analysis were preserved with nitric acid to reduce pH to less than 2. Samples submitted for cyanide analysis were preserved with sodium hydroxide to raise pH to greater than 12.5.

All sample containers were placed in shipping coolers containing "wet ice" to maintain a temperature of 4° C. Each shipping cooler was shipped to the analytical laboratory by overnight courier following chain-of-custody protocols and procedures.

A separate aliquot of sample was retained for field determination of pH, temperature, specific conductance and turbidity. The pH of each sample was measured using an Orion Research Model SA250 pH meter with an Orion Ross combination glass electrode. Standardization of the pH meter involved using a two-point calibration method. A pH 7.0 buffer was utilized first to calibrate the instrument followed by a slope adjustment using a pH 4.0 buffer. The calibration was then checked by determining and recording the instrument response to the pH 7.0 buffer. The pH meter was also equipped with an Orion ATC temperature probe to facilitate temperature measurement. The probe is factory calibrated, and no adjustment is required. Specific conductance was measured using a Yellow Springs Model 33-S-C-T conductivity meter. The meter is factory calibrated (cell consistent) and the accuracy of the meter was checked prior to use at the Site by measuring the conductivity of a potassium chloride solution standard. Turbidity measurements were made utilizing a HF Instruments Model DRT-15B. The meter was calibrated using a standard turbidity solution of 0.1 NTU prior to each turbidity measurement. A summary of the field parameters is presented in Table 2-13.

As outlined in Table 2-12, samples from five monitoring wells (MW-1S, MW-2, MW-4, MW-19, and MW-20) were analyzed for the NYSDEC Target Compound List (TCL) volatile organics. Samples from three wells, MW-1D, MW-3, and upgradient well MW-22, were analyzed for the complete NYSDEC TCL/Target Analyte List (TAL = NYSDEC Superfund Inorganics) analytes. The blind duplicate sample from MW-3(X-1) was also analyzed for the full TCL/TAL.

### 2.9.3.2 Surface Soil Samples

Seven surface soil samples (S-1, S-2, S-5, S-9, S-10, S-11 and S-12) were collected at or near points of prior sampling that had indicated evidence of contamination. Sample locations S4, S-7 and S-8 were determined on the basis of the results of DUNN's soil gas survey. Sample locations S-3 and S-6 were determined in the field on the basis of stains, stressed vegetation, and physical factors. Sample S-3 was collected in a stained area with stressed vegetation near the discharge of a drain pipe from the roof of the building. Sample S-6 was collected outside the building opposite where an above ground solvent storage tank had been located on the inside of the building. Sample S-D was collected from the location of a suspected "dry well," located west of the loading dock. An inspection of this area during sampling did not indicate the presence of such a dry well. Sample S-13 was collected at the southwestern portion of the site as a "random" sample location for the purpose of providing background sample data.

Surface soil samples were collected utilizing dedicated stainless steel sampling trowels. Samples submitted for VOC analysis were transferred directly from the trowel into the appropriate sample jars. Samples collected for semi-volatiles, pesticides/PCBs, metals and cyanide analysis were thoroughly homogenized prior to placement within the appropriate sample containers. Sample containers were subsequently placed within insulated coolers, chilled with wet ice to maintain a temperature of 4°C, and shipped to the analytical laboratory by overnight courier. Each shipping cooler was delivered to the analytical laboratory following chain-of-custody protocols and procedures.

# TABLE 2-13

## PELICAN MANUFACTURING, INC. SITE
## WELL PURGING INFORMATION
## OCTOBER 1992

| Monitoring Well | Well Depth BGS (feet) | Water Level BMP (feet) | Well Volume (gal) | Water Removed (gal) | Turbidity (NTUs) | | pH (std. units) | | Specific Conductance (umhos) | | Temperature (°C) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Initial | Final | Initial | Final | Initial | Final | Initial | Final |
| MW-1S | 13.7 | 5.54 | 1.33 | 4.0 | 32.9 | 108 | 6.9 | 6.9 | 1700 | 1800 | 15.0 | 15.0 |
| MW-1D | 28.0 | 5.72 | 4.12 | 12.5 | >200 | >200 | 9.4 | 8.5 | 270 | 410 | 14.5 | 13.1 |
| MW-2 | 23.0 | Artesian | 4.08 | 12.5 | 70.5 | 91.2 | 7.7 | 7.8 | 265 | 280 | 12.1 | 12.3 |
| MW-3 | 29.5 | Artesian | 4.82 | 15 | >200 | >200 | 7.7 | 7.6 | 305 | 310 | 11.4 | 11.2 |
| MW-4 | 29.0 | 1.06** | 4.55 | 14 | >200 | 96.5 | 7.8 | 7.8 | 370 | 335 | 12.2 | 13.1 |
| MW-19 | *9.0 | 5.49 | 0.74 | 2.5 | 157 | 101 | 7.1 | 7.1 | 850 | 790 | 13.8 | 13.6 |
| MW-20 | *10.0 | 6.70 | 0.54 | 2.0 | 72.2 | 74.3 | 7.2 | 7.2 | 950 | 950 | 14.1 | 13.7 |
| MW-22 | *9.0 | 8.46 | 0.58 | 2.0 | 68.5 | 96.6 | 6.9 | 6.9 | 340 | 335 | 14.7 | 15.3 |

Data Compiled From Field Reports
BGS = Below Ground Surface
BMP = Below Measuring Point
*From E & E Report Dated July 1987
** Also artesian, head above grand in PVC riser

excel:peli2-13.xls

### 2.9.3.3 Subsurface Soil Samples

Twelve subsurface soil samples were collected from the soil borings using a split spoon sampler. Samples were collected following ASTM Method D-1586, "Standard Method for Penetration Test and Split Barrel Sampling of Soils." A thirteenth subsurface soil sample, the "Pilot 20" sample, was collected from drill cuttings.

Four subsurface samples (DC1DS5, D2S79, D3S6, D4S6) were submitted to E3I for analysis of the NYSDEC TCL/TAL parameters, by NYSDEC, ASP CLP procedures (December 1991). The remaining nine samples were submitted for analysis of the NYSDEC TCL volatile organic parameters by the NYSDEC ASP CLP (December 1991) procedure.

### 2.9.3.4 Sediment Samples

Three sediment samples (SED-1, SED-2, and SED-3) were collected from floor drains located inside the building. SED-1 was collected from a floor drain located in the solvent room. Samples SED-2 and SED-3 were collected from an interconnected floor drain system within building No. 2223 and No. 2221 respectively. A fourth sample, SED-4, was collected from the bottom of an above-ground septic tank located outside of the building No. 2221, near its juncture with building No. 2219 1/2.

Sediment samples SED-1, SED-2, and SED-3 were collected utilizing dedicated stainless steel sampling trowels. The location of SED-1 was dry. SED-1 was split into two fractions to serve as an original and a duplicate sample; SED-1 and X-1. The SED-2 and SED-3 samples were collected from floor drains that contained water. The water was bailed out of each floor drain prior to the collection of these samples. A glass jar connected to a steel rod was utilized to collect the SED-4 sample from the bottom of the septic tank. Samples submitted for VOC analysis were transferred directly from the sampling device into the appropriate sample jars. Sample containers were subsequently placed within insulated coolers, chilled with wet ice to maintain a temperature of 4°C, and shipped to the analytical laboratory by overnight courier. Each shipping cooler was delivered to the analytical laboratory following chain-of-custody protocols and procedures.

As outlined in Table 2-12, sediment samples SED-1, SED-3 and X-1 (blind duplicate sample of SED-1) were analyzed for the full TCL/TAL parameters. Samples SED-2 and SED-4 were analyzed for the volatile fraction of the TCL.

### 2.9.4 Results

Laboratory reporting sheets (Form Ones) for all analyses of all media are presented in Appendix K.

### 2.9.4.1 Groundwater

**Chemical Analytical Results**

**Volatile Organics**

Volatile organic results are summarized in Table 2-14. Trichloroethene was detected at levels greater than the groundwater standard of 5 ug/l in wells MW-1D (93 ug/l), MW-19 (880 ug/l), and MW-20 (530 ug/l). A11 samples except MW-3 and MW-4 exhibited 1,2-dichloroethene (a breakdown product of trichloroethene) concentrations that exceeded the NYSDEC groundwater standard of 5 ug/l. MW-20 also exhibited 1,1,1-trichloroethane at a concentration of 54 ug/l, which is greater than the groundwater standard of 5 ug/l. Vinyl chloride concentrations in MW-1S, MW-1D, MW-19, MW-20, and MW-22 were at or exceeded the groundwater standard of 2 ug/l. 1,1-dichloroethane was detected in MW-1D at the groundwater standard of 5 ug/l. Toluene concentrations in MW-1S (3100 ug/l), MW-1D (160 ug/l), and MW-19 (68 ug/l) exceeded the groundwater standard of 5 ug/l. Ethylbenzene was detected in MW-1D at a concentration of 4 ug/l, which is just below the groundwater standard of 5 ug/l. The xylene concentration in MW-1D (19 ug/1) exceeded the groundwater standard of 5 ug/l. No TICs (Tentatively Identified Compounds) were detected in the groundwater samples.

Figure 2-8 presents concentrations of total VOCs in groundwater samples.

**Semi-Volatile Organics**

Groundwater semi-volatile organic results are presented in Table 2-15. There were no detections of TCL semi-volatile organics in samples MW-1D and MW-22. Bis(2-Ethylhexyl)Phthalate was detected in MW-3 at a concentration of 13 ug/l, which is below the groundwater standard of 50 ug/l. The blind duplicate sample for MW-3 (X-1) had no detections. Since Bis(2-ethylhexyl)Phthalate is a common laboratory contaminant, and was not detected in the blind duplicate sample (X-1) of MW-3, the reported result may represent contamination that was laboratory derived and not site-related.

**Pesticides/PCBs**

With the exception of delta-BHC in groundwater from "upgradient" monitoring well MW-22, no pesticides/PCBs were detected in the samples collected from the monitoring wells and analyzed for these compounds. Delta-BHC was detected in groundwater from MW-22 at an estimated concentration of 0.0056 ug/l, which exceeded the NYSDEC groundwater standard of non-detect (ND).

**Inorganics**

Groundwater monitoring well inorganic data are summarized in Table 2-16. Samples from MW-1D, MW-22, and MW-3 were analyzed for the NYSDEC TAL parameters (metals and cyanide). All metals analyses were performed on total matrix (i.e., non-filtered) samples. All of the groundwater samples exhibited iron and manganese concentrations that exceeded the

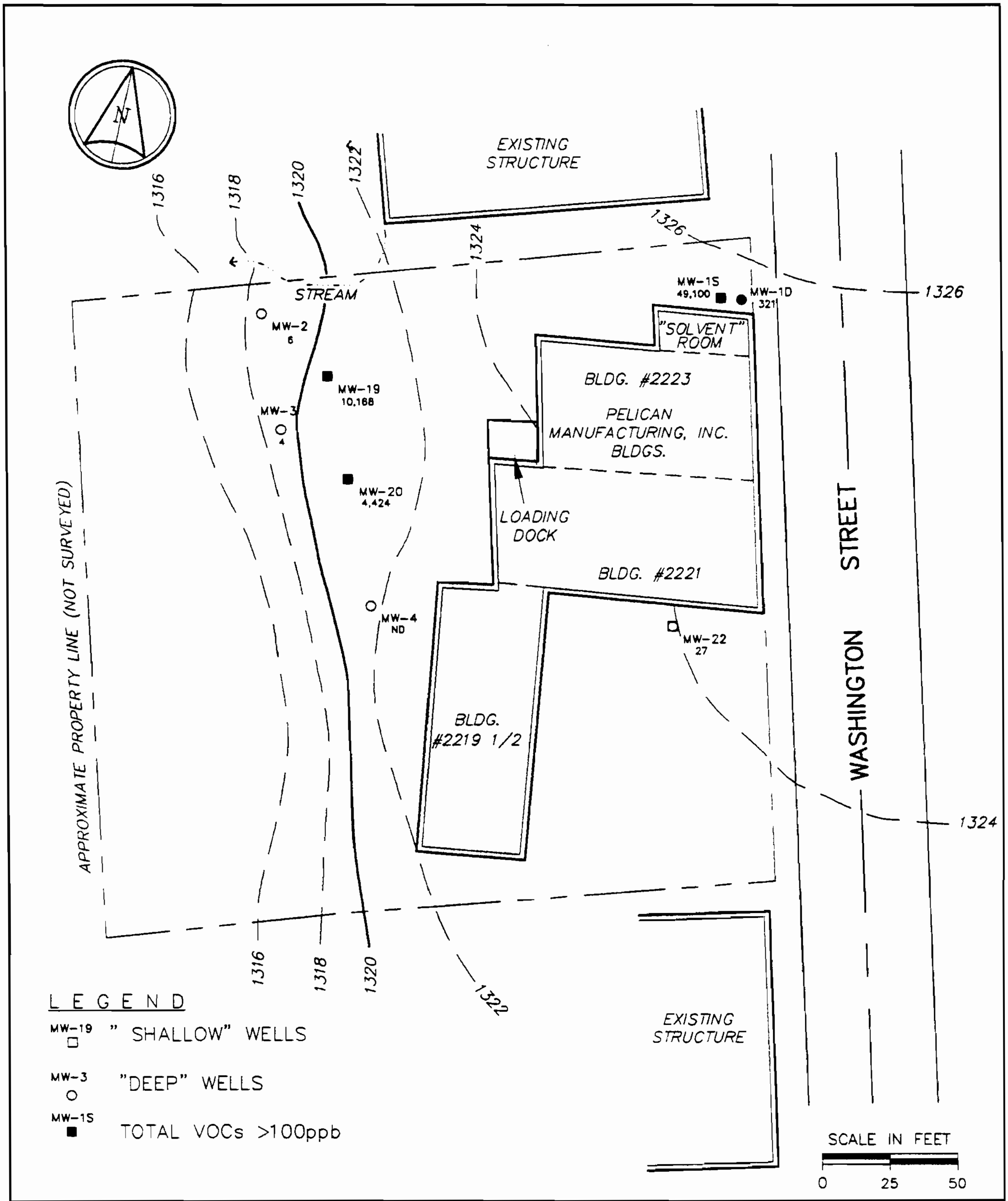
## TABLE 2-14

## PELICAN MANUFACTURING, INC. SITE
## GROUNDWATER SAMPLES
## VOLATILE ORGANICS
## OCTOBER 1992

| COMPOUND | MW-1S | MW-1D | MW-2 | MW-3 | X-1 | MW-19 | MW-20 | MW-22 | NYSDEC GROUNDWATER STANDARD/GV |
|---|---|---|---|---|---|---|---|---|---|
| **Volatile Organics** | | | | | | | | | |
| Vinyl Chloride | 11000 | 2J | | | | 320J | 240J | 2J | 2 |
| Methylene Chloride | +2500U | +10U | | | +10U | +500U | +250U | +10U | 5 |
| 1,1-Dichloroethane | | 5J | | | | | | | 5 |
| 1,2-Dichloroethene (Total) | 35000 | 38 | 6J | 4J | 3J | 8900 | 3600 | 23 | 5 |
| Trichloroethene | | 93 | | | 2J | 880 | 530 | | 5 |
| Toluene | 3100 | 160 | | | | 68J | | 2J | 5 |
| Ethylbenzene | | 4J | | | | | | | 5 |
| Xylene | | 19 | | | | | | | 5 |
| Acetone | +4100U | | | | | | +270U | | 50 GV |
| 1,1,1-Trichloroethane | | | | | | | 54J | | 5 |
| TICs Found | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NA |

NOTE: MW-4 HAD NO DETECTIONS FOR VOLATILE ORGANICS

All values expressed in ug/l (ppb)
J= Indicates an estimated value
B=Analyte is found in the associated blank as well as the sample
Blank spaces indicate non-detection
X-1 = Blind field duplicate of Sample MW-3
TICs = Tentatively identified compounds
V=Value estimated in accordance with data validation criteria
U=Undetected at specified concentration level
\+ = Undetected based on data validation
GV=Guidance Value
NA=Not Applicable



**DUNN ENGINEERING COMPANY**

DIVISION OF **RUST** ENVIRONMENT & INFRASTRUCTURE

**GROUNDWATER SAMPLES**
**MINIMUM TOTAL VOCs – OCTOBER 1992**

PELICAN MANUFACTURING, INC. SITE

City of Jamestown
Chautauqua Co., NY

PROJECT No. 35120.700
DATE 10/93
DWG. No. 35120-21
SCALE 1"=50'
FIGURE No. 2-8

# TABLE 2-15
# PELICAN MANUFACTURING, INC. SITE
# GROUNDWATER SAMPLES
# SEMI-VOLATILE ORGANICS
# OCTOBER 1992

| COMPOUND | MW-1D | MW-3 | X-1 | MW-22 | NYSDEC GROUNDWATER STANDARD/GV |
|---|---|---|---|---|---|
| | | | | | |
| Bis(2-Ethylhexyl) Phthalate | | 13 | | | 50 |
| | | | | | |
| TICs Found | 3 | 3 | 6 | 2 | NA |

Results expressed in ug/l (ppb)
Blank spaces indicate non-detection
X-1=Blind field duplicate of Sample MW-3
TICS=Tentatively Identified Compounds
GV=Guidance Value
NA=Not Applicable

# TABLE 2-16
# PELICAN MANUFACTURING, INC. SITE
# GROUNDWATER SAMPLES
# INORGANICS
# OCTOBER 1992

| COMPOUND | MW-1D | MW-3 | X-1 | MW-22 | NYSDEC GROUNDWATER STANDARD/GV |
|---|---|---|---|---|---|
| Aluminum | 82200.00 | 21200.00 | 18700.00 | 13200.00 | NS |
| Antimony | | | | | 3GV |
| Arsenic | 36.10V | 13.20V | 10.70V | 7.60V | 25.00 |
| Barium | 940.00 | 273.00 | 256.00 | 236.00 | 1000.00 |
| Berylium | 3.40B | 0.80B | 0.90B | | 3GV |
| Cadmium | | | | | 10 |
| Calcium | 170000.00 | 93100.00 | 89100.00 | 88500.00 | NS |
| Chromium | 125.00 | 25.90 | 23.00 | 16.80 | 50.00 |
| Cobalt | 80.90 | 20.40B | 16.30B | 10.00B | NS |
| Copper | 183.00 | 35.90 | 29.10 | 47.50 | 200.00 |
| Iron | 186000.00 | 43800.00 | 37200.00 | 22500.00 | 300.00 |
| Lead | 147.00V | 24.40V | 29.60V | 161.00V | 25.00 |
| Magnesium | 62800.00 | 27000.00 | 26200.00 | 8750.00 | 35,000GV |
| Manganese | 3980.00V | 715.00V | 642.00V | 822.00V | 300.00 |
| Nickel | 169.00 | 65.10 | 52.30 | 30.20B | NS |
| Silver | | | | | 50 |
| Potassium | 17000.00 | 4930.00B | 4740.00B | 3550.00B | NS |
| Sodium | 31300.00 | 5130.00 | 5100.00 | 8370.00 | 20000.00 |
| Thallium | | | | | 4GV |
| Vanadium | 110.00 | 30.90B | 27.00B | 25.30B | NS |
| Zinc | 503.00 | 114.00 | 97.30 | 164.00 | 300.00 |
| Mercury | | | | 0.32 | 2.00 |
| Cyanide | | | | | 100 |

Results expressed in ug/l (ppb)
B=Detected below the CRQL but above the instrument detection limit.
Blank spaces indicate non-detection
X-1 = Blind field duplicate of Sample MW-3
V=Value estimated in accordance with data validation criteria
GV=Guidance Value
NS=No Standard

NYSDEC groundwater standard (0.3 mg/l for both iron and manganese; 0.5 mg/l for a combination of the two). Groundwater from monitoring well MW-1D exhibited concentrations of arsenic, beryllium, chromium, lead, magnesium, sodium and zinc that exceeded the applicable NYSDEC groundwater standard or guidance value. Groundwater from monitoring well MW-22 exhibited a lead concentration (161 ug/l) that exceeded the groundwater standard (25 ug/l). The lead value exhibited by the MW-3 groundwater sample was just below the laboratory reporting limit; however, the value from the blind duplicate sample from well MW-3 (X-1) was just above the groundwater standard. The MW-3 and X-1 lead values were within the variability associated with the analytical method. The lead data from these two samples indicate that the total matrix lead concentration in groundwater from MW-3 is near the groundwater standard.

Field turbidity measurements performed at the time of sample collection revealed that all three monitoring well samples analyzed for metals exhibited high turbidity values, indicating that the groundwater contained suspended sediments that were subsequently incorporated into the total matrix metals samples. High sediment concentrations in groundwater samples can result in reported groundwater metals values that are biased high and do not accurately depict the groundwater metals loading. When the samples are preserved in the field with acid prior to analysis, followed by preparation in the laboratory via hot acid digestion, metals will be desorbed from the entrained sediment. This will result in reported metal concentrations higher than the levels actually present in the groundwater. However, it should be noted that the SED-1 sample collected from inside the building did exhibit elevated concentrations of chromium, lead, copper and zinc. Therefore, the reported metal values detected in groundwater from MW-1D cannot be discounted as being potentially site-related.

#### 2.9.4.2 Surface Soil

**Volatile Organics**

Surface soil volatile organic analytical data are summarized in Table 2-17. Trichloroethene was detected in all the surface soil samples except sample S-9. Concentrations ranged from a low of 3 ug/kg to a high of 9,800 ug/kg (S-8). Analytical data revealed that, with the exception of trichloroethene in samples S-8 (9,800 ug/kg) and S-12 (1,400 ug/kg), and acetone (1,100 ug/kg), and 1,1,1-trichloroethane (1,400 ug/kg) in S-8, all surface soil volatile organic analytical concentrations were less than the NYSDEC Recommended Soil Cleanup Objectives (Cleanup Objectives or RSCOs) that are: trichloroethene 700 ug/kg; 1,1,1-trichloroethane, 800 ug/kg; acetone, 200 ug/kg.

Surface soil sample S-8 was collected at the northwest corner of the loading dock, where elevated volatile organics were detected in the sub-surface vadose zone during the soil gas survey. Sample S-12 was collected 30 feet from the northwest corner of building No. 2219 (see Figure 2-7). The sample was collected from a depth of two to six inches below the ground surface.

# TABLE 2-17

## PELICAN MANUFACTURING, INC. SITE
## SURFACE SOIL SAMPLES
## VOLATILE ORGANICS
## OCTOBER 1992

| COMPOUND | S-1 | S-1 RE | S-2 | S-3 | S-4 | S-5 | S-6 | S-7 | S-7 RE | S-8 | S-9 | S-10 | S-11 | S-11 RE | S-12 | S-12 RE | S-13 | NYSDEC RSCO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Methylene Chloride | +30U | +19U | | +13U | +28U | +11U | +12U | +11U | +11U | +1400U | +11U | +15U | +13U | +14U | +13U | +23U | +11U | 100 |
| 1,2-Dichloroethene (Total) | 12J | | 26 J | | | | | 6 J | 5J | | | | | | 93V | 140 | | 300 |
| 1,1,1-Trichloroethane | 26U | +41U | | +13U | | +11U | +12U | +11U | +22U | 1400 J | +11U | +26U | +42U | +29U | +31U | 120 B | +11U | 800 |
| Trichloroethene | 250V | 230 | 440 | 27 | 350 | 3 J | 18 | 150 | 150 | 9800 | | 230 | 50 | 46 | 1000 E | 1400 E | | 700 |
| Tetrachloroethene | 21V | 21V | 11 J | 4 J | 8 J | | | 4 J | 4J | | | 13 J | | | 7 J | 9J | | 1400 |
| Toluene | 4 J | 3 J | | | 10 J | | | | 3 J | 190 J | | 4 J | 4 J | | 3 J | 19 J | | 1500 |
| Acetone | | +25U | | +13U | +29U | +11U | +12U | | +16U | 1100 J | | 19 B | | | | 51 BJ | | 200 |
| 2- Butanone | | | | | | | | | | +1400U | | | | | | | | 300 |
| 1,1-Dichloroethene | | | | | | | | | | | | | | | | 13 J | | 400 |
| TICs Found | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | N/A |

Results expressed in ug/kg (ppb)
RSCO=Recommended Soil Cleanup Objective
Blank spaces indicate non-detection
J=Indicates an estimated value
B=Analyte is found in associated blank as well as the sample
E=Identifies analyte whose concentration exceeded the calibration range of the GC/MS instrument for that specific analysis
RE=Reanalysis
TICs=Tentatively identified compounds
V=Value estimated in accordance with data validation criteria
U=Undetected at specified concentration level
+=Undetected based on data validation
N/A= Not Applicable

Figure 2-9 presents concentrations of TCE in surface soil samples. The pattern of elevated concentrations of TCE in surface soil closely matches the results of the soil gas survey (see Figures 2-2 and 2-3). This pattern may relate to distinct discharge points (floor drain outlets) and migration pathways or to indiscriminant disposal areas, or to both.

### Semi-Volatile Organics

Surface soil semi-volatile organic data are summarized in Table 2-18. Review of the analytical data revealed that surface soils S-1, S-6 and S-10 exhibited concentrations of several polynuclear aromatic hydrocarbons (PAHs) that exceeded the Cleanup Objectives. PAH compounds exceeding Cleanup Objectives included benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene and benzo(a)pyrene. Soil samples S-1 (15,000 ug/kg), S-6 (520 ug/kg) and S-10 (1,200 ug/kg) exhibited benzo(a)anthracene concentrations that exceeded the Cleanup Objective of 220 ug/kg. Samples S-1, S-6 and S-10 exhibited concentrations of chrysene, (S-1, 15,000 ug/kg; S-6, 510 ug/kg; S-10, 1,300 ug/kg) and benzo(a)pyrene (S-1, 13,000 ug/kg; S-6, 320 ug/kg; S-10, 760 ug/kg) that exceeded the Cleanup Objectives of 400 ug/kg and 61 ug/kg, respectively. Sample S-13 exhibited a benzo(a)pyrene value (170 ug/kg) that exceeded the Cleanup Objective of 61 ug/kg. Samples S-1 and 5-10 exhibited benzo(b)fluoranthene (S-1, 14,000 ug/kg; S-10, 1,00 ug/kg) and benzo(k)fluoranthene (S-1, 12,000 ug/kg; S-10, 1,300 ug/kg) that exceeded the Cleanup Objective of 1,100 ug/kg.

Soil sample S-1 was collected from the ground surface to six inches below ground; samples S-6 and S-10 were collected from two to six inches below the ground surface. All three samples contained dark brown clay mixed with pieces of brick.

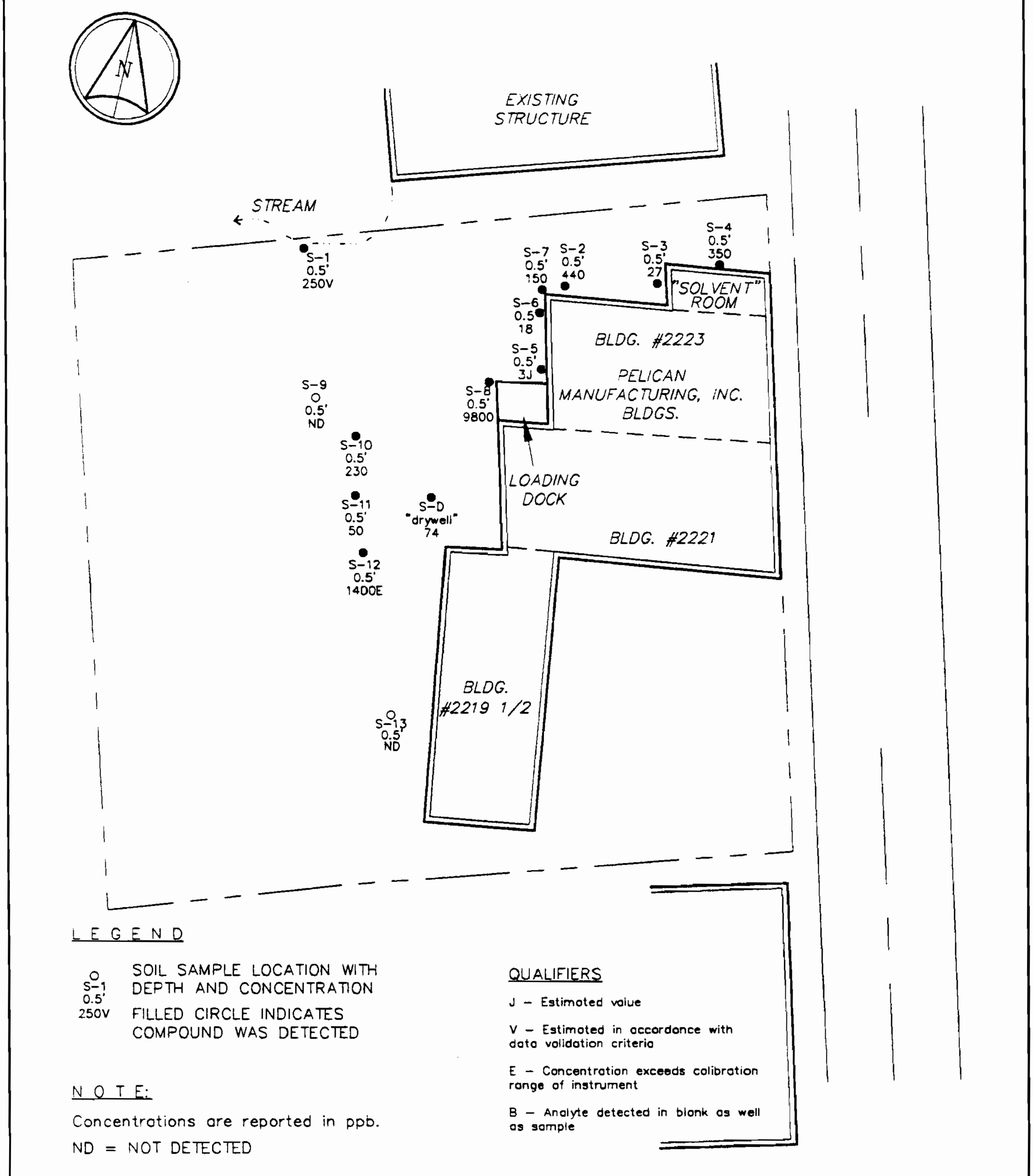
PAH compounds are constituents of petroleum products. Considering the historical use of the Site as an auto repair shop, the loading dock in the rear (west) of the building and an alleyway/driveway along the north side of the building, the presence of PAHs in surface soils is not unexpected. In addition, PAH compounds are common in Construction and Demolition (C & D) debris and other fill materials identified as being present on the Site. PAHs were not detected in the groundwater samples analyzed for these compounds during the First Phase RI.

### Pesticides/PCBs

Pesticide/PCB results for sample S-13 are presented in Table 2-19. Analysis of samples S-1, S-6, and S-10 for pesticides/PCBs was not performed because of a laboratory problem. Due to an equipment malfunction in the gel permeation chromatography step in the lab, the sample extracts were lost and could not be analyzed. Although several pesticides were detected in soil sample S-13, all concentrations were well below the Cleanup Objectives.

### Inorganics

Surface soil samples S-1, S-6, S-10 and S-13 were analyzed for the NYSDEC TAL parameters (metals and cyanide). Analytical results are summarized in Table 2-20. Analytical results revealed that all four soil samples exhibited zinc; samples S-1, S-6 and S-10 lead; samples S-1 and S-10 arsenic; samples S-1 and S-6 mercury; sample S-10 copper, and S-1 selenium,



LEGEND

○ S-1 0.5' 250V — SOIL SAMPLE LOCATION WITH DEPTH AND CONCENTRATION

FILLED CIRCLE INDICATES COMPOUND WAS DETECTED

NOTE:

Concentrations are reported in ppb.

ND = NOT DETECTED

QUALIFIERS

J – Estimated value

V – Estimated in accordance with data validation criteria

E – Concentration exceeds calibration range of instrument

B – Analyte detected in blank as well as sample

DUNN ENGINEERING COMPANY
DIVISION OF RUST ENVIRONMENT & INFRASTRUCTURE

SURFACE SOIL SAMPLES
TRICHLOROETHENE RESULTS

PELICAN MANUFACTURING, INC. SITE

City of Jamestown | Chautauqua Co., NY

| PROJECT No. 35120.000 | DATE 8/94 | DWG. No. 35120-22 | SCALE 1"=50' | FIGURE No. 2-9 |
|---|---|---|---|---|

# TABLE 2-18

## PELICAN MANUFACTURING, INC. SITE
## SURFACE SOIL SAMPLES
## SEMI-VOLATILE ORGANICS
## OCTOBER 1992

| COMPOUND | S-1 | S-6 | S-6 RE | S-10 | S-13 | NYSDEC RSCO |
|---|---|---|---|---|---|---|
| Naphthalene | 10000 | 78J | 85J | 1500 | | 13000 |
| 2-Methylnaphthalene | 11000 | 93J | 98J | 2000 | | 36400 |
| Acenaphthene | 4800J | 90J | 89J | | | 41000 |
| Dibenzofuran | 3500J | 62J | 61J | 510J | | 6200 |
| Fluorene | 3900J | 76J | 78J | | | 50000 |
| Phenanthrene | 29000 | 900 | 960 | 2500 | 310J | 50000 |
| Anthracene | 9300 | 140J | 150J | 210J | 64J | 50000 |
| Fluoranthene | 34000 | 1100 | 1200 | 2400 | 550 | 50000 |
| Pyrene | 19000 | 1600 | 1800 | 1800 | 310J | 50000 |
| Benzo (a) Anthracene | 15000 | 520 | 450 | 1200 | 190J | 220 |
| Chrysene | 15000 | 510 | 530 | 1300 | 250J | 400 |
| Bis (2-Ethylhexyl) Phthalate | 590J | 47J | 65J | 890 | 63J | 50000 |
| Benzo (b) Fluoranthene | 14000 | 700V | 560V | 1700 | 170J | 1100 |
| Benzo (k)Fluoranthene | 12000 | 540V | 440V | 1300 | 140J | 1100 |
| Benzo (a) Pyrene | 13000 | 320J | 230J | 760J | 170J | 61 |
| Benzo (g,h,i) Perylene | 700J | | | | 95J | 50000 |
| Carbozole | 11000 | 230J | 370J | 390J | 76J | NR |
| 1,2,4-Trichlorobenzene | | | | 130J | | na |
| Hexachlorobutadiene | | | | 320J | | na |
| Di-n-Butylphthalate | | | | 120J | 39J | 8100 |
| Di-n-Octyl Phthalate | | | | 1100 | | 50000 |
| Indeno (1,2,3-cd) Pyrenell | | | | | 110J | 3200 |
| TICs Found | 20 | 6 | 7 | 16 | 16 | NA |

Results expressed in ug/kg (ppb)
RSCO=Recommended Soil Cleanup Objective
Blank spaces indicate non-detection
J= Indicates an estimated value
RE=Reanalysis
TICs=Tentatively identified compounds
V=Value estimated in accordance with data validation criteria
na=Not Available
NA=Not Applicable
NR=No RSCO

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# TABLE 2-19

## PELICAN MANUFACTURING, INC. SITE
## SURFACE SOIL SAMPLES
## PESTICIDES/PCBS
## OCTOBER 1992

| COMPOUNDS | S-13 | NYSDEC RSCO |
|---|---|---|
| Alpha-BHC | | |
| Beta-BHC | | |
| Delta-BHC | 0.63JP | 300 |
| Heptachlor | | |
| Heptachlor Expoxide | | |
| Endosulfan I | | |
| Dieldrin | 0.59JP | 44 |
| 4,4'-DDE | 2.3JP | 2100 |
| Endrin | R | 100 |
| Endosulfan II | 0.47JP | 900 |
| 4,4'-DDD | 0.37JP | 2900 |
| 4,4'-DDT | 0.38JP | 2100 |
| Methoxychlor | 3.3JP | * |
| Endrin Ketone | 0.50JPN | na |
| Alpha-Chlordane | | |
| Aroclor-1254 | | |
| Aroclor-1260 | | |
| | | |

Results expressed in ug/kg (ppb)
RSCO=Recommended Soil Cleanup Objective
Blank spaces indicate non-detection
J=Estimated value
P=% D for concentrations between two GC Columns is >25%
R=Value rejected in accordance with data validation criteria; value reported is considered unusable
N=Tentatively identified (qualified during validation)
na=Not Available
*=Total Pesticides<10ppm (10,000ppb)

# TABLE 2-20

## PELICAN MANUFACTURING, INC. SITE
## SURFACE SOIL SAMPLES
## INORGANICS
## OCTOBER 1992

| COMPOUND | S-1 | S-6 | S-10 | S-13 | NYSDEC RSCO | Eastern US Background |
|---|---|---|---|---|---|---|
| | | | | | | |
| Aluminum | 7,780 | 11700 | 8,510 | 7,050 | SB | 33000 |
| Antimony | | | | | SB | na |
| Arsenic | 119 | 12.90 | 33.60 | 12.60 | 7.5 or SB | 3-12 |
| Barium | 214V | 176V | 103V | 61.90V | 300 or SB | 15-600 |
| Beryllium | .70 B | .43B | .70 B | .29 B | 1 or SB | 0-1.75 |
| Cadmium | | | | | 1 or SB | 0.1-1 |
| Calcium | 26700 | 5440 | 23200 | 19000 | SB | 130-35000 |
| Chromium | 26.70 | 14.80 | 24.10 | 9 | 10 or SB | 1.5-40 |
| Cobalt | 10.60 B | 7.50B | 6.50 B | 7.10 B | 30 or SB | 2.5-60 |
| Copper | 120 | 45.10 | 87.70 | 22.20 | 25 or SB | 1-50 |
| Iron | 69200 | 21300 | 19000 | 19300 | 2000 or SB | 200-500 |
| Lead | 300V | 241V | 115V | 51V | 30 or SB | 4-61 |
| Magnesium | 3870 | 2770 | 5680 | 6170 | SB | 100-5000 |
| Manganese | 577V | 499V | 588V | 732V | SB | 50-5000 |
| Mercury | 1.80V | 1.10V | 0.20V | 0.11V | 0.1 | 0.001-0.2 |
| Nickel | 26.60 | 18.70 | 17.40 | 16.50 | 13 or SB | 0.5-25 |
| Potassium | 1270 B | 745B | 847 B | 743 B | SB | 8500-43000 |
| Selenium | 8 B | | R | | SB | 0.1-3.9 |
| Sodium | 150 B | 35.50B | 142 B | 35.10 B | SB | 6000-8000 |
| Thallium | 2.80 | .56B | .74 B | | SB | na |
| Vanadium | 18.60 | 18.10 | 12.40 | 11.10 | 150 or SB | 1-300 |
| Zinc | 320VE | 171VE | 199VE | 185VE | 20 or SB | 9-50 |

Results expressed in mg/kg (ppm)
Blank spaces indicate non-detection
RSCO=Recommended Soil Cleanup Objective
B=Detected below the CRQL but above the instrument detection limit
V=Value estimated in accordance with data validation criteria
E=Estimated due to suspected matrix interference
R=Value rejected in accordance with data validation criteria; value reported is considered unusable
na=Not Available

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concentrations that were elevated with respect to both eastern U. S. background soil concentrations and the Cleanup Objectives.

Groundwater monitoring well MW-3 is located downgradient of surface sample S-6 and S-10. With the exception of iron and manganese, which were not detected at elevated concentrations in the surface soil samples, metal concentrations in the MW-3 groundwater sample were not elevated with respect to NYSDEC groundwater standards. The data indicate that the elevated surface soil metal concentrations have not impacted groundwater quality in the lower, semi-confined water bearing zone.

#### 2.9.4.3 Subsurface Soil

**Volatile Organics**

Subsurface soil volatile organic analytical results are summarized in Table 2-21. Analytical data revealed that four samples, DC1DS5, D2S79, D3S2 and D3S6 exhibited 1,2-dichloroethene (total) concentrations that exceeded the Cleanup Objective of 300 ug/kg. Two samples, D3S2 and D4S2, exhibited trichloroethene concentrations that exceeded the Cleanup Objective of 700 ug/kg. The D3S2 sample exhibited a trichloroethene concentration of 99,000 ug/kg. Sample D3S2 also exhibited a tetrachloroethene concentration that was equal to the Cleanup Objective of 1,400 ug/kg.

Three samples, DC1DS5, D2S3 and D4S2, exhibited acetone concentrations that exceeded the Cleanup Objective of 200 ug/kg. However, acetone is a common laboratory contaminant, and was also detected in the laboratory method blanks associated with these samples. USEPA data validation criteria state that sample results less than ten times the results in a blank sample should be flagged as non-detect at either the reporting limit or the analytical result, whichever is higher. Although these samples exhibited concentrations that were greater than ten times the associated blank value, the reported results are considered suspect and most likely laboratory derived and not site-related.

The D3S2 subsurface soil sample (2'-4') exhibited the highest subsurface volatile organic concentrations. However, with the exception of a low 1,2-dichloroethene concentration, that was below the groundwater standard, no volatile organic compounds were detected in groundwater from the well installed at this location (MW-3). The data indicate that, in the vicinity of this well, volatile organic contamination is limited to the shallow subsurface soils (0-12 feet).

**Semi-Volatile Organics**

Subsurface soil semi-volatile organic analytical results are summarized in Table 2-22. Two of the four subsurface boring samples, DC1DS5 and D2S79, analyzed for semi-volatiles, exhibited concentrations of several polynuclear aromatic hydrocarbons (PAHs) that exceeded their respective Cleanup Objectives. PAH compounds are contaminants commonly derived from petroleum type compounds and C & D or other common fill material. Both of these samples consisted of fill material, which is a potential source of the PAHs. Samples D3S6 and D4S6, which consisted of mixed morainal deposits underlying the

# TABLE 2-21

## PELICAN MANUFACTURING, INC. SITE
## SUBSURFACE SOIL SAMPLES
## VOLATILE ORGANICS
## SEPTEMBER 1992

| | DCIDS2 | DCIDS5 | DCIDS9 | D2S3 | D2S5 | D2S79 | D3S2 | D3S6 | D4S2 | D4S6 | X-1 | D4S11 | PILOT 20 | NYSDEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COMPOUND** | 2'-4' | 8'-10' | 24'-29' | 4'-6' | 8'-10' | 7'-9' | 2-4' | 10-12' | 2-4' | 10-14' | 10-14' | 20-22' | 3' | RSCO |
| **Volatile Organics** | | | | | | | | | | | | | | |
| Methylene Chloride | +30U | +39U | +12U | +39U | +18U | +41U | +6300U | +31U | | +11U | +12U | +13U | | 100 |
| Acetone | +30U | 230B | +22U | 470B | +21U | +110U | | +58U | 980B | +44U | +89U | +24U | +190U | 200 |
| 1,2-Dichoroethene (Total) | 36 | 510 | 12J | 5J | 85 | 360 | 4700J | 380 | 92 | 6J | | | 7J | 300 |
| Trichloroethene | 400 | 34J | 25 | 16J | 260 | 240 | 99000 | 290B | 1300 | 33B | +12U | +13U | +13U | 700 |
| Tetrachloroethene | 4J | | | | 8J | 15J | 1400J | | | | | | | 1400 |
| Toluene | 11J | 240 | 32 | 18J | | 14J | | 11J | 49J | 140 | 4J | 10J | 17 | 1500 |
| Vinyl Chloride | | 56 | | | | | | | | | | | | 200 |
| Ethylbenzene | | 50 | | | | | | | | | | | | 5500 |
| Xylene | | 120 | 3V | | | | | | | | | | | 1200 |
| 2-Butanone | | | | 53V | | | | | | | | | 20 | 300 |
| Carbon Disulfide | | | | | 9J | | | | | 5J | | | | 2700 |
| Bromoform | | | | | | | | | | | | | 2J | NR |
| 1,1,2,2-Tetrachloroethane | | | | | | | | | | | | | 2J | 60U |
| TICs Found | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | NA |

All values expressed in ug/kg (ppb).
Blank spaces indicate non-detection.
RSCO = Recommended Soil Cleanup Objective
J=Estimated value.
B=Analyte is found in asociated blank as well as the sample.
TICs = Tentatively Identified Compounds
V=Value estimated in accordance with data validation criteria
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U=Undetected at specified concentration level
+=Undetected based on data validation
NA=Not Applicable
NR=No RSCO
X-1=Blind field duplicate of Sample D4S6
Pilot 20=VES monitoring probe 20' south of extraction well.

# TABLE 2-22

# PELICAN MANUFACTURING, INC. SITE
## SUBSURFACE SOIL SAMPLES
## SEMI-VOLATILE ORGANICS
## SEPTEMBER 1992

| COMPOUND | DC1DS5 (8' - 10') | DC1DS5 DL | D2S79 (7' - 9') | D2S79 DL | D3S6 (10' - 12') | D4S6 (10' - 14') | X-1 | NYSDEC RSCO |
|---|---|---|---|---|---|---|---|---|
| **Semi-Volatile Organics** | | | | | | | | |
| 4-Methylphenol | 140J | 130JD | 72J | | | | | 900 |
| Naphthalene | 2500 | 2700D | 1200 | 1200JD | | | | 13000 |
| 2-Methylnaphthalene | 2000V | 2100DV | 920V | | | | | 36400 |
| Acenaphthalene | 540 | 580JD | 870 | 930JD | | | | 50000 |
| Debenzofuran | 870 | 920DV | 710 | 790JD | | | | 6200 |
| Fluorene | 470 | 480JD | 720 | 730JD | | | | 50000 |
| Phenanthrene | 3500E | 3700DV | 6200E | 6500DV | | | | 50000 |
| Anthracene | 660V | 820DV | 1800V | 1800JD | | | | 50000 |
| Fluoranthene | 2000V | 2200DV | 4800E | 6900DV | | | | 50000 |
| Pyrene | 1800V | 1900DV | 12000E | 7200DV | | | | 50000 |
| Benzo (a) Anthracene | 1000V | 1200DV | 5500E | 4200DV | | | | 220 |
| Chrysene | 1200V | 1200DV | 5000E | 3900DV | | | | 400 |
| Bis (2-Ethylhexyl)Phthalate | 530V | 500JD | 1800V | 1100JD | 78J | 100J | 41J | 50000 |
| Indeno (1,2,3-cd) Pyrene | 590V | 270JD | 3600V | 1200JD | | | | 3200 |
| Benzo(b)Fluoranthene | 1900V | 1800DV | 6700E | 4800DV | | | | 1100 |
| Benzo(k)Fluoranthene | 1100V | 1200DV | 3400V | 4100DV | | | | 1100 |
| Benzo(a)Pyrene | 830V | 950DV | 3900V | 3200DV | | | | 61 |
| Dibenz(a,h)Anthracene | 170J | | 1500V | 430JD | | | | 14 |
| Benzo(g,h,i)Perylene | 870V | 340JD | 5400E | 1400JD | | | | 50000 |
| Carbazole | 550V | 880DV | 870V | 1000JD | | | | NR |
| N-Nitroso-di-phenylamine | | 96JD | | | | | | na |
| N-Nitroso-di-n-Propylamine | | | 610 | | | | | na |
| Acenaphthylene | | | 160J | | | | | 41000 |
| di-n-Butylphthalate | | | 200BJ | | 230J | | | 8100 |
| di-n-Octyl Phthalate | | | 230J | | 150J | | | 50000 |
| Hexachlorobenzene | | | | 600JD | | | | 410 |
| TICs Found | 20 | 17 | 20 | 20 | 20 | 20 | 13 | NA |

All values expressed in ug/kg (ppb).
RSCO=Recommended Soil Clean-up Objective
Blank spaces indicate non-detection.
X-1 = Blind field duplicate for sample D4S6
J=Estimated value.
B=Analyte is found in asociated blank as well as the sample.
E=Identifies compounds whose concentrations exceeded the calibration range of the GC/MS instrument for that specific analysis.
D=Identifies all compounds identified in an analysis at a secondary dilution factor.
TICs = Tentatively Identified Compounds
V=Value estimated in accordance with data validation criteria

NR=No RSCO
na=Not Available
NA=Not Applicable

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fill and an organic-rich layer of soil, did not exhibit elevated PAH concentrations. PAHs were not detected in the groundwater sample from the MW-1D (boring location D-1S and D-1D), indicating that the PAHs are apparently being adsorbed onto the soil and are not leaching to the groundwater at this location.

A second diluted analysis of D2S79 exhibited hexachlorobenzene at an estimated concentration above the instrument detection limit but below the contract required quantitation limit (CRQL). Hexachlorobenze was not detected in the original undiluted analysis, therefore, the diluted analysis result is considered suspect.

**Pesticides/PCBs**

Subsurface soil results for Pesticides/PCBs analysis are summarized in Table 2-23. Low concentrations of several pesticides were detected in all four samples analyzed for Pesticides/PCBs (DC1DS5, D2S79, D3S6 and D4S6). However, for those pesticide compounds with a Cleanup Objective, all results were below the respective objectives. PCBs were not detected in any of the four samples.

**Inorganics**

Subsurface soil inorganic analytical results are summarized in Table 2-24. The inorganic data revealed that all four soil samples (DC1DS5, D2S79, D3S6, and D4S6) exhibited mercury concentrations that exceeded both the NYSDEC RSCO and the eastern U.S. background soil concentrations. Samples DC1DS5, D2S79 and D4S6 exhibited zinc values that exceeded both the NYSDEC RSCO and eastern U.S. background soil concentrations.

Sample D2S79 also exhibited concentrations of arsenic, copper, lead, magnesium and nickel that were higher than both the NYSDEC RSCO and the eastern U.S. background concentrations.

Although mercury was detected at elevated concentrations in all four subsurface samples, it was not detected at elevated levels in the three groundwater monitoring well samples (MW-1D, MW-3, MW-22) upon which mercury analyses was performed. Sample D2S79 and DC1DS5 consisted of fill material and were not collected from native soil. The fill material is a potential source of the elevated metal concentrations in these two samples.

### 2.9.4.4 Sediment

**Volatile Organics**

Sediment sample volatile organic analytical results are summarized in Table 2-25. The sediment sample analytical results have been compared to the Cleanup Objectives and not the NYSDEC sediment criteria because the sediment samples were either from points inside the building (SED-1, SED-2, SED-3) or from an above ground septic tank (SED-4) located outside of the building. The NYSDEC sediment criteria are not applicable since the samples were not collected in natural aquatic habitats. Sediment volatile organic analytical results revealed that sample SED-1 exhibited very high concentrations of several volatile organic

# TABLE 2-23

## PELICAN MANUFACTURING, INC. SITE
## SUBSURFACE SOIL SAMPLES
## PESTICIDES/PCBS
## SEPTEMBER 1992

| COMPOUND | DCIDS5 (8' - 10') | D2S79 (7' - 9') | D3S6 (10' - 12') | D4S6 (10' - 14') | X-1 | NYSDEC RSCO |
|---|---|---|---|---|---|---|
| | | | | | | |
| Delta-BHC | 13V | 77V | 3.0PV | | | 300 |
| Gamma-BHC | | | 4.7V | 0.99JP | | 60 |
| 4,4'-DDE | 2.9NV | 43NV | 2.4J | 0.80JPN | 0.40JPN | 2100 |
| 4,4'-DDD | | 51NV | 9.9V | | | 2900 |
| 4,4'-DDT | R | R | 1.7JP | R | R | 2100 |
| Endrin Ketone | 15NV | 48NV | 0.43JPN | | | na |
| Aldrin | | | | 0.52JPN | | 41 |
| Endrin Aldehyde | | | | | 0.58JPN | na |
| Heptachlor Epoxide | | 7.8V | | | | 20 |
| Endrin | R | R | R | | R | 100 |

Results expressed in ug/kg (ppb)
RSCO = Recommended Soil Cleanup Objective
Blank spaces indicate non-detection
J=Indicates an estimated value
P=% D for concentrations between two GC columns is >25%
X-1=Blind field duplicate for sample D4S6
V=Value estimated in accordance with data validation criteria
R=Value rejected in accordance with data validation criteria;
value reported is considered unusable
N=Tentatively identified (qualified during validation)
na=Not Available

# TABLE 2-24

## PELICAN MANUFACTURING, INC. SITE
## SUBSURFACE SOIL SAMPLES
## INORGANICS
## SEPTEMBER 1992

| COMPOUND | DC1DS5 (8' - 10') | D2S79 (7' - 9') | D3S6 (10' - 12') | D4S6 (10' - 14') | X-1 (D4S6) | NYSDEC RSCO | Eastern U.S. Background |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Aluminum | 7380.00 | 11700.00 | 5430.00 | 4380.00 | 4340.00 | 30 or SB | 33000 |
| Antimony | | 19.60V | | | | 30 or SB | |
| Arsenic | 10.10V | 208.00V | 10.10 | 24.90 | 15.50 | 7.5 | 3 - 12 |
| Barium | 66.30 | 220.00 | 36.90B | 329.00 | 27.20B | 300 or SB | 15 - 600 |
| Beryllium | 0.31B | 0.70B | 0.22B | 0.28B | 0.20B | 0.14 | 0 - 1.75 |
| Cadmium | | | | | | 1 or SB | 0.0 - 1 |
| Calcium | 2060.00 | 19500.00 | 46900.00 | 13500.00 | 21700.00 | SB | 130 - 35000 |
| Chromium | 9.20 | 31.90 | 11.80 | 17.40 | 6.10 | 10 or SB | 1.5 - 40 |
| Cobalt | 5.80B | 13.20B | 5.10B | 2.80B | 4.10B | 30 or SB | 2.5 - 60 |
| Copper | 25.70 | 84.80 | 13.60 | 18.60 | 9.30 | 25 or SB | 1 - 50 |
| Iron | 20100.00 | 46800.00 | 15300.00 | 12400.00 | 18200.00 | 2000 or SB | 2000 - 550000 |
| Lead | 21.30V | 117.00V | 11.70V | 9.5+V | 6.50SV | 30 or SB | 4 - 61 |
| Magnesium | 2840.00VE | 6840.00VE | 4840.00 | 2430.00 | 5160.00 | SB | 100 - 5000 |
| Manganese | 709.00V | 695.00V | 497.00V | 397.00V | 207.00V | SB | 50 - 5000 |
| Mercury | 0.40 | 1.10 | 1.10V | 1.30V | 3.00V | 0.1 | 0.001 - 0.2 |
| Nickel | 9.80V | 22.60BV | 8.60BV | 5.00BV | 7.00BV | 13 or SB | 0.5 - 25 |
| Potassium | 724B | 2140.00 | 593.00B | 419.00B | 596.00B | 4000 or SB | 8,500 - 43000 |
| Selenium | | 2.20V | | | | 2 or SB | 0.1 - 3.9 |
| Sodium | 191.00B | 246.00B | 156B | 140.00B | 36.30B | 3000 or SB | 6000 - 8000 |
| Thallium | 0.48BV | 2.70BV | 0.66BV | | 0.53BV | 20 or SB | |
| Vanadium | 14.50 | 23.20 | 11.90 | 9.10B | 13.80 | 150 or SB | 1 - 300 |
| Zinc | 55.10E | 181.00E | 48.50 | 192.00 | 29.50 | 20 or SB | 9 - 50 |
| Silver | 0.82B | | | | 0.83 | 200 | |
| Cyanide | | | | | | SS | |

Results expressed in mg/kg (ppm)
RSCO = Recommended Soil Clean-up Objective
Blank spaces indicate non-detection
B= below the CRQL but above the instrument detection limit.
X-1=Blind field duplicate of Sample D4S6
S=Value calculated from MSA
+ = Value calculated from MSA with a correlation coefficient less than 0.995
V=Value estimated in accordance with data validation criteria
E=Estimated due to suspected matrix interference
SB = Site Background
SS = Site Specific

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# TABLE 2-25

## PELICAN MANUFACTURING, INC. SITE
## SEDIMENT SAMPLES
## VOLATILE ORGANICS
## OCTOBER 1992

| COMPOUND | SED-1 | X-1 | X-1 RE | SED-2 | SED-3 | SED-3 RE | SED-4 | SED-4 RE | S-D (DRYWELL) | NYSDEC RSCO |
|---|---|---|---|---|---|---|---|---|---|---|
| Methylene Chloride | 18,000 U | +48,000 U | +2,400,000 U | +4,500 U | +96 U | +48 U | +13,000 U | 210 J | +12U | 100 |
| 1, 1-Dichloroethene | 22,000 J | 82,000 | | | | | | | | 400 |
| 1, 1-Dichloroethane | 64,000 J | 72,000 | | | | 16 J | | | | 200 |
| 1, 2-Dichloroethene (Total) | 110,000 J | 110,000 | | | | | | | 72 | 300 |
| 1,1,1-Trichloroethane | 9,100,000 E | 1,200,000 E | 68,000,000 E | 580 J | +120 U | +85 U | | +510 U | +12U | 800 |
| Carbon Tetrachloride | 53,000 J | 18,000 J | | | | | | | | 600 |
| Trichlorethene | 2,700,000 | 3,100,000 E | 5,800,000 | | 86 J | 34 J | | | 74 | 700 |
| Tetrachloroethene | 1300,00 J | 160,000 | | | | | | | 2 J | 1400 |
| Toluene | 1,500,000 | 1,900,000 E | 3,700,000 | 38,000 | 200V | 210V | 27,000 | 24,000 E | | 1500 |
| Ethylbenzene | 49,000 J | 74,000 | | 1,400 J | 200V | 190V | | 100 J | | 5500 |
| Xylene | 250,000 | 160,000 | | 8,600 | 870V | 900V | 16,000 | 1,000 | | 1200 |
| Acetone | | | | 4,500 J | +440 U | 600 B | | +2,100 U | | 200 |
| 2-Butanone | | | | +4,500 U | | 110 | | | | 300 |
| Benzene | | | | | 30 J | 31 J | | | | 60 |
| Chloroform | | | | | | | | | 2J | 300 |
| 1,1,2,2-Tetrachloroethane | | 5,500 J | | | | | | | | 600 |
| TICs Found | 0 | 1 | 2 | 6 | 3 | 2 | 1 | 2 | 0 | NA |

Results expressed in ug/kg (ppb)

RSCO=Recommended Soil Cleanup Objective

Blank spaces indicate non-detection

J= Indicates an estimated value

B= Analyte is found in the associated blank as well as the sample

E=Analyte whose concentration exceeded the calibration range of the GC/MS instrument for that specific analysis.

X-1=Blind field duplicate of Sample SED-1

RE=Reanalysis

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TICs=Tentatively identified compounds

V=Value estimated in accordance with data validation criteria

U=Undetected at specified concentration level

+=Undetected based on data validation

NA=Not Applicable

compounds that exceeded the Cleanup Objectives. Compounds detected in Sample SED-1 at concentrations exceeding the Cleanup Objective included 1,1-dichloroethene, 1,2-dichloroethene, 1,1,1-trichloroethane, carbon tetrachloride, trichloroethene, tetrachloroethene, toluene, ethylbenzene and xylene.

Sample SED-1 was collected from a floor drain located in the solvent room. Sediments in this drain could represent a source area for continuing groundwater contamination if a mechanism for their release was available. Groundwater from monitoring well MW-1S, and to a lesser extent MW-1D, exhibited concentrations of several volatile organics that exceeded NYSDEC groundwater standards. Monitoring wells MW-1S and MW-1D are located at the northeast corner of the building, adjacent to the solvent room and just outside (north) of the floor drain from which SED-1 was obtained. Leakage from the solvent room drain line (if any) could potentially have contaminated subsurface soils and migrated to the groundwater. However, 1,1,1-trichloroethane was detected at a high concentration (9,100 ppm estimated) in sediment sample SED-1; yet 1,1,1-trichloroethane was not detected in the MW-1S and MW-1D groundwater samples. This apparent anomalous situation may be a result of the difference between the historic usage of TCE and the more recent usage of 1,1,1-TCA, as well as differences in housekeeping and disposal practices while these compounds were in use. The presence of TCE and its breakdown products, but not 1,1,1-TCA, in the groundwater might also be indicative of the use or working condition of the floor drain during the time of usage of the two compounds.

Sediment samples SED-2 and SED-4 exhibited toluene and acetone and SED-2 xylene concentrations that exceeded the Cleanup Objectives. Acetone is a common laboratory contaminant. Although acetone was not detected in the method blank associated with these two samples, it was detected in the method blank associated with other sediment samples. Acetone was detected in the method blank associated with the re-analysis of both the SED-4 and SED-3 samples and in the original analysis of SED-3. The SED-3 original sample result was less than ten times the associated blank value, however, the SED-3RE analysis was not. Following USEPA data validation guidelines, the SED-3 sample was flagged as non-detect at the CRQL. The SED-3RE result was greater than ten times the blank value and therefore could not be rejected. Considering that acetone is a common laboratory contaminant, that it was detected in laboratory method blanks, and the conflicting sample results, the reported acetone results are considered suspect and potentially laboratory derived and not site-related.

The blind duplicate sample of SED-1 (X-1) exhibited a 1,1,2,2-tetrachloroethane concentration (5,500 ug/kg) that exceeded the Cleanup Objective of 600 ug/kg, however, 1,1,2,2-tetrachloroethane was not detected in the original SED-1 sample. Although the presence of 1,1,2,2-tetrachloroethane is suspect, considering the documented high concentrations of other volatile compounds, the absence or presence of 1,1,2,2-tetrachloroethane should not influence any remedial decision or cleanup of the contaminated sediments.

### Semi-Volatile Organics

Sediment samples SED-1 and SED-3 were analyzed for the NYSDEC TCL semi-volatile organic parameters. Analytical results are summarized in Table 2-26. The sediment sample

# TABLE 2-26

# PELICAN MANUFCTURING, INC. SITE
## SEDIMENT SAMPLES
## SEMI-VOLATILE ORGANICS
## OCTOBER 1992

| COMPOUND | SED-1 | X-1 | SED-3 | SED-3 RE | NYSDEC RSCO |
|---|---|---|---|---|---|
| | | | | | |
| 2-Methylphenol | 1400J | | | | 100 OR MDL |
| 4-Methylphenol | 1700J | 640J | | | 900 |
| Naphthalene | 2900J | 2500J | 1000J | | 13000 |
| 2-Methylnaphthalene | 1200J | 1200J | 1100J | | 36400 |
| Phenanthrene | 1300J | 820J | 13000 | 7600J | 50000 |
| Di-n-Butylphthalate | 740J | 790J | 2900J | 2700J | 8100 |
| Fluoranthene | 1100J | 1000J | 16000 | 12000J | 50000 |
| Pyrene | 580J | 730J | 15000 | 8600J | 50000 |
| Chrysene | 720J | | 7700 | 4700J | 400 |
| Bis (2-Ethylhexyl) Phthalate | 15000 | 22000V | 74000E | 63000V | 50000 |
| Acenaphthene | | | 1100J | | 50000 |
| Dibenzofuran | | | 900J | | 6200 |
| Fluorene | | | 1700J | | 50000 |
| Anthracene | | | 2700J | 1500J | 50000 |
| Butylbenzylphthalate | | | 6600 | 4700J | 50000 |
| Benzo (a) Anthracene | | | 7800 | 4600J | 224 OR MDL |
| Di-n-Octyl Phthalate | | | 5600J | 2400J | 50000 |
| Benzo (b) Fluoranthene | | 360J | 7200V | 3600J | 1100 |
| Benzo (k) Fluoranthene | | 360J | 7700V | 3600J | 1100 |
| Benzo (a) Pyrene | | | 4100J | 3300J | 61 OR MDL |
| Indeno (1,2,3-cd) Pyrene | | | 740J | 2400J | 3200 |
| Carbozole | | | 2300J | 1600J | na |
| Benzo (g,h,i) Perylene | | | | 1800J | 50000 |
| TICs Found | 16 | 15 | 20 | 20 | NA |

Results expressed in ug/kg (ppb)
RSCO=Recommended Soil Cleanup Objective
Blank spaces indicate non-detection
E=Identifies compounds whose concentrations exceeded the calibration range of the GC/MS instrument for that specific
J = Indicates an estimated value.
X-1=Blind field duplicate of Sample SED-1
RE=Reanalysis
TICs=Tentatively identified compounds
V=Value estimated in accordance with data validation criteria
NA=Not Applicable
na=Not Available
MDL=Method Detection Limit

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semi-volatile data revealed that sample SED-1 exhibited concentrations of 2-methylphenol (RSCO 100 ug/kg) , 4-methylphenol (RSCO 900 ug/kg) and chrysene (RSCO 400 ug/kg) that exceeded the Cleanup Objectives. Sample SED-3 exhibited concentrations of several PAH compounds and bis-(2-ethylhexyl) phthalate (RSCO 50,000 ug/kg) that exceeded the Cleanup Objectives. The PAH compounds that exceeded the Cleanup Objective are chrysene (RSCO 400 ug/kg), benzo(a)anthracene (RSCO 220 ug/kg), benzo (b)fluoranthene (RSCO 1,100 ug/kg), benzo(k)fluoranthene (RSCO 1,100 ug/kg) and benzo(a) pyrene (RSCO 61 ug/kg).

PAH compounds are constituents of petroleum products. Considering the historical use of the Site as an automotive shop, the presence of the PAH compounds is not unexpected. The detection of the PAHs in the sediment drain samples may or may not be related to the results of the surface soil samples, which also exhibited elevated levels of PAHs.

### Pesticides/PCBs

Sediment pesticide/PCB analytical results for samples SED-1 and SED-3 are summarized in Table 2-27. The data revealed that sample SED-1 exhibited concentrations of heptachlor, heptachlor epoxide and endrin that exceeded the Cleanup Objectives. Sample X-1, a blind field duplicate of SED-1, exhibited dieldrin at an estimated concentration below the CRQL but which exceeded the Cleanup Objective. However, dieldrin was not detected in the original SED-1 sample. The original SED-1 sample exhibited a PCB aroclor 1254 concentration that exceeded the Cleanup Objective of 1.0 ppm, however, this aroclor was not detected in the blind duplicate sample.

Sample SED-3 exhibited concentrations of endrin, aroclor 1254 and aroclor 1260 that exceeded the Cleanup Objective of 100 ug/kg for endrin and 1,000 ug/kg for each aroclor. The laboratory re-analyzed sample SED-3 at a higher dilution, and reported dieldrin in the diluted sample, at an estimated concentration that exceeded the Cleanup Objective. However, dieldrin was not detected in the undiluted sample. Dieldrin is not considered by DUNN to be a contaminant of concern at the Site.

### Inorganics

Inorganic (metals and cyanide) analytical results for SED-1 and SED-3 are summarized and compared to NYSDEC RSCOs and Eastern U.S. background concentrations in Table 2-28. The data revealed that both sample SED-1 and SED-3 exhibited concentrations of a number of metal analytes that exceeded both the eastern U. S. background concentrations and the NYSDEC RSCOs.

The data presented in Table 2-28 indicate that sample SED-1 exhibited concentrations of cadmium, chromium, copper, lead, mercury, nickel, and zinc that exceeded both the eastern U.S. background soil concentrations and the NYSDEC RSCOs. Sample SED-3 exhibited concentrations of all of the above listed metals in excess of both the eastern U. S. background soil concentrations and the NYSDEC RSCOs.

# TABLE 2-27

## PELICAN MANUFACTURING, INC. SITE
## SEDIMENT SAMPLES
## PESTICIDES/PCBS
## OCTOBER 1992

| COMPOUNDS | SED-1 | SED-1DL | X-1 | X-1DL | SED-3 | SED-3DL | NYSDEC RSCO |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Alpha-BHC | | 600JP | | | | | 110 |
| Beta-BHC | | | | | 19JP | | 200 |
| Delta-BHC | | | | | | | 300 |
| Heptachlor | 560PV | 1200 | 230PV | 350PV | | | 100 |
| Heptachlor Expoxide | 470PV | | 250PV | 200PV | | | 20 |
| Endosulfan I | 310PV | | 59PV | | | | 900 |
| Dieldrin | | | 200PV | | 8.4JP | 47JP | 44 |
| 4,4'-DDE | | | | | 20P | 20JPN | 2100 |
| Endrin | 360PV | | 93PV | | 230PV | 230JP | 100 |
| Endosulfan II | | | | | | | 900 |
| 4,4'-DDD | 56JP | | 18JPN | 330JPN | | | 2900 |
| 4,4'-DDT | R | | R | R | 9.3JP | R | 2100 |
| Methoxychlor | | | 42JP | | | | * |
| Endrin Ketone | 46JP | | | | 270PV | 270JP | na |
| Alpha-Chlordane | | | 78PV | 100PV | | | 540 |
| Aroclor-1254 | 6900PV | 4600JP | | | 2300PV | 4500 | 1000 |
| Aroclor-1260 | | | | | 3000PV | 6000JP | 1000 |

Results expressed in ug/kg (ppb)
RSCO=Recommended Soil Cleanup Objective
Blank spaces indicate non-detection
J=Estimated value
DL=Diluted sample
P=% D for concentrations between two GC Columns is >25%
X-1=Blind field duplicate of SED-1
V=Value estimated in accordance with data validation criteria
R=Value rejected in accordance with data validation criteria; value reported is considered unusable
N=Tentatively identified (qualified during validation)
*=Total Pesticides<10ppm (10,000ppb)
na=Not Available

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# TABLE 2-28
# PELICAN MANUFACTURING, INC. SITE
# SEDIMENT SAMPLES
# INORGANICS
# OCTOBER 1992

| COMPOUND | SED-1 | X-1 | SED-3 | NYSDEC RSCO | EASTERN US BACKGROUND |
|---|---|---|---|---|---|
| Aluminum | 6,880 | 8,660 | 8,530 | SB | 33000 |
| Antimony |  | 34.40V | 205V | SB | na |
| Arsenic | 5.90 | 3.30 | 14.30 | 7.5 or SB | 3-12 |
| Barium | 95.70V | 137V | 1800V | 300 or SB | 15-600 |
| Beryllium |  | .25 B | .41 B | 1 or SB | 0-1.75 |
| Cadmium | 2.20V | 3.30V | 21.50V | 1 or SB | 0.0-1.0 |
| Calcium | 13700 | 12800 | 51600 | SB | 130-35000 |
| Chromium | 371 | 1870 | 192 | 10 or SB | 1.5-40 |
| Cobalt | 11.10 B | 12.70 B | 15.60 B | 30 or SB | 2.5-60 |
| Copper | 518 | 509 | 1080 | 25 or SB | 1-50 |
| Iron | 20200 | 24100 | 77800 | 2,000 or SB | 2000-550000 |
| Lead | 1260V | 1210V | 3670V | 30 or SB | 4-61 |
| Magnesium | 2370 | 3060 | 5480 | SB | 100-5000 |
| Manganese | 229V | 336V | 813V | SB | 50-5000 |
| Mercury | 0.67V | 0.57V | 1.60V | 0.1 | 0.001-0.2 |
| Nickel | 19 | 22.60 | 98 | 13 or SB | 0.5-2.5 |
| Potassium | 445 B | 1020 B | 1000 B | SB | 8500-43000 |
| Selenium |  |  |  | 2 or SB | 0.1-3.9 |
| Sodium | 307 B | 381 B | 442 B | SB | 6000-8000 |
| Thallium | .92 B |  |  | SB | na |
| Vanadium | 9.90 B | 11.70 B | 15 B | 150 or SB | 1-300 |
| Zinc | 1210VE | 10900VE | 3960VE | 20 or SB | 9-50 |

SB=Site background
Results expressed in mg/kg (ppm)
RSCO=Recommended Soil Cleanup Objective
Blank spaces indicate non-detection
B=Detected below the CRQL but above the instrument detection limit
X-1=Blind field duplicate of Sample SED-1
V=Value estimated in accordance with data validation criteria
E=Estimated due to suspected matrix interference
na=Not Available
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### 2.9.5 Conclusions

#### 2.9.5.1 Groundwater

Groundwater in the upper, unconfined water bearing zone flows west toward, and most likely discharges to, the Chadakoin River and surrounding wetlands. Additionally, during periods of a seasonal or temporal high water table, the upper water bearing zone may discharge to the drainage ditch and small wet area located adjacent to and west of the Site. However, no seeps were observed in these areas during the investigation.

Review of the volatile organic analytical results for the groundwater samples revealed that the water from monitoring wells MW-1S, MW-19 and MW-20, screened in the upper, unconfined, water bearing zone, exhibited the highest concentrations of VOCs. Monitoring well MW-1S is located at the northeast comer of building No. 2223. There is a floor drain located on the inside of the building, in the northeast comer, that represents a potential source of the volatile organics detected in groundwater from monitoring well MW-1S. This possibility was confirmed by the results of the analysis of the sediment sample collected from this floor drain. Sediment sample analytical results and conclusions are discussed in Sections 2.9.4.4 and 2.9.5.4, respectively. Groundwater monitoring wells MW-19 and MW20 are located west, and hydrologically downgradient, of the Pelican buildings. Additionally, these wells are located downgradient of the loading dock where elevated concentrations of volatile organics were detected in the subsurface vadose zone during the soil gas survey.

Monitoring wells MW-19 and MW-20 are screened in the fill and shallow overburden (total depths-10 feet). Monitoring wells MW-2, MW-3, and MW-4 are screened in a deeper, semi-confined water-bearing zone. Monitoring wells MW-2, MW-3 and MW-4 exhibit artesian conditions, i.e., they have an upward vertical gradient. Wells MW-2 and MW-3 flow at the ground surface. The water in MW-4 stands within the stickup at a level above the ground surface. The analytical results from the Site revealed that the volatile organic contamination is primarily restricted to the upper, unconfined water bearing zone.

Although groundwater from monitoring well MW-1D exhibited elevated concentrations of several VOCs, this well appears to be screened in the same water bearing zone as MW-1S, but at a different elevation within the zone.

The semi-volatile organic and pesticide/PCB analytical results from the monitoring well samples indicate that these analytes do not represent a significant concern in groundwater at the Pelican site.

Although groundwater samples collected at the Site exhibit elevated concentrations of several metals detected at elevated concentrations in the sediment and surface soil samples, the groundwater samples were highly turbid. The elevated metals concentrations are potentially related to the sample sediment load causing the turbidity and, therefore, related to the soil matrix concentrations and not groundwater concentrations. This conclusion is supported by the analytical data from monitoring wells MW-1S and MW-1D. Groundwater from MW-1D generally exhibited the highest metal concentrations. However, the highest volatile organic concentrations were detected in groundwater from MW-1S, which did not exhibit elevated metal concentrations. Volatile organics are generally more mobile in the subsurface environment than metals. If the sediment load was the source of the elevated groundwater metal concentrations, higher levels would have been expected in groundwater from MW-1S.

### 2.9.5.2 Surface Soil

The surface soil sample analytical results revealed that two samples, S-8 and S-12, exhibited concentrations of trichloroethene and 1,1,1-trichloroethane (S-8 only) in excess of the Cleanup Objectives. Locations from which samples S-1, S-8 and S-12 were collected represent existing, potential, continuing sources of groundwater contamination. These areas should be excavated, contained, or treated, in order to remove these potential sources of groundwater contamination.

Three surface soil samples; S-1, S-6 and S-10, exhibited concentrations of several PAH compounds that exceeded the Cleanup Objectives. Sample S-1 also exhibited the highest soil concentrations of PAHs. Elevated concentrations of PAHs have not been detected in Site groundwater, indicating that the PAH compounds are either not being released or are being sorbed to organic matter in the overburden (fill, soil, muck) at the locations where these samples were collected. However, the upper, unconfined water bearing zone downgradient of the Pelican buildings (MW-19 and MW-20) was not evaluated with respect to semi-volatiles and inorganics during the First Phase R.I..

### 2.9.5.3 Subsurface Soil

Subsurface soil analytical results revealed that elevated concentrations of VOCs, semi-volatile organics and metals were detected in subsurface soils collected at the Site. The subsurface soils did not exhibit elevated pesticide/PCB concentrations.

One or more subsurface soil samples exhibited concentrations of 1,2-dichloroethene, trichloroethene, tetrachloroethene and acetone that exceeded the Cleanup Objectives. The reported acetone concentrations are considered suspect. Acetone is a common laboratory contaminant and was detected in laboratory method blanks.

Two of the subsurface soil samples (DClDS5 and D2S79) exhibited concentrations of several PAH compounds that exceeded the Cleanup Objectives. The PAHs may potentially be related to the fill material from which the samples were collected. Groundwater data indicate the PAHs are either not being released, or are being sorbed to the organic matter in the overburden and are not leaching to groundwater. However, the upper, unconfined water bearing zone downgradient of the Pelican buildings (MW-19 and MW-20) was not evaluated with respect to semi-volatiles and inorganics during the First Phase R.I..

A number of metals (mercury, zinc, arsenic, copper, lead, magnesium and nickel) were detected in sample D2S79 at concentrations exceeding the eastern U.S. background concentrations and the NYSDEC RSCOs. Mercury was detected at elevated concentrations in the three other subsurface soil samples (DC1DS5, D3S6, D4S6) and zinc (D1DS5, D4S6) in two of the other samples. The D2S79 sample was collected in fill which may be the source of the elevated metals.

### 2.9.5.4 Sediment

Sediment sample SED-1, a floor drain sample collected from inside the solvent storage room, exhibited concentrations of several VOCs (1,1-dichloroethene, 1,2-dichloroethene, 1,1,1-trichloroethane, carbon tetrachloride, trichloroethene, tetrachloroethene, toluene, ethylbenzene and xylene) that exceeded the Cleanup Objectives. Sample SED-1 also exhibited concentrations of several VOCs (1,2-dichloroethene, 1,1,1-trichloroethane, trichloroethene, toluene and xylene), that were detected in groundwater at concentrations exceeding the groundwater standard. The SED-1 sample is a likely source of the elevated volatile concentrations in the MW-1S groundwater sample. The solvent room floor drain has the potential to represent a continuing source area for groundwater contamination.

SED-2 and SED-4 exhibited toluene, and SED-2 also` exhibited xylene concentrations that exceeded the Cleanup Objectives. The reported acetone concentrations in these two samples are considered suspect and potentially laboratory derived. The toluene detected in samples SED-2 and SED-4 and the xylene reported in SED-2 are also groundwater contaminants at the Site. Sediment sample SED-3 exhibited concentrations of several PAH compounds that exceeded the Cleanup Objectives. Sediment sample SED-3 also exhibited the highest sediment concentrations of PAHs. Elevated concentrations of PAHs have not been detected in site groundwater samples analyzed for these compounds, indicating that the PAH compounds are either not being released or are being sorbed to organic matter in the overburden. However, the upper, unconfined water bearing zone downgradient of the Pelican building (MW-19 and MW-20) was not evaluated with respect to semi-volatiles and inorganics during the First Phase R.I.

Sediment samples SED-1 and SED-3 exhibited concentrations of pesticides and PCBs that exceeded the Cleanup Objectives (SED-1 - endrin, heptachlor epoxide, Aroclor 1254; SED-3 - Aroclor 1260, endrin). None of these compounds were detected at elevated concentrations in the groundwater samples analyzed for these compounds. However, the upper, unconfined water bearing zone downgradient of the Pelican buildings (MW-19 and MW-20) was not evaluated with respect to semi-volatiles and inorganics during the First Phase R.I. The elevated levels of pesticides/PCBs would be eliminated during removal of the drain sediments due to the high volatile organic concentrations in these sediments.

Two sediment samples from the Site were analyzed for the NYSEDC TAL parameters. Analytical data revealed concentrations of several metals in at least one of the sediment samples (antimony, arsenic, barium, cadmium, calcium, chromium, copper, lead, mercury, nickel and zinc) in excess of Cleanup Objectives. Excavation/removal of the sediments contaminated with volatile organics would also address the metals contamination at this location.

## 2.10 Data Validation

### 2.10.1 Introduction

All analytical data were reviewed to evaluate data quality. The data were validated by ChemWorld Environmental, Inc. (Bethesda, Maryland) following USEPA validation criteria modified to include NYSDEC ASP CLP requirements. ChemWorld is approved by the NYSDEC for NYSDEC CLP data validation.

### 2.10.2 Objectives

The objectives of the data validation process were to evaluate the validity of the reported sample results and to determine if data were of sufficient quality, i.e., both valid and usable, to meet project requirements.

### 2.10.3 Methods

Data validation was performed in accordance with guidelines established in the USEPA Region 2 SOP No. HW-6, Revision #8, *CLP Organics Data Review and Preliminary Review, and* SOP No. HW-2, Revision *#11, Evaluation of Metals Data for the Contract Laboratory Program* (CLP). These documents are checklists designed to investigate the degree of accuracy and completeness exhibited by a package of CLP data.

Validation reports are composed of a narrative and the tabulated results of the review. Tabulation consists of the preparation of summary tables of actual sample data and any final note of validation decision or qualification, along with any pertinent footnote references. Additionally, laboratory "Form 1" sample result sheets are qualified where necessary.

For work performed under NYSDEC ASP (1991) CLP analytical procedures, additions or changes to the general EPA validation procedures were incorporated into the process and the data were assessed according to the NYSDEC-specific requirements.

ChemWorld validators reviewed the appropriate data and reporting forms outlined below. After the entire data package had been reviewed, a narrative report and deliverables summary was prepared describing data reduction, reporting and validation procedures. These reports provided an indication of the general quality of the data and identified any specific problems with the results. The reports also indicated if the data were valid and usable.

**Volatile and Semi-Volatile Organic Mass Spectrometry Analysis and Reporting**

- Case Narrative
- Deliverables Requirements

- Holding Times and Sample Preparation
- GC/MS Tuning and Mass Calibration
- Initial Calibration Data (GC/MS) for Each Instrument
- Continuing Calibration Data (GC/MS) for Each Instrument
- Method Blank Summary and Data
- Surrogate Recoveries and Summary
- MS/MSD Summary and Recoveries
- Internal Standard Areas and Retention Times
- Organic Analysis Data Sheets (Form I) and Data
- Reconstructed Ion Chromatogram(s) (RIC)
- Quantitation Reports
- Mass Spectral Data
- EPA/NIH Mass Spectral Library Search for TICs

**Pesticide/PCB Analysis and Reporting**

- Case Narrative
- Deliverables Requirements
- Holding Times and Sample Preparation
- Surrogate Recoveries and Summary (Form 2)
- MSB/MS/MSD Recoveries and Summary (Form 3)
- Instrument and Method Blanks and Summaries (Form 4C)
- Pesticide Initial Calibration of Single and Multi-Component Analytes (Forms 6D, 6E and 6F) and Data
- Pesticide Calibration Verification Summaries (Forms 7D and 7E) and Data

- Pesticide Analytical Sequence (Form 8D) and Data
- Pesticide Clean-up Procedures QA/QC (Forms 9A and 9B)
- Pesticide Identification Summaries of Single and Multi-Component Analytes (Forms 10A and 10B)
- Pesticide Analysis Data Sheets (Form 1D) and Data

**Inorganic Analysis and Reporting**

- Case Narrative
- Deliverables Requirements
- Holding Times and Sample Preparation
- Instrumentation Calibrations
- Instrument and Preparation Blanks
- ICP Interference Check Samples
- Matrix Spike Recoveries
- Duplicate Sample Analyses
- Laboratory Control Samples
- ICP Serial Dilution Data
- Furnace Atomic Absorption QC
- Inorganic Analysis Data Sheets (Form I) and Data

ChemWorld's results were reviewed and authenticated by a DUNN chemist. ChemWorld's corrected Data Validation Reports for the analytical results from the Pelican site First Phase RI have been provided to the Department under separate cover.

### 2.10.4 Results

Validation of the Pelican site groundwater, surface soil, sediment and subsurface soil analytical data indicates that, with the exception of selenium in one sample and 4,4'-DDT, endrin, acetone and methylene chloride in several samples, all data are considered valid and usable.

The selenium result for surface soil sample S-10 was rejected due to poor matrix spike recovery. The 4,4'-DDT results in samples SED-1, D4S6, X-1, DClDS5 and D2S79, and the endrin results for S13, D3S6, DC1DS5 and D2S79, were rejected due to low spike recoveries and/or high performance evaluation mixture relative percent difference results.

The reported acetone and methylene chloride in several samples were disregarded and flagged as non-detect due to laboratory contamination. The reported acetone results for samples S-10, D4S2 and DC1DS5 are considered suspect due to detection of acetone in a laboratory blank, however, the USEPA criteria for disregarding the results was not met.

### 2.10.5 Conclusions

Based on the results of the data validation process, the laboratory analytical data are, with the exception of the previously discussed selenium, endrin, and 4,4'-DDT data, of sufficient quality to meet the needs of the project. There are sufficient valid data for selenium, endrin, and 4,4'-DDT to indicate that these compounds are not a concern at the Site.

## 2.11 Habitat Based Assessment (Fish and Wildlife Impact Analysis)

### 2.11.1 Introduction

This section presents the findings of the Fish and Wildlife Impact Analysis (FWIA) performed for the Pelican site. A Step I site description and a Step II pathway/exposure analysis were performed and are discussed in the following text.

The objective of a Step I site description is to identify the fish and wildlife resources that exist in the vicinity of a site that could potentially be affected by site-related contaminants.

The following site description includes descriptions of the vegetative habitats, land use, fish and wildlife resources, value of the habitats to fish and wildlife, and the value of the resources to humans. Additionally, applicable fish and wildlife regulatory criteria are presented. The pathway/exposure analysis evaluates the potential for fish and wildlife to be exposed to contaminants detected at the Site.

### 2.11.2 Step I Site Description

#### 2.11.2.1 Within One-Half Mile of the Site

A cover type map detailing the major land use/vegetative habitats or cover types located within one-half mile of the Site is presented in Figure 2-10. The cover type map was prepared through the evaluation/interpretation of aerial photographs and topographic maps, followed by field checking for accuracy. The base map was prepared from aerial photographs. The cover type classifications were performed using a combination of the New York Natural Heritage Program Classification System (NHPCS, Reschke, 1990) and the U.S. Geological Survey Classification System (Anderson, 1976).

Where access was possible during the field check of the draft cover type map, the dominant vegetation in each cover type was identified for areas classified as terrestrial natural (TN) and Palustrine (P). The determination of dominance was qualitative, based on visual estimates. Vegetative plots and transects were not used in determining dominance. These methods are beyond the scope of a Step I analysis.

The land use within one-half mile of the Site is a mixture of commercial, residential, recreational and undeveloped; terrestrial natural (TN), palustrine (P) and aquatic habitats. Natural areas identified as TN or P on the cover type map and also identified with a number (e.g., #1) were accessible during the field check of the map. The areas not numbered were either not accessible or were similar in nature to the other areas. The numbers in each area correspond to the numbers and descriptions of dominant vegetation for each area as presented in Table 2-29.

The most significant aquatic and palustrine habitat within one-half mile of the Site is the Chadakoin River and the associated deciduous forested wetlands located along the river. The Chadakoin River and the associated wetland system is located approximately 1600 feet west of the Site. The Chadakoin River in this area is designated by the NYSDEC as a Class C stream. The wetlands located along the banks of the Chadakoin River are NYSDEC regulated Freshwater Wetlands and are designated as Class 1.

The dominant overstory vegetation in the wetlands located along the Chadakoin River are silver maple (Acer saccharinum) and American elm (Ulmus americana). Silky dogwood (Cornus ammonium) is common in the shrub layer and Arrow alum (Peltranda virginica) is common in the herbaceous layer.

There is a small, localized herbaceous emergent/scrub palustrine wetland located adjacent to and west of the Site. This area is approximately one acre in size.

The predominant herbaceous, emergent vegetation in this area is purple loosestrife (Lythrum salicaria) and common cattail (Typha iatifolia). The predominant shrubs are willow (Salix spp) and red oiser dogwood (Cornus stolonifera). This wetland area drains to the west and then south via a combined surface and subsurface drainage feature located in the middle of the former Jamestown City landfill and also to the south via a north/south oriented drainage feature located along the eastern boundary of the landfill. Runoff from the Pelican site and adjacent areas also enter this latter drainage ditch. This north/south drainageway has been dammed up at the south end of the Scutella property located at No. 2119 Washington Street. The Scutellas operate a wildlife rehabilitation center at this location. The pond formed by the damming of the north/south drainageway is used by the Scutellas as a holding/rearing area for waterfowl This drainage feature discharges to the 18th Street Ditch, which then discharges to the Chadakoin River and associated wetland.

## TABLE 2-29

## PELICAN MANUFACTURING, INC. SITE
## DOMINANT VEGETATION IDENTIFIED IN NATURAL AREAS WITHIN ONE-HALF MILE OF THE SITE.

| | |
|---|---|
| **#P1:** | **Emergent Wetland**<br>Purple loosestrife (Lythrum salicaria), common cattail (Typha latifolia). willow species (Salix spp.), red oiser dogwood (Cornus stolonifera), red panicle dogwood (Cornus racemosa). |
| **#2 TNI:** | **Open Upland/Successional Field**<br>Goldenrod species (Solidago spp.), wild carrot (Daucus carota), pearly everlasting (Anaphalis margaritacea). |
| **#3 P2:** | **Deciduous Forested Wetland**<br>Silver maple (Acer saccharinum), American elm (Ulmus americana), arrow alum (Peltranda virginica), Silky dogwood (Comus ammonum). |
| **#4 TN1:** | **Open Upland/Successional Field**<br>Goldenrod species, red panicle dogwood, grass spp., quaking aspen (Populus tremuloides). |
| **#5 P2/TN1:** | Willow spp., goldenrod spp. |
| **#6 TN2D:** | **Terrestrial Deciduous Forest Area**<br>Red maple (Acer rubrum), sugar maple (Acer saccharum), black cherry (Prunus serotina), quaking aspen. |

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The former Jamestown City Landfill is located approximately 200 feet west of the Pelican site buildings. The landfill west of the Site is no longer active and much of the area has been covered and has reverted to old field type habitat or has been constructed into recreational ball fields. The primary vegetation on the old field habitats is goldenrod (Solidago spp.), wild carrot (Daucus carota) and grass spp.

North of the site there are a number of isolated tracts of deciduous forest, located south of the Southern Tier Expressway (Route 17) and north of Route 430 (Fluvanna Avenue). The dominant overstory species in these areas are sugar maple (Acer saccharum), red maple (Acer rubrum), black cherry (Prunus serotina) and quaking aspen (Populus tremuloides). There are also a few areas of isolated successional field areas located north of and within one-half mile of the Site. The predominant vegetation in these areas is goldenrod spp., grass spp., willow spp., red oiser dogwood and quaking aspen.

The remainder of the land use within one-half mile of the Site is a mixture of residential, commercial and industrial. These areas comprise approximately fifty percent of the area within one-half mile of the Site.

#### 2.11.2.2 Wetlands Within One-Half Mile and Two Miles of the Site

There are three NYSDEC regulated wetlands located along the Chadakoin River within a one-half mile radius of the Site. These are wetlands LW-10, LW-4 and LW-11. All three wetlands are part of the same wetland system and are Class 1 wetlands. These wetlands are forested deciduous wetlands with the predominant overstory consisting of silver maple.

NYSDEC has four classifications for wetlands, Class 1 through Class 4, with Class 1 representing the most significant habitat. NYSDEC only regulates wetlands greater than 12.4 acres in size (unless a smaller wetland is declared of unusual local importance). A wetland is considered a Class 1 wetland if it exhibits one or more of seven specific criteria which are described in 6 NYCRR Part 664 Freshwater Wetlands Maps and Classifications Regulations.

There are two other regulated wetlands located within a two mile radius of the Pelican site. These are NYSDEC wetlands LW-7 (Class 2) and LW-12 (Class 3).

#### 2.11.2.3 Streams Within One-Half and Two Miles of the Site

There are several NYSDEC classified streams located within a two mile radius of the Pelican site. These include the Chadakoin River, Moon Creek and tributaries to both the Chadakoin River and Moon Creek. The Chadakoin River and all but one of its classified tributaries are Class C streams. The usage of a Class C stream is defined as fishing. Class C waters are suitable for fish propagation and survival. They are also suitable for primary and secondary contact recreation, although factors besides water quality may limit their use for these purposes. Moon Creek is a Class B stream, as is one of the tributaries of the Chadakoin River (from Allen Park to the Source). The best usage of a Class B stream is primary and secondary contact recreation and fishing. Class B waters are also suitable for fish propagation and survival.

### 2.11.3 Resource Characterization Within One-Half and Two Miles of the Site

Resource characterization consists of determining the wildlife species that may potentially utilize the habitats identified in the previous sections as existing within one-half mile of the Site and any significant species or habitats that may exist within two miles of the Site. Additionally, the general quality of the habitat in providing for the needs of the organisms, any areas of observed vegetative stress, leachate seeps, fish and/or wildlife mortality and any known wildlife population impacts related to site contaminants are discussed below.

#### 2.11.3.1 Endangered, Threatened or Special Concern Fish and Wildlife Species or Significant Habitats

The United States Fish and Wildlife Service (USFWS), the NYDEC Wildlife Resources Center and the NYDEC Region 9 Office were contacted regarding the known occurrence of endangered, threatened or special concern species or habitats located within a two-mile radius of the Site. The USFWS and the NYDEC Significant Habitat Unit reported that there were no federal or New York State species of Concern that were known to exist within a two-mile radius of the Site.

#### 2.11.3.2 Fish and Wildlife Species Potentially Using Habitats Within a One-Half Mile Radius of the Site

Mammal, amphibian and reptile species and fish, and bird species that could potentially utilize the habitats within one-half mile of the Site, for at least a portion of their life cycle, are listed in Tables 2-30, 2-31 and 2-32, respectively. These lists are not meant to indicate that these species can always be found, or that all will be present at one time within one-half mile of the Site. These lists were prepared following a limited field evaluation of habitats within one-half mile of the Site and review of available literature. These lists are not the result of a site-specific population survey. Actual population surveys are very complex and time sensitive, and are beyond the scope of a Step I baseline evaluation.

Many wildlife species are very mobile and generally require a wide range of habitat types to meet their life cycle requirements. In addition, many species will only use the area within one-half mile of a site for a portion of their life requisites. Thus, all the species identified on these lists were not actually observed within one-half mile of the Site.

During field checking of the cover type map, the species listed below were directly observed within one-half mile of the Site.

- Wood duck
- Mallard duck
- American crow
- Blue jay
- Red-tailed hawk
- Black-capped chickadee
- White-breasted nut hatch

## TABLE 2-30

## PELICAN MANUFACTURING, INC. SITE
## MAMMAL/AMPHIBIAN/REPTILE SPECIES THAT COULD POTENTIALLY BE FOUND UTILIZING HABITATS WITHIN ONE-HALF MILE OF THE SITE

### Mammals

| COMMON NAME | GENUS AND SPECIES |
|---|---|
| Virginia Opossum | Didelphis virginiana |
| Northern Short-tailed Shrew | Blarina brevicauda |
| Hairy-tailed Mole | Parascalops brewri |
| Star-nosed Mole | Condylura cristata |
| Little Brown Myotis | Myotis lucifugus |
| Keen's Myotis | Myotis keenii |
| Big Brown Bat | Eptesicus fuscus |
| Eastern Cottontail | Sylvilagus floidanus |
| Woodchuck | Marmota monax |
| Gray Squirrel | Sciurus carolinensis |
| Deer Mouse | Peromyscus leucopus |
| Southern Red-backed Vole | Clethrionomys gapperi |
| Meadow Vole | Microtos pennsylvanicus |
| Woodland Vole | Microtos pinetroum |
| Muskrat | Ondatra zibethicus |
| Norway Rat | Rattus norvegicus |
| House Mouse | Mus musculus |
| Meadow Jumping Mouse | Zapus hudsonius |
| Woodland Jumping Mouse | Napaeozapus insigis |
| Red Fox | Vulpes vulpes |
| Raccoon | Procyon lotor |
| Ermine | Mustella erminea |
| Long-tailed Weasel | Mustella frenata |
| Mink | Mustella vison |
| Striped Skunk | Mephitis mephitis |
| Bobcat | Lynx rufus |
| White-tailed Deer | Odocoileus virinianus |
| Beaver | Custor canadensis |

### Amphibians/Reptiles

| COMMON NAME | GENUS AND SPECIES |
|---|---|
| Snapping Turtle | Chetydra serapentina |
| Spotted Salamander | Ambystoma mulculatum |
| Green Frog | Rana clamitans |
| Bull Frog | Rana catesbeiana |
| Pickerel Frog | Rana palustris |
| Spring Peeper | Hyla crucifer |
| Painted Turtle | Chrysemys picta |
| Brown Snake | Storeria dekayi |
| Eastern Ribbon Snake | Thamnophis sauritus |
| Northern Water Snake | Nerodia Sipedon |

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## TABLE 2-31

## PELICAN MANUFACTURING, INC. SITE
## FISH SPECIES THAT COULD POTENTIALY BE FOUND UTILIZING AQUATIC HABITATS WITHIN ONE-HALF MILE OF THE SITE

| COMMON NAME | GENUS AND SPECIES |
|---|---|
| Brown Bullhead | Ictalurus nebulosus |
| White Sucker | Catostomus commersoni |
| Northern Hogsucker | Hypentelium nigricans |
| Golden Shiner | Notemigonus crysoleucas |
| Longnose Dace | Rhinichthys cataractae |
| Common Shiner | Notropis cornutus |
| Blacknose Shiner | Notropis heterolepis |
| Spottail Shiner | Notropis hudsonius |
| Bluntnose Minnow | Pimephales notatus |
| Banded Killifish | Fundulus diaphanus |
| Brook Stickleback | Culaea inconstrans |
| Rock Bass | Ambloplites rupestris |
| Pumpkinseed | Lepomis gibbosus |
| Bluegill | Lepomis macrochirus |
| Smallmouth Bass | Micropterus dolomieui |
| Largemouth Bass | Micropterus salmoides |
| Black Crappie | Pomoxis nigromaculatus |
| Fantail Darter | Ethoestoma flabellare |
| Yellow Perch | Perca flavescens |
| Creek Chub | Semotilus atromaculatus |
| Fathead Minnow | Pimephales promelas |
| Muskellunge | Esox masquinonsy |
| Walleye | Stizostedion vitreum |
| Blacknose Dace | Rhinichthys atratulus |
| Pearl Dace | Semotilus margarita |
| Golden Redhorse | Moxostoma anisurum |
| Carp | Cyprinus carpio |
| White Crappie | Pomoxis annulais |
| Johnny Darter | Etheostoma nigrum |
| Spottail Darter | Etheostoma maculatum |
| Rainbow Trout | Salmo gairdnieri |
| Brown Trout | Salmo trutta |
| Brook Trout | Salvelinus fontinalis |

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## TABLE 2-32

## PELICAN MANUFACTURING, INC. SITE
## BIRD SPECIES THAT COULD POTENTIALLY BE FOUND UTILIZING HABITATS WITHIN ONE-HALF MILF OF THE SITE

| COMMON NAME | GENUS AND SPECIES |
|---|---|
| Red-breasted Merganser | Mergus serrator |
| American Black Duck | Anas rubripes |
| American Wigeon | Anas americana |
| Northern Pintail | Anas acuta |
| Blue-winged teal | Anas discors |
| Red-winged Blackbird | Agelaius phoneniceus |
| Mallard | Anas platyrhynchos |
| Common Merganser | Mergus merganser |
| Hooded Merganser | Lophodytes cucullatus |
| Canada Goose | Branta canadensis |
| Spotted Sandpiper | Actitis macularia |
| Rough-winged Swallow | Stelgidopteryx serripennis |
| Killdeer | Charadrius vociferus |
| Common Nighthawk | Chordeiles minor |
| Common Barn Owl | Tyto alba |
| American Kestrel | Falco sparverius |
| Barn Swallow | Hirudo rustica |
| American Goldfinch | Carduelis trustis |
| Mourning Dove | Zenaida macroura |
| Rock Dove | Columba livia |
| Chimney Swift | Chaetura pelagica |
| American Robin | Turdus migratorius |
| Blue Jay | Cyanocitta cristata |
| Ruby-throated Hummingbird | Archilochus colubris |
| House Wren | Troglodytes aedon |
| Cedar Waxwing | Bonbycila cedrorum |
| Brown-headed Cowbird | Molothrus ater |
| House Sparrow | Passer domesticus |
| Song Sparrow | Melospiza melodia |
| European Starling | Sturnus vulgaris |
| Common Grackle | Quiscalus guiscula |
| American Crow | Corvus brachyrhynchos |
| Yellow Warbler | Dendroica petechia |
| Common Yellowthroat | Geothypis trichas |
| Northern Cardinal | Cardinalis cardinalis |
| Screech Owl | Otus asio |
| Downy Woodpecker | Picoides pubescens |
| Black-capped Chickadee | Parus atricapillus |
| Eastern Phoebe | Sayonis phoebe |
| Great-horned Owl | Bubo virginianus |
| Cooper's Hawk | Accipiter cooperii |
| Ruffed Grouse | Bonasa unbellus |
| Wild Turkey | Meleagris gallopavo |
| Red-tailed Hawk | Buteo jamaicensis |

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- Downy woodpecker
- Eastern cotton-tail
- Eastern woodchuck

### 2.11.3.3 General Habitat Quality Within One-Half Mile of the Site

The land use/habitats within one-half mile of the Site are a combination of residential, natural, recreational and commercial. The following text describes the general quality of the different habitat types to wildlife.

There are numerous residential homes and commercial businesses scattered within a one-half mile radius of the Site. Habitats available to wildlife within the cultivated habitats (if any) associated with these areas are limited. The number of species utilizing these areas is limited to those adjusted to survival in close proximity to man, species that require small habitats for their life requisites and/or species that are highly mobile. Such species would include small birds (American robin, sparrows, etc.) and small mammals (Eastern cotton-tails, moles, Eastern gray squirrels, etc.). Generally, these habitats would be of marginal quality for other species.

The regulated wetlands located along the Chadakoin River represent a high quality habitat for a variety of wildlife species. The wetlands are of sufficient size to provide suitable habitat for both wetland dependent species and species that, although not wetland dependent, would utilize the wetlands for part of their life requisites. The wetlands are associated with and adjacent to a large and permanent body of water (Chautauqua Lake and the Chadakoin River), which typically increases the diversity and abundance of the wetland-dependent bird species that would utilize an area. The forested nature of the wetland would serve to potentially support a high diversity and abundance of migrating and wintering wetland species. Forested vegetation generally provides a wide diversity of habitat structure through vertical layering and increased patchiness resulting from horizontal overlap of layers.

The successional fields located west of the Site, on the site of the former Jamestown City Landfill, are low to moderate quality habitat. The location of these areas adjacent to wetland LW-4 results in an increase in habitat diversity and edge, which typically increases the value of the habitat. However, the relatively sparse and open nature of the successional fields and their location directly adjacent to the developed recreational areas, lowers the value of this habitat.

The deciduous forested and successional field areas located north of the Site and south of the Southern Tier Expressway are moderate quality habitats. The habitats are small in size and interspersed with commercial, cultural and residential areas, which reduce the overall value of the habitats to wildlife. These areas would represent good quality habitat for species with small home ranges/habitat requirements and/or species that are highly mobile. Such species would include small mammals (Eastern cotton tails, moles, field mice, Eastern gray squirrels) and small birds (American robin, sparrows, etc.). Generally, these habitats would be of marginal quality for other species which have greater habitat requirements.

The wet area adjacent to and west of the Site is a low quality habitat. The area is relatively small and is located away from any other significant habitats. Purple loosestrife and cattails form dense stands in the emergent area of this wetland.

No areas of stressed vegetation were observed in the vicinity of the Site during the field confirmation of the cover type map. No significant areas of stressed vegetation were reported by other field personnel on site during the implementation of other Remedial Investigation activities.

DUNN submitted a letter to the NYDEC Wildlife Pathology Unit, requesting information on known occurrences of wildlife mortality within a two mile radius of the Site. No response was received and it has been assumed that there are no known cases.

### 2.11.3.4 Use of Natural Resources Within One-Half Mile of the Site by Humans

The habitats/wildlife located within one-half mile of the Site would provide recreational opportunities for hunting, fishing, photography and wildlife observation. The habitats in the vicinity of the Pelican site are located in or just outside the City of Jamestown, which makes these areas readily available to a large number of people.

The Chadakoin River Park is located east of and adjacent to the Chadakoin River and east of wetlands LW-14 and LW-10. The park provides access to the Chadakoin River and the associated wetlands, thereby increasing recreational opportunities in the area.

Carmen and Alicia Scutella operate a wildlife rehabilitation center at No. 2199 Washington Street, south of the Pelican site. The Scutellas have created a pond by damming the drainageway that flows south past the Pelican site. The pond is used as a holding/rearing area for waterfowl.

### 2.11.4 Applicable Fish and Wildlife Regulatory Criteria

The appropriate Site Specific Criteria (SSC) that may potentially be applicable to the Site will be partially dependent on the selected remedial alternative (if any). This section presents the fish and wildlife SSC that should be considered. SSC will be further discussed in the Feasibility Study section of this report.

Fish and wildlife-related SSC that may be applicable to the site are presented below:

- Clean Water Act, 233 U.S.C. 1261 et seq. Sec. 404 regulates the discharge of pollutants into wetlands and other water bodies, including dredged or fill materials.

- The Freshwater Wetlands Act (Article 24 of the Environmental Conservation Law) and the Freshwater Wetlands Implementing Regulations (6 NYCRR Parts 663 and 664) are designed to protect wetlands. Only wetlands that have been mapped by the State of New York are regulated.

- New York State Surface Water and Groundwater Standards. Title 6 Chapter 10 Part 700-703 NYCRR.

- Executive Order 11990, Protection of Wetlands. This order recognized the value of wetlands and directs federal agencies to minimize the degradation, destruction and loss of wetlands.

- Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.).

- Fish and Wildlife Coordination Act.

### 2.11.5 Pathway Analysis/Criteria Specific Analysis

This section evaluates the potential for wildlife exposure to site-related contaminants. This evaluation includes identification of habitats that could potentially be impacted by site-related contaminants and the identification of possible food chain contamination pathways.

The magnitude and significance of any potential exposure is dependent upon site chemistry, the extent of any contamination and the land use/habitats located near the Site. Additionally, habitat quality, wildlife utilization of the habitats, and the extent/duration of exposure are important factors in evaluating the significance of any impact a site may have on the ecosystems in the vicinity of the Site.

The Pelican site is located in an area that is currently and has historically been intensively used for industrial and commercial purposes. Additionally, the former Jamestown City Landfill is located directly west of the Pelican site, between the Site and the Class 1 wetlands located along the Chadakoin River. Evaluation and isolation of the impact the Pelican site may have had on fish and wildlife from any impact associated with other potential sources of environmental contamination in the area (industrial and the former landfill) is not possible.

The two habitats/areas that exhibit the greatest potential to be impacted by the contaminants from the Pelican site are the small wetland habitat adjacent to and west of the Site and the associated drainage feature that flows north to south between the landfill and the Pelican site. Neither the small wetland adjacent to the Site nor the drainage feature are considered high quality habitats. Both areas likely receive minimal use by wildlife. However, the drainage feature is used by the Scutellas as part of their wildlife rehabilitation efforts. Additionally, this drainage feature ultimately discharges to the Chadakoin River, which could potentially be impacted by site-related contaminants through migration via the drainage feature.

During the First Phase Remedial Investigation, environmental samples were not collected from either the small wetland or the drainage feature located adjacent to and west of the Site. However, in November 1993, NYSDEC personnel collected surface water and sediment samples from the referenced drainage feature. A total of four sets of surface water and sediment samples were collected, two upgradient of the Site, one adjacent to the Site, and one downgradient of the Site. The samples were analyzed for volatile organics and metals. The analytical results are discussed in Section 3.5.1, and summarized and compared to NYSDEC surface water standards and sediment criteria in Tables 3-6 and 3-7. The analytical results are discussed and evaluated with respect to the Habitat Based Assessment in the following text

The surface water analytical results revealed that the sample collected adjacent to the site (PMSW-C) exhibited a 1, 2-dichloroethene concentration (182 ug/l) that exceeded the NYSDEC surface water guidance value (5 ug/l). This value is based on the NYSDOH drinking water standard and is not applicable for comparison with respect to the protection of wildlife. The PMSW-C sample also exhibited trichloroethene, arsenic, lead and zinc concentrations that exceeded the NYSDEC surface water standards. However, upgradient/upstream samples PMSW-A and PMSW-B exhibited zinc and lead concentrations that also exceeded the NYSDEC surface water standard indicating other potential sources of these metals in addition to the Site. Trichloroethene was detected in the PMSW-A sample (5ug/l) at a concentration below the surface standard. The trichloroethene standard is based on protection of human health from consumption of fish. Considering that the drainage feature does not represent a viable sport or commercial fishery, this standard is not applicable to the protection of fish and wildlife. The arsenic, lead and zinc standards are based on protection of the propagation of aquatic life and wildlife.

The surface water sample collected downgradient of the Site (PMSW-D) exhibited concentrations of chromium, lead and zinc that were elevated with respect to the surface water standard for protection of the propagation of aquatic life and wildlife. The reported chromium concentration (12 ug/l) was only slightly higher than the standard (9 ug/l).

The surface water data indicate that the surface water in the drainage feature has been impacted with respect to its ability to support aquatic life/wildlife. However, as previously stated, the drainage feature does not represent a high quality habitat. The effect of the surface water concentrations on the wildlife associated with the Scutella's wildlife rehabilitation program is unknown. However, considering that the wildlife residents in the Scutella program are only temporary residents, the impact on propagation is, most likely, limited.

The PMSD-C sediment sample collected adjacent to the Site, exhibited arsenic and zinc concentrations that exceeded the NYSDEC severe effect level. The chromium, lead and mercury concentrations were significantly higher than the NYSDEC lowest effect level. The compound 1,2-dichloroethene was detected in the PMSD-C sample at a concentration of 940 ug/kg. There is no NYSDEC Sediment Criteria Value for this compound; however, 1,2-dichloroethene was not detected in the sample PMSD-D collected just downgradient of the Site.

The sediment analytical results from the sample collected downgradient of the Site (PMSD-D) exhibited an arsenic concentration that exceeded the NYSDEC sediment criteria severe effect level concentration, and lead and zinc concentrations that exceeded the NYSDEC sediment criteria lowest effect level concentration. The reported zinc concentration (260 mg/kg) was, however, only slightly below the severe effect level criteria concentration (280 mg/kg). The PMSD-D sediment arsenic and zinc concentrations were significantly lower than the PMSD-C values, which indicates that sediment concentrations may be attenuating with distance from the Pelican site.

The PMSD-D sample also exhibited a toluene concentration of 85 ug/kg. There is no NYSDEC sediment criteria value for toluene. However, calculation of a guidance value was performed following the procedure presented in the NYSDEC Water Quality Regulations for Surface Waters and Groundwaters, 6 NYCRR Part 702.10 (d) (2). The toluene 96 hour LC50 for the blue gill (Lepomis machrochirus) is 13,000 ug/l. Application of a one hundredfold factor to this concentration results in a fresh water chronic toxicity guidance value of 130 ug/l. Calculation of an aquatic chronic toxicity based sediment criteria concentration was performed using the formula provided below:

SC=WQCxKowxFoc

where SC=Calculated Sediment Criteria Value

WQC=Water Quality Criteria (derived guidance value)

Kow=Octanol Water Partition Coefficient

Foc=Organic Carbon Concentration (assumed 3 percent)

Results in a sediment criteria value of:

SC=130 ug/l x 489.77 l/kg x 1 kg/1000g OC x 3g OC/kg = 3%

SC=191 ug/kg

The PMSD-D toluene concentration of 85 ug/kg is below the sediment derived criteria concentration of 191 ug/kg. The data indicate that the reported toluene concentration in the drainage ditch does not represent a significant threat to aquatic life. Although 1, 2-dichloroethene was detected in the PMSD-C sample collected adjacent to the Site, it was not detected in the PMSD-D sample collected downstream of the Site. A sediment criteria value was not derived for this compound.

Although surface water and sediment metals concentrations indicate that the sediments in the drainage feature have been impacted with respect to the ability to support aquatic life/wildlife, the drainage feature does not represent a high quality habitat. Additionally, it is not apparent that the Pelican site is the only source of metal contaminants. As previously stated, there is the potential for the metals to originate from locations adjacent to and/or upstream of the Site. The removal of sediments adjacent to the Site might not be sufficient to significantly improve long term sediment quality adjacent to or downstream of the Site, considering that there could still be other sources of contaminants.

The Chadakoin River and the wetlands along the river could potentially be impacted by site-related contaminants through the discharge of contaminated groundwater to the river/wetlands and the migration of contaminants to the river/wetlands via the drainage feature that flows past the Pelican site into the 18th Street Ditch, and then discharges in the Chadakoin River and associated wetland system.

Groundwater data from the Pelican site indicate that groundwater in the shallow overburden (fill and native material) is contaminated with volatile organics at concentrations that exceed NYSDEC groundwater standards. Groundwater from the overburden most likely discharges to the Chadakoin River and the associated Class 1 wetlands. During high groundwater conditions, groundwater from the overburden may also discharge to the small wetland area adjacent to the Site and the associated drainage feature.

No samples were collected from the small wetland area adjacent to the Site during Phase 1 of the R.I.. Therefore, no information was initially available on whether this area had been impacted by site-related contaminants. Also, there have been no samples collected from the Chadakoin River or the associated Class 1 wetlands as part of the Pelican remedial investigation. However, as part of a Preliminary Site Assessment (PSA) of the former Jamestown City Landfill, (performed by DUNN for the NYSDEC, March 1993) two surface water and two sediment samples were collected from wetland LW-4, located on the east side of the Chadakoin River. The samples were analyzed for the NYSDEC TCL/TAL analytes.

Surface water and sediment samples SW-1/SED-1 and SW-2/SED-2 were collected from wetland LW-4 as part of the former Jamestown City Landfill PSA. Samples SW-1/SED-1 and SW-2/SED-2 were collected upstream and downstream, respectively, of where the 18th Street Ditch discharges to the Chadakoin River/wetland system. The SW-3/SED-3 sample was collected from the 18th Street Ditch downstream of where the drainage feature from the Site discharges to the ditch and downstream of where storm water from a section of the City of Jamestown enters the ditch. Summary Tables of the initial environmental sampling analytical results from the former Jamestown City Landfill PSA are presented in Appendix L.

Volatile organic analytical results from the SW-2/SED-2 and SW-3/SED-3 samples revealed that none on the Pelican site volatile organic compounds were detected in these samples. The data indicate that the Chadakoin River and wetland LW-4 have not been impacted by volatile organics related to the Pelican site.

Surface water analytical results from the SW-2 and SW-3 revealed that arsenic, lead and zinc concentrations in these samples were not elevated with respect to NYSDEC surface water standards. The data support the conclusion that the elevated levels of arsenic, lead and zinc detected in the surface water samples from the drainage feature adjacent to the Pelican site are being attenuated through dilution/sorbtion prior to reaching the Chadakoin River and wetland LW-4.

The sediment sample collected from wetland LW-4 (SED-2) and the 18th Street Ditch (SED-3) exhibited concentrations of arsenic that were slightly higher than the NYSDEC lowest effect level criteria. Lead and zinc concentrations in the wetland LW-4 sample were elevated with respect to the NYSDEC lowest effect level criteria, the lead value being well above the lowest effect level criteria but below the severe effect level criteria and the zinc concentration being only slightly above the lowest effect level criteria. However, a sample collected from wetland LW-4 (SED-1) located upstream from the discharge of the 18th Street Ditch to the Chadakoin River exhibited arsenic, lead and zinc concentrations that were higher than the levels detected in the downstream LW-4 (SED-2) wetland sample.

Both the 18th Street Ditch sediment sample (SED-3) and the LW-4 wetland sample (SED-2) exhibited concentrations of PAHs that were elevated with respect to the NYSDEC sediment criteria. These PAHs were also detected at elevated concentrations in the Pelican site surface soils; however, with the exception of the Pelican S-1 surface soil sample results, the concentrations detected in the 18th Street Ditch were significantly higher than the concentrations detected in the Pelican site surface soils. The concentrations detected in the 18th Street Ditch were also an order of magnitude higher than the levels detected in the LW-4 SED-2 sample.

The presence of the metals and PAH compounds in the Chadakoin River wetland sediment samples cannot be linked directly to and, most likely, are not strictly related to the Pelican site soils. There are numerous other sources of potential contamination to the Chadakoin River wetlands, including storm sewers which collect storm water from the City of Jamestown and the former Jamestown City Landfill.

### 2.11.6 Summary and Conclusions

The Step I Site Description Analysis revealed that the Chadakoin River and the associated wetlands are the most significant fish and wildlife habitats located within a one-half mile radius of the Site. The Chadakoin River in the vicinity of the Site is a NYSDEC Class C stream. The wetlands located along the banks of the Chadakoin River are NYSDEC regulated Freshwater Wetlands (LW-4, LW-10 and LW-11) and are designated as Class I. There is a north/south oriented drainage feature which flows past the Site on the west. Runoff from the Pelican site and adjacent areas enter this drainage ditch. This north/south drainageway has been dammed up at the south end of the Scutella property. The Scutellas operate a wildlife rehabilitation center and use the drainageway as a holding/rearing area for waterfowl. The drainage feature discharges into the 18th Street Ditch which then discharges into the Chadakoin River.

The data from the Chadakoin River wetland LW-4 collected as part of the PSA for the former Jamestown City Landfill, indicate that the Pelican site has, most likely, not significantly impacted the Chadakoin River LW-4 wetland. No volatile organic compounds were detected in the LW-4 surface water or sediment samples. Although arsenic, lead and zinc were detected at concentrations above the NYSDEC Sediment Criteria concentrations in the wetland LW-4 (SED-2) sample, these metals were detected at higher concentrations in the upstream wetland LW-4 (SED-1) sample, indicating a potential upstream source. The PAH compounds detected at concentrations exceeding the NYSDEC Sediment Criteria cannot be directly attributable to the Pelican site. There are numerous other potential sources of these compounds. The PAHs detected in he LW-4 wetland SED-2 sample were detected at concentrations an order of magnitude higher in the 18th Street Ditch (SED-3) sample. The 18th Street Ditch receives storm water runoff from the City of Jamestown as well as runoff from the former Jamestown City Landfill and the Pelican site, any or all of which could impact the ditch.

The surface water and sediment samples collected from the drainage feature located adjacent to the Pelican site exhibited concentrations of metals that were elevated with respect to surface water standards and NYSDEC sediment criteria concentrations. The concentrations of arsenic, lead, mercury and zinc in all of the sediment samples and chromium in the PMSD-C sample, indicate that the sediments have been impacted with respect to the ability to support aquatic life. However, the drainage feature represents a poor quality habitat, as does the small isolated wet area located west of the Site. Additionally, considering the potential for other sources upstream of the Site, removal of sediments adjacent to the Pelican site may not be sufficient to significantly improve sediment quality in the long term.

Available data indicate that no further ecological evaluation is necessary at the Site. The data indicate that the most significant habitat located within a one-half mile radius of the site, the Chadakoin River wetland LW-4, has, most likely, not been significantly impacted by the Pelican site. To properly evaluate any possible impact to the Chadakoin River system, an investigation incorporating all potential sources would be necessary since there are numerous other sources of potential contamination to the Chadakoin River wetlands, including storm sewers which collect storm water from the City of Jamestown and the former Jamestown City Landfill.

## 2.12 Health Risk Assessment

Due to the length of this section and the number of accompanying tables (30), and the specialized nature of the subject matter, the Health Risk Assessment (Qualitative Human Health Evaluation) has been prepared as a separate "stand alone" document (Volume II) of this report. Although presented in this section (First Phase RI), the health risk assessment addresses the results of the Second Phase RI as well.

## 2.13 New York State Standards, Criteria and Guidance

### 2.13.1 Introduction

The requirements set forth below have been preliminarily identified as applicable or relevant and appropriate "New York State Standards, Criteria, and Guidance" as defined in 6 NYCRR Part 375, Inactive Hazardous Waste Disposal Site Remedial Program, May 1992. TAGM HWR-90-4030 refers to the same requirements as "Standards, Criteria and Guidelines" (SCGs). SCGs also include federal standards that are more stringent than State Standards, Criteria and Guidelines. Remedial activities for a site must comply with the substantive portions of a requirement or regulation, but need not comply with the administrative requirements of State permits.

SCGs represent minimum requirements that a remedy must satisfy. SCGs can be waived provided one of the following circumstances is satisfied:

- the proposed action is only part of a complete remedial program that will conform to such standard or criterion upon completion;

- conformity to such standard or criterion will result in greater risk to the public health or to the environment than the alternatives;

- conformity to such standard or criterion is technically impractical from an engineering perspective;

- the remedial program will attain a level of performance that is equivalent to that required by the standard or criterion through the use of another method or approach; or

- the State has not consistently applied a State requirement in similar circumstances involving other remedial actions within the State.

SCGs may be specific to either the site location, or the contaminants present, or the remedial actions planned at a site. Location-specific SCGs may apply due to the geographical location of a site or its physical setting (e.g., in a wetland). Contaminant-specific SCGs may apply due to the contaminants present or their concentrations, and typically include standards for environmental media and concentration levels governing land disposal. Action-specific SCGs apply to on-site activities and may include design standards, discharge limits, or treatment requirements. These three types of SCGs are individually discussed below.

In addition, there are instances when SCGs do not exist for a particular contaminant or remedial action, or the existing SCGs are not protective of human health and the environment. Therefore, to-be-considered (TBC) criteria including, but not limited to, State guidance documents and other unpromulgated criteria may be used to aid in the design and selection of a remedial alternative. TBCs are also discussed below.

### 2.13.2 Location-Specific SCGs

Location-specific SCGs are requirements that apply to remedial actions due to the location of a site. Table 2-33 presents location-specific SCGs that may be potentially applicable to the Pelican site. In addition to those SCGs listed, local zoning ordinances and building codes must be considered.

The Pelican site location requires identification of SCGs relative to surface water and groundwater. Location-specific SCGs relating to Marine Habitat Protection, Coastal Management, Historic Preservation and Agriculture and Markets, and Endangered and Threatened Species of Wildlife are neither applicable nor relevant and appropriate since the Site does not fulfill criteria establishing jurisdiction under these regulations.

The Freshwater Wetlands Maps and Classification Regulations set forth in 6 NYCRR Part 664 define areas considered to be wetlands by the State. State wetland laws require an area to be at least 12.4 acres, or to be of unusual local significance, as determined by the Commissioner pursuant to ECL 24-0301, to be considered a wetland. There are no regulated wetlands on or immediately adjoining the Site. However, there is a regulated deciduous forested wetland located along the Chadakoin River, a Class C stream, within one-half mile of the Site.

## TABLE 2-33

## PELICAN MANUFACTURING, INC. SITE LOCATION-SPECIFIC SCGs

| REQUIREMENT<br>STATE | SYNOPSIS | CONSIDERATION |
|---|---|---|
| Floodplain Management Regulations (6 NYCRR Part 500) | These regulations protect areas of special flood hazard, related erosion hazard, or special mud slide hazard. | Not Applicable |
| Use and Protection ot Waters (6 NYCRR Part 608; ECL 15-0501 and 15-0505) | Under this regulation, a permit is required to change, modify, or disturb any protected stream, its bed or banks, sand, gravel, or any other material; or to excavate or place fill in any of the navigable waters or in any marsh, estuary or wetland, contiguous to any of the navigable waters of the State. Before granting a permit ,NYSDEC shall ascertain the probable effect on the use of such waters for navigation; the health, safety and welfare of the people of the State; and the effect on the natural resources including soil, forests, water, fish and aquatic resources therein. | No permit from the NYSDEC is required, but the substantive requirements of a permit must be satisfied. |
| New York State Ambient Water Quality Standards (6 NYCRR Parts 700, 701,702,705) | Defines surface water classification (A-special International Boundary Waters) and aquifer classification (GA and GSA) and lists specific chemical standards. | Classifications and standards can be used to help establish remedial cleanup standards. |
| Endangered and Threatened Species of Wildlife (6 NYCRR Part 182) | Site activities must minimize impact on identified endangered or threatened species of fish or wildlife. | No endangered species have been identified at the Site. |
| Freshwater Wetlands Maps and Classifications Regulations (6 NYCRR Part 664) | Identifies and defines wetlands. | There are no classified State wetlands at the Site. |
| New York State Coastal Management Program (CMP) (15 CFR Part 930) | Consistency of proposed activity with the State's CMP is required by U.S. Department of Commerce regulations. | Not Applicable |

## TABLE 2-33 (CONTINUED)
## PELICAN MANUFACTURING, INC. SITE
## LOCATION-SPECIFIC SCGs

| REQUIREMENT<br>FEDERAL | SYNOPSIS | CONSIDERATION |
|---|---|---|
| RCRA Location Standards (40 CFR 264.18) | This regulation outlines the requirements for constructing a RCRA facility on a 100-year floodplain. A facility located on a 100-year floodplain must be designed, constructed, operated and maintained to prevent wash-out of any hazardous waste by a 100-year flood, unless no adverse effects on human health and the environment would result. | Not Applicable |
| Floodplains Executive Order (EO 11998) | Federal Agencies are required to reduce the risk of flood loss, to minimize the impact of floods, and to restore and preserve the natural and beneficial value of floodplains. | Not Applicable |
| U.S. Army Corps of Engineers Nationwide Permit Program (33 CFR 330) | Activities involving the construction or alteration of bulkheads, dikes, or navigable waters including wetlands are regulated by the Corps of Engineers. | Not Applicable |
| Fish and Wildlife Coordination Act (16 USC 662) | Any action that proposes to modify a body of water or wetland requires consultation with the U.S. Fish and Wildlife Service. | Not Applicable |
| Endangered Species Act (50 CFR 200, 402) | Site activities must minimize impacts on identified endangered plant and animal species. | No endangered plant or animal species have been identified at the Site. |
| Clean Water Act, Section 404(b)(1), Executive Order (EO 11990) | Requires the impacts of chemical residuals and potential remedial action be addressed in the form of a wetland assessment. | Substantive requirements of a wetland assessment will need to be satisfied. |

### 2.13.3 Chemical-Specific SCGs

Chemical-specific SCGs are health or risk-based numerical standards for chemical contaminants that may be present in environmental media (air, water, soil, sediment, etc.). New York State has also adopted standardized methodologies that result in the determination of a concentration limit for chemical contaminants in environmental media which may also serve as target cleanup concentrations. The following sections discuss chemical-specific SCGs with respect to groundwater, surface water, soil and sediment.

#### 2.13.3.1 Groundwater and Surface Water

Chemical-specific Federal and State SCGs relative to water are presented in Table 2-34. State groundwater standards are applied at the point of compliance. The point of compliance, defined by NYCRR 373-2.6(f), is the downgradient limit of the waste management area. No surface waters have been identified as having been contaminated due to activities at the Site. Remedial activities will be reviewed to ensure compliance with appropriate SCGs.

The Qualitative Human Health Evaluation, Section 2.12 (Volume II) of this report, presents a comparison of groundwater contaminant concentrations to the state drinking water standards. Section 2.9.4.1 of this report discusses chemicals detected in the groundwater at concentrations in excess of the NYSDEC groundwater standards.

#### 2.13.3.2 Soil

There are no Federal or promulgated State SCGs for the soil contaminants of concern, however, the State has recommended soil cleanup objectives as contained in TAGM HWR-92-4046 REVISED (January, 1994) entitled, "Determination of Soil Cleanup Objectives and Cleanup Levels".

Section 2.9.4.2 of this report discusses chemicals detected in the surface soil samples at concentrations that exceed the NYSDEC RSCOs.

Target cleanup concentrations for soils may be established using a health-based exposure analysis giving consideration to site-specific conditions. Site-specific conditions depend on various factors including the nature of the soil, the nature of the contaminants, open exposure pathways, and the effects of the chemicals in the soil on human health and the environment. The Qualitative Human Health Evaluation evaluates chemicals found at the Site relative to their potential risk to humans.

#### 2.13.3.3 Floor Drain/Septic Tank Sediment

Chemical-specific SCGs for soil are neither relevant nor appropriate for sediment sampled from the floor drains inside the building and from the septic tank outside the building. The Qualitative Human Health Evaluation presented in Section 2.12 (Volume II) of this report evaluates the concentrations of contaminants found in these sediments relative to potential

## TABLE 2-34

## PELICAN MANUFACTURING, INC. SITE CHEMICAL-SPECIFIC SCGs

| REQUIREMENT STATE | SYNOPSIS | CONSIDERATION |
|---|---|---|
| NYSDEC Quality Standards for Groundwater (6 NYCRR PART 703.5) | Establishes standards for Class GA, GSA and GSB groundwater. | These standards apply to groundwater in the overburden/bedrock deposits as as appropriate. |
| NYSDOH Sources of Water Supply (10 NYCRR PART 170) | Establishes standards for raw drinking water quality. | These standards apply to sources of drinking water. |
| NYS Surface Water Quality Standards (6 NYCRR Parts 701, 702, and 704) | Establishes standards for surface water quality. | These standards apply to waters of New York. |
| NYSDOH Public Water Supplies (1 0 NYCRR 5) | Establishes standards for public drinking water (i.e., finished water). | These standards apply to finished drinking water delivered to consumers. |
| NYS Drinking Water Act MCLs (1 0 NYCRR Part 5) | Establishes maximum contaminant levels for drinking water. | These standards apply to potential drinking waters. |
| NYS RCRA Groundwater Protection Standards (6 NYCRR Parts 256 and 257) | Establishes groundwater protection standards. | These standards apply to groundwaters inpacted by RCRA corrective actions. |
| NYS Ambient Air Quality Standards (6 NYCRR Parts 256 and 257) | Establishes ambient air quality standards. | These standards apply to concentrations in the air resulting in emissions. |

## TABLE 2-34 (CONTINUED)

## PELICAN MANUFACTURING, INC. SITE
## CHEMICAL-SPECIFIC SCGs

| REQUIREMENT | SYNOPSIS | CONSIDERATION |
|---|---|---|
| **FEDERAL** | | |
| RCRA Groundwater Concentration Limits (40 CFR 264, Subpart F) | Establishes groundwater protection standards for RCRA facilities. | This would apply to any treatment, storage, or disposal facility to be constructed. |
| Safe Drinking Water Act Maximum Contaminant Levels (MCLs) (40 CFR 141.11-.16) | Enforcable standards for public drinking water systems. | These requirements apply to finished drinking water delivered to the consumer. |
| Effluent Limitations (40 CFR Part 301 and 302) | Enforceable standards for effluent discharges. | These requirements will apply to liquid discharges from the Site. |
| National Ambient Air Quality Standards (40 CFR 50) | Enforceable standards for air quality. | These requirements will apply to air emissions at the Site. |
| RCRA Regulation for Identifying Hazardous Waste (40 CFR 261) | Enforceable standards for determining the hazardous waste status. | These requirements will determine the nature of wastes generated at the Site. |

health risk from human exposure. This risk analysis provides guidance in determining the need for remediation of these sediments.

Action-specific SCGs must be considered for proposed remedial alternatives for the handling and treatment and/or disposal of the sediments from the floor drains and septic tank.

### 2.13.4 Action-Specific SCGs

Action-specific requirements set controls or restrictions on the design, performance and other aspects of implementation for actions taken at a site. For example, RCRA requirements will be applicable if the remediation constitutes treatment, storage or disposal of a hazardous waste as defined under RCRA. Other examples of action-specific requirements are Clean Water Act standards for discharge of treated groundwater and New York State regulations 6 NYCRR Part 703 which establishes surface water and groundwater quality standards and groundwater effluent standards.

Since action-specific SCGs apply to discrete remedial activities, their evaluation is presented with the detailed analysis of alternatives for each retained alternative. The following action-specific SCGs are potentially applicable to the Pelican site:

**State:**

- New York State RCRA Standards for the Design and Operation of Hazardous Waste Treatment Facilities (i.e., landfills, incinerators, tanks, containers, etc.) Minimum Technology Requirements (6 NYCRR Parts 370-372);
- New York State RCRA Closure and Post-Closure Standards (Clean Closure and Waste-in-Place Closures) (6 NYCRR Part 372);
- New York State RCRA Generator and Transporter Requirements for Manifesting Waste for Off-Site Disposal (6 NYCRR Parts 364 and 372);
- New York State Land Disposal Restrictions (6 NYCRR Part 376); and
- New York State Air Emission Requirements (VOC Emission for Air Strippers and Process Vents, General Air Quality) (6 NYCRR Parts 200-212).

**Federal:**

- RCRA Subtitle C Hazardous Waste Treatment Facility Design and Operating Standards for Treatment and Disposal Systems, (i.e., landfills, incinerators, tanks, containers, etc.) (40 CFR 264 and 265) (Minimum Technology Requirements);

## 3.0 SECOND PHASE REMEDIAL INVESTIGATION

### 3.1 Introduction

On the basis of a review of the Draft First Phase RI/FS Report for the Pelican site dated July, 1993, the Department determined that additional investigative work was necessary at the Site. Following receipt of the Department's comments relative to the draft report, and discussions between NYSDEC and DUNN personnel, it was decided to perform a Second Phase RI. The scope of the Second Phase RI was to include: the collection of surface water and sediment samples from the shallow drainageway that borders the Site on the west; the collection of soil samples from beneath the floor slab of the northern two Pelican buildings (No's 2221 and 2223 Washington Street); with headspace screening of those samples by field GC, and laboratory analysis of selected soil samples; the collection an additional round of groundwater samples from selected on-site wells; and the excavation of several test pits to investigate possible subsurface pipes and/or discharge locations and to collect soil samples for chemical analysis.

### 3.2 Objectives

The objectives of the Second Phase RI were to ascertain if the surface water and/or sediment in the drainageway had been impacted by activities at the Site; to determine if significant soil contamination existed beneath the concrete floor slab of the Pelican buildings where solvents are known to have been stored and used; to further evaluate groundwater quality in the upper, unconfined water bearing zone underlying the Site, particularly with respect to metals; to research the possible existence and location of subsurface outlet pipes from the SED-1 floor drain inside the "solvent room" of building No. 2223 and from the above ground septic tank (SED-4 location) at the rear (west) of building No. 2221 where it joins building No. 2219 1/2; and, finally, to collect soil samples from the test pits to explain or confirm the results of the previous soil gas survey and surface soil sampling.

### 3.3 Preliminary Second Phase RI Sampling

Prior to DUNN's performance of Second Phase RI, Department personnel collected surface water and sediment samples from four locations (A, B, C, and D) in the shallow drainageway that borders the Site to the northwest and west. This area had initially been targeted for sampling during the First Phase RI on the basis of historical sampling results and evidence of contamination in the drainageway near the northwest corner of the Site. However, because of the off-site, upgradient location of some of the historical sampling points, and the fact the drainageway formed a natural boundary between the toe of the fill on the Pelican site and the toe of the fill on the adjacent (westward) Jamestown City Landfill, sampling of this feature was not included in the First Phase RI. And, while discussed as a potential part of DUNN's Second Phase RI activities, this sampling effort was actually performed by the Department in November of 1993.

The four sampling points were selected to represent two "upstream" (A and B), one "side stream" (C) and one "downstream" location (D). A surface water and sediment sample were collected at each location and analyzed by NYSDEC Mobile Lab personnel for selected metals (arsenic, chromium, lead, zinc and mercury). The locations of the four sampling points are shown in Appendix M.

## 3.4 Methodologies for the Second Phase RI Sampling

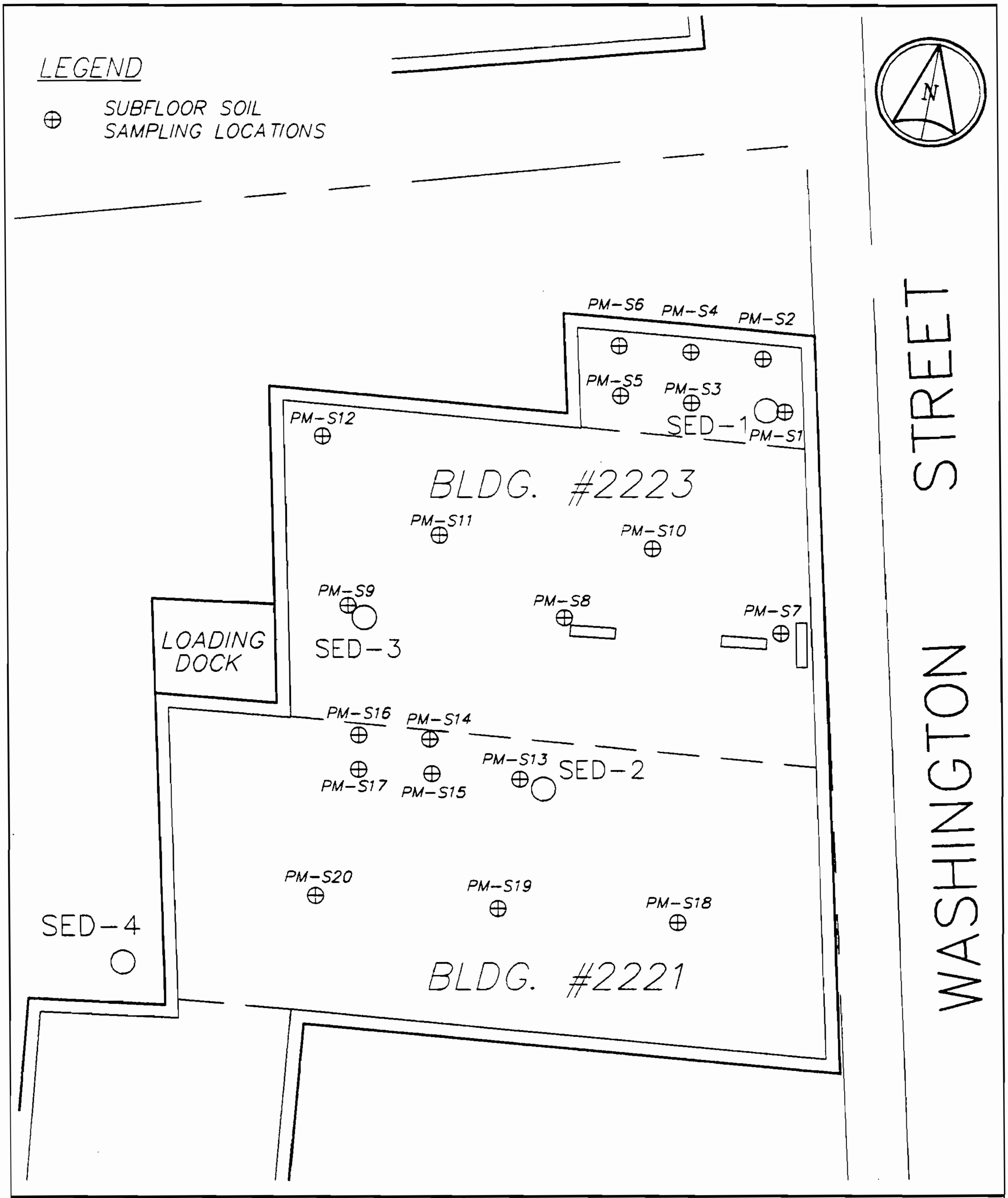
### 3.4.1 Interior Soil Sampling

Twenty potential locations were identified for the collection of soil samples from beneath the concrete floor slab. Twelve of the sampling locations were in building No. 2223, including six in the "solvent room", and eight of the locations were in building No. 2221. The locations in building No 2223 were identified on the basis of reports and evidence of solvent storage tanks, the location of the SED-1 floor drain, the floor drain grates and the SED-3 floor drain and to provide general coverage throughout the building. The locations in building No. 2221 were identified on the basis of an initial site inspection during the summer of 1992, the SED-2 floor drain, and to provide general coverage throughout the building. Refer to Figure 3-1 for the interior soil sampling locations.

The methodology utilized to obtain the interior soil samples was first to drill through the approximate four inch thick concrete floor slab with a four inch diameter, carbide tipped, coring bit and removing the core to allow access to the subfloor materials. The coring machine was electrically powered and water lubricated utilizing utilities within the building. Only the minimum amount of water was utilized because of freezing temperatures and to avoid flooding the core hole. An HNU Photoionization detector was utilized to screen the vapors emanating from the corehole and beneath the floor both for health and safety purposes as well as to identify potential sampling locations.

Following removal of the concrete core, a small diameter stainless steel auger was inserted into the corehole to penetrate the soil beneath the floor slab. Samples were then extracted from various depths beneath the slab using the auger or by hand. In many instances, the sub-floor materials consisted of fill and/or coarse materials (brick, rock, gravel, cobbles, etc.) that were too large to be removed through the corehole or to provide a viable sample for headspace screening or chemical analysis.

The samples were placed in containers and transported to the sampling van or nearby location for preparation and conduct of headspace screening with a field GC. Upon completion of the field GC screening, selected duplicate samples were sent to a laboratory for further analysis. Refer to the next section for specific details of the headspace screening procedure and results, and the criteria for selecting samples for laboratory analysis.



**DUNN ENGINEERING COMPANY**

DIVISION OF **RUST** ENVIRONMENT & INFRASTRUCTURE

**INTERIOR SUBFLOOR SOIL SAMPLING LOCATIONS**

PELICAN MANUFACTURING, INC. SITE

City of Jamestown
Chatauqua Co., NY

PROJECT No. 35120.700
DATE 7/18/94
DWG. No. 35120-01
SCALE 1"=20'
FIGURE No. 3-1

## 3.4.2 Headspace Screening

### 3.4.2.1 Sample Analysis

**Instrumentation**

A Photovac 10S70 Gas Chromatograph (GC) equipped with a photoionization detector (PID) was utilized for analysis of the six site-specific volatile organic compounds (VOCs) consisting of trans-1,2-dichloroethene, cis-1,2-dichloroethene, 1,1,1-trichloroethane, trichloroethene, toluene and tetrachloroethene. The Photovac GC analyzes gaseous samples and generates quantitative data specific to each compound. After injection into the instrument, the gaseous sample flows through a chromatographic column prior to the PID. The various VOCs pass through this column at different rates and thus reach the detector at different times after the injection. A strip-chart record of detector response versus time is obtained during each analysis and the presence of VOCs in the sample is manifested by peaks on this strip-chart record.

The portable GC measures two parameters for each peak observed during the analysis. First, the length of time (known as the retention time) is measured between the initial injection of the sample and the detection of the peak; each VOC has a characteristic retention time by which it is tentatively identified. Second, the portable GC integrates the detector response to measure the area under the peak. The area measured in millivolt seconds (mv-s) is proportional to the concentration of the compound in the sample. The concentration of the analyte in the sample is calculated by direct comparison with a standard of known concentration.

**Standards Preparation**

Stock and working standards were prepared as follows. Pure product of each analyte was added by 10 microliter (ul) syringe to a previously tared 10 milliliter (ml) volumetric flask half filled with reagent grade methanol. The exact weight of the analyte added was recorded to the nearest 0.0001g. Each analyte was added to the same tared flask in a similar fashion at the appropriate ratio's and diluted to the 10ml mark with reagent grade methanol to yield a stock standard mix. A 100ul aliquot of the stock standard mix was then withdrawn (via 100ul syringe), introduced to a second 10ml volumetric flask half filled with methanol, and diluted to the mark to yield a working calibration standard mix. Refer to Appendix N for standard preparation logs.

Calibration standards were prepared by injecting an aliquot of the working calibration standard mix into 10 grams (g) of sodium sulfate in a 40ml VOA vial. Twenty milliliters of distilled water was quickly added to the standard (50-50 headspace/sample). The VOA vial was shaken vigorously for one minute and allowed to stand for four minutes in a heated sand bath (50° Celsius). A 250ul aliquot of headspace vapor was then withdrawn with a gas-tight syringe and injected into the GC for analysis.

### Instrument Calibration

In order to determine the linear range of the detector, an external calibration curve was established by preparing calibration standards at six different concentrations and analyzed as previously discussed. The ratio of the instrument response (peak area in mv-s) to the mass of analyte injected (in ug), defined as the response factor (RF), was calculated for each standard. Since the percent relative standard deviation of the response factors was less than or equal to 30% over the working range, linearity through the origin was assumed (refer to Table 3-1). The 20ul and 50ul aliquot of working stock standards were chosen for continuing calibration standards since they yielded an approximate half scale response. Continuing calibration standards were used to calculate target compound concentrations in succeeding samples

### Sample Preparation and Analysis

Sample preparation and analyses were conducted in the same manner as the calibration standards. Approximately 10g of sample was added to a previously tared 40ml VOA vial and the weight recorded to the nearest 0.0001g. Twenty milliliters of distilled water was quickly added to the sample. The VOA vial was shaken vigorously for one minute and allowed to stand in a heated sand bath (50 degrees Celsius) for four minutes. A 250ul aliquot of headspace vapor was withdrawn with a gas tight syringe and injected into the GC for analysis. Ten grams of sample was chosen since it yielded 5 ug/kg to 10 ug/kg (ppb wet weight) detection limits for all the site specific analytes with the exception of 1,1,1-trichloroethane (250 ug/kg). When sample results were above the linear range of the detector, a smaller aliquot of sample (not < 1.0g) was weighed and analyzed in a similar fashion.

Sample analyte concentrations were identified and quantified using the preceding standard and calculated in accordance with the following equation.

Sample Conc (ug/kg)=((SA)x(ug)x(1000))/((STA)x(Wt))

Where: SA=sample analyte peak area (mv-s)

ug=mass of standard injected (ug)

STA=standard analyte peak area (mv-s)

Wt=sample wet weight (g)

1000=conversion factor from g to kg

Sample calculations can be found beneath individual chromatograms in Appendix N, tabulated results are presented in Table 3-2.

# TABLE 3-1
# PELICAN MANUFACTURING, INC. SITE
# SUBFLOOR SOIL ANALYSES
# INSTRUMENT INITIAL CALIBRATION DATA
# FEBRUARY 2 1994

| | | Microliters of Working Stock to Twenty Milliliters of Water | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Parameter | Parameter Data | 5ul | 10ul | 20ul | 50ul | 100ul | 150ul | %RSD |
| Trans-1,2-Dichloroethene | Retention Time (Sec) | 32.80 | 31.60 | 34.80 | 29.80 | 30.50 | 30.50 | |
| | ug Injected | 0.0295 | 0.059 | 0.118 | 0.295 | 0.59 | 0.885 | |
| | Peak Area (mv-s) | 256 | 489 | 870 | 2200 | 3700 | 5900 | |
| | Response Factor | 8680 | 8290 | 7370 | 7460 | 6270 | 6670 | 12% |
| Cis-1,2-Dichloroethene | Retention Time (Sec) | 41.30 | 40.00 | 43.70 | 36.20 | 37.50 | 36.90 | |
| | ug Injected | 0.0685 | 0.137 | 0.274 | 0.685 | 1.37 | 2.055 | |
| | Peak Area (mv-s) | 159 | 347 | 611 | 1600 | 2600 | 4800 | |
| | Response Factor | 2320 | 2530 | 2230 | 2340 | 1900 | 2340 | 9.20% |
| 1,1,1-Trichloroethane | Retention Time (Sec) | - | 54.60 | 59.30 | 47.50 | 49.60 | 49.00 | |
| | ug Injected | - | 2.756 | 5.512 | 13.78 | 27.56 | 41.34 | |
| | Peak Area (mv-s) | - | 119 | 533 | 1000 | 1800 | 3100 | |
| | Response Factor | - | 43.20 | 96.70 | 72.60 | 65.30 | 75 | 27% |
| Trichloroethene | Retention Time (Sec) | 84.50 | 82.70 | 88.70 | 68.10 | 71.90 | 69.90 | |
| | ug Injected | 0.058 | 0.116 | 0.232 | 0.58 | 1.16 | 1.74 | |
| | Peak Area (mv-s) | 336 | 633 | 1100 | 2500 | 3800 | 5700 | |
| | Response Factor | 5790 | 5460 | 4740 | 4310 | 3280 | 3280 | 25% |
| Toluene | Retention Time (Sec) | 149.90 | 146.90 | 156.80 | 114.50 | 123.50 | 119 | |
| | ug Injected | 0.093 | 0.186 | 0.372 | 0.93 | 1.86 | 2.79 | |
| | Peak Area (mv-s) | 673 | 1200 | 2100 | 4700 | 6800 | 10200 | |
| | Response Factor | 7240 | 6450 | 5650 | 5050 | 3660 | 3660 | 28% |
| Tetrachloroethene | Retention Time (Sec) | 220.10 | 218.10 | 226.50 | 165.80 | 178.40 | 172.50 | |
| | ug Injected | 0.175 | 0.35 | 0.70 | 1.75 | 3.50 | 5.25 | |
| | Peak Area (mv-s) | 1000 | 1900 | 3100 | 7300 | 11300 | 17300 | |
| | Response Factor | 5700 | 5430 | 4430 | 4170 | 3230 | 3300 | 24% |

Response Factor (RF)=Analyte Peak Area (mv-s)/Mass Injected (ug)

Percent Relative Standard Deviation (%RSD)=(Standard Deviation of RF/Mean RF)x100

%RSD QC Limits=30%

excel:peli3-1.xls

# TABLE 3-2
# PELICAN MANUFACTURING, INC. SITE
## SUBFLOOR SOIL ANALYSES
## FIELD GAS CHROMATOGRAPHY RESULTS
## JANUARY 31 TO FEBRUARY 11, 1994

| **Parameter** | **PMS-1 1ft** | **PMS-1 2ft** | **PMS-1 3ft** | **PMS-2 1ft** | **PMS-2 1ft Dup** | **PMS-2 2ft** | **PMS-2 3ft** | **PMS-2 3ft Spike** | **PMS-3 6in** | **PMS-4 1ft** |
|---|---|---|---|---|---|---|---|---|---|---|
| Trans-1,2-Dichloroethene | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | 53 | <5.0 | <5.0 |
| Cis-1,2-Dichloroethene | 360 | 440 | 970E | 130* | 78E | 180 | 290 | 310 | 22 | 7.9 |
| 1,1,1 -Trichloroethane | <250 | 1500 | 1700 | <250 | <250 | <250 | <250 | 2000 | <250 | <250 |
| Trichloroethene | 2000E | 2000E | 2500E | 1100* | 340E | 1500E | 1600E | 1400E | 340 | 1400E |
| Toluene | <10 | <10 | <10 | 40 | 28 | 13 | 18 | 150 | <10 | <10 |
| Tetrachlorothene | 34 | 31 | 55 | 16 | 15 | 17 | 18 | 310 | <10 | <10 |

| **Parameter** | **PMS-4 2ft** | **PMS--4 3ft** | **PMS-5 1.5ft** | **PMS-7 1ft** | **PMS-7 2ft** | **PMS-7 3ft** | **PMS-8 1ft** | **PMS-8 2ft** | **PMS-8 3ft** | **PMS-9 1ft** |
|---|---|---|---|---|---|---|---|---|---|---|
| Trans-1,2-Dichloroethene | <5.0 | <50 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 |
| Cis-1,2-Dichloroethene | 11 | 10 | 9.9 | <5.0 | <5.0 | 6.6 | 25 | 12 | 8.1 | <5.0 |
| 1,1,1 -Trichloroethane | <250 | <250 | <250 | <250 | <250 | <250 | <250 | <250 | <250 | <250 |
| Trichloroethene | 860 | 550 | 2800E | 60 | 52 | 60 | 170E | 83 | 64 | 28 |
| Toluene | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| Tetrachlorothene | <10 | <10 | 27 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |

| **Parameter** | **PMS-9 1ft Dup** | **PMS-9 2ft** | **PMS-9 3ft** | **PMS-10 1ft** | **PMS-10 2ft** | **PMS-10 3ft** | **PMS-10 3ft Dup** | **PMS-11 1ft** | **PMS-11 2ft** | **PMS-11 3ft** |
|---|---|---|---|---|---|---|---|---|---|---|
| Trans-1,2-Dichloroethene | <5.0 | 5.3 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 |
| Cis-1,2-Dichloroethene | <5.0 | 26 | 9 | <5.0 | <5.0 | 18 | 12 | 12 | 17 | 13 |
| 1,1,1 -Trichloroethane | <250 | <250 | <250 | <250 | <250 | <250 | <250 | <250 | <250 | <250 |
| Trichloroethene | 35 | 34 | 76 | 87 | 120E | 300E | 200 | 150E | 250E | 190 |
| Toluene | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| Tetrachlorothene | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |

All units in ug/kg (ppb) on a wet weight basis

E=Analyte concentration exceeds the linear range of the detector and is an estimated value

*=The 10g sample result was used for duplicate comparison

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# TABLE 3-2 (CONTINUED)
# NYSDEC/SSP-PELICAN MANUFACTURING
# SUBFLOOR SOIL ANALYSES
# FIELD GAS CHROMATOGRAPHY RESULTS
# JANUARY 31 TO FEBRUARY 11,1994

| Parameter | PMS-12 1 ft | PMS-12 1 ft Dup | PMS-12 2 ft | PMS-12 3 ft | PMS-12 3 ft Dup | PMS-13 1 ft | PMS-13 2 ft | PMS-14 1 ft | PMS-14 2ft | PMS-14 3ft |
|---|---|---|---|---|---|---|---|---|---|---|
| Trans-1,2-Dichloroethene | <50 | <50 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 |
| Cis-1,2-Dichloroethene | 240 | 240 | 17 | 10 | 7.5 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 |
| 1,1,1 -Trichloroethane | <2500 | <2500 | <250 | <250 | <250 | <250 | <250 | <250 | <250 | <250 |
| Trichloroethene | 6600E | 5800E | 280 | 74 | 81 | 67 | 76 | 40 | 53 | 43 |
| Toluene | 1600 | 1200 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| Tetrachlorothene | 210 | 180 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |

| Parameter | PMS-14 3ft Spike | PMS-15 1ft | PMS-15 2ft | PMS-15 3 ft | PMS-16 1 ft | PMS-16 2 ft | PMS-16 3 ft | PMS-17 1ft | PMS-17 2 ft | PMS-17 3 ft |
|---|---|---|---|---|---|---|---|---|---|---|
| Trans-1,2-Dichloroethene | 8.7 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 |
| Cis-1,2-Dichloroethene | 15 | <5.0 | <5.0 | <5.0 | <5.0 | 8.3 | 9 | 5.2 | <5.0 | 11 |
| 1,1,1 -Trichloroethane | 1100 | <250 | <250 | <250 | <250 | <250 | <250 | <250 | <250 | <250 |
| Trichloroethene | 53 | 75 | 97 | 83 | 14 | 45 | 50 | 53 | 48 | 110 |
| Toluene | 27 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| Tetrachlorothene | 53 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |

| Parameter | PMS-17 3 ft Dup | PMS-18 1 ft | PMS-18 1 ft Spike | PMS-18 2 ft | PMS-18 3 ft | PMS-18 3 ft Dup | PMS-19 1 ft | PMS-19 2 ft | PMS-20 1 ft | PMS-20 2 ft |
|---|---|---|---|---|---|---|---|---|---|---|
| Trans-1,2-Dichloroethene | <5.0 | <5.0 | 43 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 |
| Cis-1,2-Dichloroethene | 7.7 | <5.0 | 100 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | 13 | 11 |
| 1,1,1 -Trichloroethane | <250 | <250 | 5000 | <250 | <250 | <250 | <250 | <250 | <250 | <250 |
| Trichloroethene | 83 | 18 | 130 | 19 | <5.0 | <5.0 | 23 | 42 | 140 | 180 |
| Toluene | <10 | <10 | 120 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| Tetrachlorothene | <10 | <10 | 210 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |

All units in ug/kg (ppb) on a wet weight basis

E=Analyte concentration exceeds the linear range of the detector and is an estimated value

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#### 3.4.2.2 Quality Assurance/Quality Control

**Blanks**

Instrument/syringe blanks were analyzed daily to demonstrate that the instrument and injection syringe were contaminant free. Method blanks were prepared and analyzed daily to verify that the distilled water, methanol, associated glassware and syringes were contaminant free. Method blanks were prepared and analyzed identically to standards except reagent grade methanol was substituted for the amount of working standard added. Blank results can be found in Appendix N.

**Continuing Calibration Standards**

Continuing calibration standards are mid level concentrations of each analyte (determined from curve) that are used to calculate succeeding samples. Continuing calibration standards were prepared and analyzed on a frequency of at least every six sample injections (refer to Appendix N).

**Duplicate Sample Analyses**

Duplicate analyses were performed on seven samples: PMS-2, 1ft; PMS-9, 1ft; PMS-10, 3ft; PMS-12, 1ft; PMS-12, 3ft; PMS-17, 3ft and PMS-18, 3ft. Results expressing analytical precision in the form of relative percent difference (RPD) are presented in Table 3-3. All samples exhibited acceptable analytical precision between duplicates for field screening activities.

**Matrix Spike Analysis**

Matrix spikes were performed on three samples: PMS-2, 3ft; PMS-14, 3ft and PMS-18, 1ft. Results expressed in percent recovery are presented in Table 3-4 and are acceptable for field screening activities.

### 3.4.3 Additional Groundwater Sampling

The Second Phase RI groundwater sampling program consisted of sampling five of the eight on-site groundwater monitoring wells. The five wells were selected on the basis of their location (both horizontal and screened interval), sampling history and prior results. The wells designated for sampling included "upgradient" wells MW-1S, MW-1D, and MW-22 and downgradient wells MW-19 and MW-20. Water-level measurements were obtained from each of the five monitoring wells prior to initiating the sampling event. To ensure acquisition of representative groundwater samples, each monitoring well was purged by evacuating a minimum of four well volumes. The purging was accomplished using well-dedicated, PVC, bottom-filling bailers and dedicated nylon rope. Field parameters (temperature, pH, conductivity and turbidity) were measured prior to the collection of samples (see Table 3-5). Upon sufficient water-level recoveries, the wells were sampled using the dedicated bailers and in such a manner as to minimize violatilization of the groundwater sample. The appropriate sample containers were filled, packed in ice-filled

# TABLE 3-3
# PELICAN MANUFACTURING, INC. SITE
# SUBFLOOR SOIL ANAYSES DUPLICATE SAMPLE RESULTS
# JANUARY 31 TO FEBRUARY 11,1994

| Parameter | PMS-2 1ft Dup | PMS-2 1ft | RPD | PMS-9 1ft | PMS-9 4ft Dup | RPD |
|---|---|---|---|---|---|---|
| Trans-1,2-Dichloroethene | <5.0 | <5.0 | 0.00% | <5.0 | <5.0 | 0.00% |
| Cis-1,2-Dichloroethene | 77E* | 78E | 13% | <5.0 | <5.0 | 0.00% |
| 1,1,1-Trichloroethane | <250 | <250 | 0.00% | <250 | <250 | 0.00% |
| Trichloroethene | 370E* | 340E | 8.50% | 28 | 35 | 22% |
| Toluene | 40 | 28 | 35% | <10 | <10 | 0.00% |
| Tetrachloroethene | 16 | 15 | 6.50% | <10 | <10 | 0.00% |

| Parameter | PMS-10 3ft | PMS-10 3ft Dup | RPD | PMS-12 1ft | PMS-12 1ft Dup | RPD |
|---|---|---|---|---|---|---|
| Trans-1,2-Dichloroethene | <5.0 | <5.0 | 0.00% | <50 | <50 | 0.00% |
| Cis-1,2-Dichloroethene | 18 | 12 | 40% | 240 | 240 | 0.00% |
| 1,1,1-Trichloroethane | <250 | <250 | 0.00% | <2500 | <2500 | 0.00% |
| Trichloroethene | 300E | 200 | 40% | 6600E | 5800E | 13% |
| Toluene | <10 | <10 | 0.00% | 1600 | 1200 | 29% |
| lTetrachloroethene | <10 | <10 | 0.00% | 210 | 180 | 15% |

| Parameter | PMS-12 3ft | PMS-12 3ft Dup | RPD | PMS-17 3ft | PMS-17 3ft Dup | RPD |
|---|---|---|---|---|---|---|
| Trans-1,2-Dichloroethene | <5.0 | <5.0 | 0.00% | <5.0 | <5.0 | 0.00% |
| Cis-1,2-Dichloroethene | 10 | 7.5 | 29% | 11 | 7.7 | 35% |
| 1,1,1-Trichloroethane | <250 | <250 | 0.00% | <250 | <250 | 0.00% |
| Trichloroethene | 74 | 81 | 9.00% | 110 | 83 | 28% |
| Toluene | <10 | <10 | 0.00% | <10 | <10 | 0.00% |
| Tetrachloroethene | <10 | <10 | 0.00% | <10 | <10 | 0.00% |

| Parameter | PMS-18 3ft | PMS-18 3ft Dup | RPD |
|---|---|---|---|
| Trans-1,2-Dichloroethene | <5.0 | <5.0 | 0.00% |
| Cis-1,2-Dichloroethene | <5.0 | <5.0 | 0.00% |
| 1,1,1-Trichloroethane | <250 | <250 | 0.00% |
| Trichloroethene | <5.0 | <5.0 | 0.00% |
| Toluene | <10 | <10 | 0.00% |
| Tetrachloroethene | <10 | <10 | 0.00% |

All units in ug/Kg (ppb) on a wet weight basis
*'=Duplicate comparisons based on log sample analysis
Relative Percent Difference (RPD)=((S1-S2)/((S1+S2)/2))*100
Where: SI=original sample result
S2=duplicate sample result
RPD QC Limits =40%
E=Analyte concentration exceeds the linear range of the detector and is an estimated value

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# TABLE 3-4
# PELICAN MANUFACTURING, INC. SITE
# SUBFLOOR SOIL ANALYSES
# MATRIX SPIKE RESULTS
# JANUARY 31 TO FEBRUARY 11, 1994

| Sample PMS-2 3 ft | | | | |
|---|---|---|---|---|
| **Parameter** | **Sample Concentration** (ug/kg) | **Amount Analyte Added** (ug/kg) | **Value Recieved** (ug/kg) | **Percent Recovery** (ug/kg) |
| Trans-1,2-Dichloroethene | <5.0 | 44 | 53 | 120% |
| Cis-1,2-Dichloroethene | 290 | 100 | 310 | 790% |
| 1,1,1-Trichloroethane | <250 | 2100 | 2000 | 95% |
| Trichloroethene | 1600E | 86 | 1400E | 0% |
| Toluene | 18 | 140 | 150 | 95% |
| Tetrachloroethene | 18 | 260 | 310 | 112% |

| Sample PMS-14 3ft | | | | |
|---|---|---|---|---|
| **Parameter** | **Sample Concentration** (ug/kg) | **Amount Analyte Added** (ug/kg) | **Value Recieved** (ug/kg) | **Percent Recovery** (ug/kg) |
| Trans-1,2-Dichloroethene | <5.0 | 9.9 | 8.7 | 88% |
| Cis-1,2-Dichloroethene | <5.0 | 21 | 15 | 71% |
| 1,1,1-Trichloroethane | <250 | 900 | 1100 | 122% |
| Trichloroethene | 43 | 24 | 53 | 79% |
| Toluene | <10 | 32 | 27 | 84% |
| Tetrachloroethene | <10 | 51 | 53 | 104% |

| Sample PMS-18 1ft | | | | |
|---|---|---|---|---|
| **Parameter** | **Sample Concentration** (ug/kg) | **Amount Analyte Added** (ug/kg) | **Value Recieved** (ug/kg) | **Percent Recovery** (ug/kg) |
| Trans-1,2-Dichloroethene | <5.0 | 59 | 43 | 73% |
| Cis-1,2-Dichloroethene | <5.0 | 120 | 100 | 83% |
| 1,1,1-Trichloroethane | <250 | 5300 | 5000 | 94% |
| Trichloroethene | 18 | 140 | 130 | 82% |
| Toluene | <10 | 190 | 120 | 63% |
| Tetrachloroethene | <10 | 300 | 210 | 70% |

Spike Recovery QC Limits = 60 - 140%

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# TABLE 3-5

## PELICAN MANUFACTURING, INC. SITE
## FIELD PARAMETERS
## FEBRUARY 8, 1994

| Monitoring Well (MW) | Temperature (°C) | pH (Std). | Specific Conductance (UMHO'S/CM²) | Turbidity (NTU) |
|---|---|---|---|---|
| *1S | 7.7 | 6.61 | 3510 | 106 |
| 1D | 10.4 | 6.94 | 520 | >1000 |
| 19 | 7.2 | 7.05 | 1760 | 125 |
| 20 | 7.3 | 7.14 | 1470 | 9 |
| 22 | 6 | 6.96 | 772 | 765 |

*="Septic or Sulfur Odor" noted in this well

C=celsius

Std.=Standard Units

umho's/cm²=Micromho's per square centimeter

NTU=Nephelometric Turbidity Units

coolers, and sent by overnight express delivery to Aquatec, Inc. laboratory for analysis. Groundwater samples from each monitoring well, with the exception of MW-22, were analyzed for the following parameters: TCL-CLP volatile organics, semi-volatile organics, TAL metals (total and soluble) and cyanide. Groundwater from MW-22 was analyzed for TCL-CLP volatile organics, semi-volatile organics and cyanide. Field filtering of the suspended metals in all groundwater samples was accomplished using location - dedicated field filters.

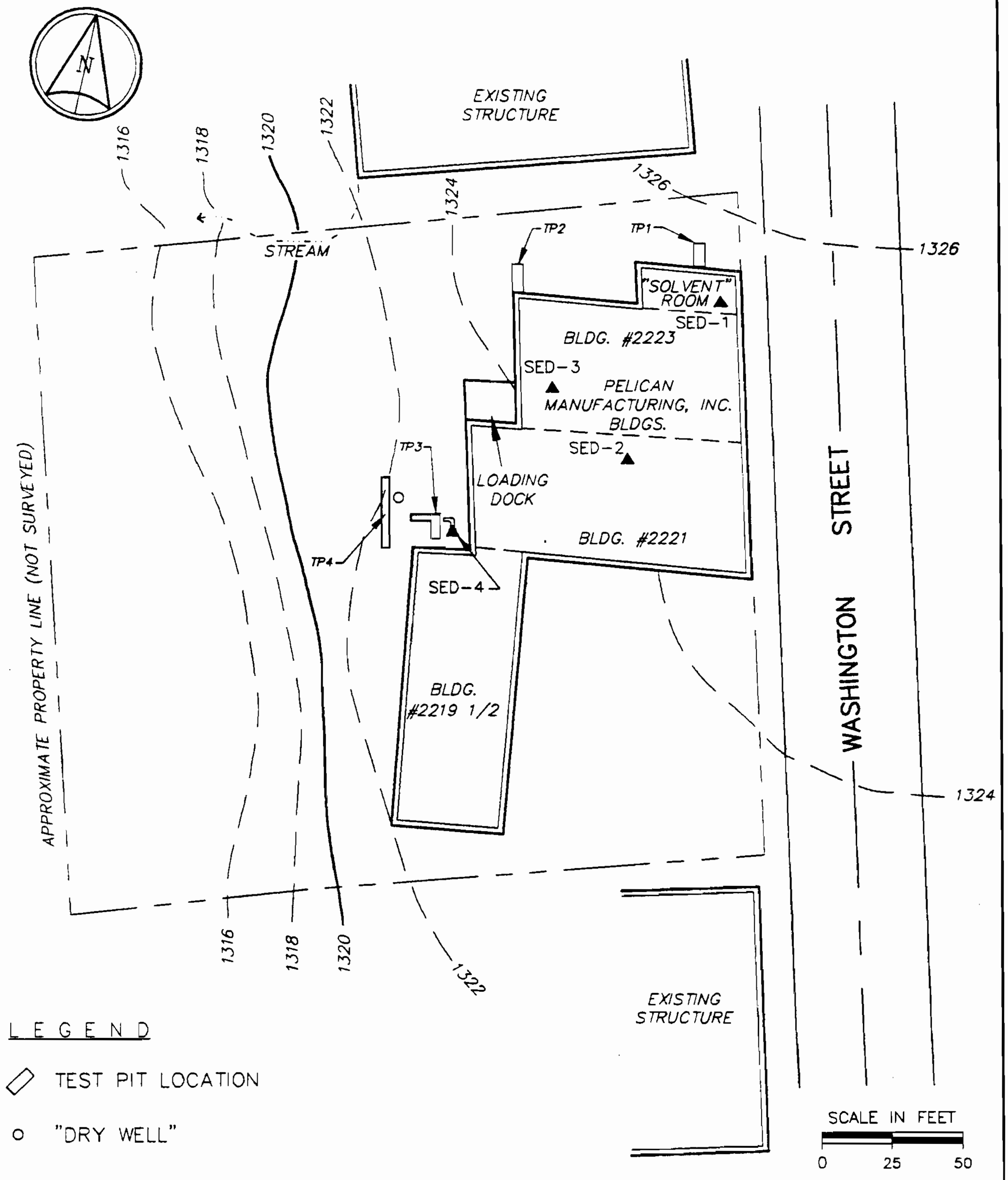
A matrix spike/matrix spike duplicate (MS/MSD) sample was obtained from MW-1D to fulfill the requirements of the QA/QC program. However, field filtering for TAL metals analysis of the MS/MSD sample was not performed on this sample since only TAL metals (total) analysis was requested.

### 3.4.4 Test Pitting and Soil Sampling

A total of four test pits, PM-TP1 through PM-TP4, were excavated by American Auger and Ditching Co. as part of the Second Phase RI subsurface investigation program. The test pits were excavated using a rubber-tired backhoe and were advanced to a depth of three to five feet below existing grade. The test pits were advanced to determine the presence of underground drainage lines emanating from the north side of building No. 2223, possibly from the SED-1 floor drain location inside the "solvent room"; to confirm the First Phase soil gas survey and surface soil sampling results; and to determine the possible connection between the above-ground septic tank and the suspected dry well. Refer to Figure 3-2 for the approximate test pit locations. Test Pit Logs, which provide detailed soil descriptions, headspace results, and intervals sampled at each location, are presented in Appendix D.

Subsurface soils were excavated in approximate one-foot lifts and soil samples were obtained at approximately 1-2 feet, 2-3 feet and 3-4 feet below grade. Both laboratory sample jars and headspace sample jars were filled at each sampling interval using location-dedicated sampling equipment. Representative soil samples from each interval were obtained from the bottom of the test pits using stainless steel trowels. Test pit soils to be analyzed for VOCs were obtained with a stainless steel trowel and transferred directly into the appropriate containers. Soil required for the remainder of the analyses was placed in a stainless steel mixing bowl, homogenized to ensure a representative sample, and subsequently transferred to the appropriate containers. Headspace soil samples were covered with aluminum foil and allowed to equilibrate in a heated location prior to screening with an HNu organic vapor analyzer equipped with a 10.2Ev lamp and calibrated for a benzene standard.

Soil samples from all intervals exhibiting the highest headspace results were shipped overnight express to Aquatec, Inc. laboratory and analyzed for full NYSDEC CLP-TCL and TAL parameters. The only exception to this methodology occurred at PM-TP1, where an underground drainage pipe was encountered at a depth of approximately 18 inches below grade. Based on the elevated headspace results at this location (refer to test pit logs in Appendix D), the soil samples from all intervals sampled (1-2 feet, 2-3 feet, and 3-4 feet) were sent to the laboratory for complete CLP TCL/TAL analysis, with the exception of soil sample PM-TP1, 3-4 feet which was analyzed for TCL VOCs only. As part of the QA/QC program, a matrix spike/matrix spike duplicate sample was obtained from PM-TP3 at a



**DUNN ENGINEERING COMPANY**
DIVISION OF **RUST** ENVIRONMENT & INFRASTRUCTURE

**TEST PIT LOCATIONS**

PELICAN MANUFACTURING, INC. SITE

City of Jamestown
Chautauqua Co., N.Y.

PROJECT No. 35120.700
DATE 7/28/94
DWG. No. 2A9421_4
SCALE 1"=50'
FIGURE No. 3-2

depth of 2-3 feet. Subsurface conditions encountered at each location and the associated analytical results are discussed in Section 3.5.5.

## 3.5 Results

### 3.5.1 NYSDEC Surface Water and Sediment Sample Analytical Results

In November 1993, NYSDEC personnel collected four surface water and four sediment samples in the vicinity of the Pelican site. Surface water and sediment samples PMSW-A/PMSD-A and PMSW-B/PMSD-B were collected from locations upstream of the Site. Surface water/sediment sample PMSW-C/PMSD-C was collected adjacent to the Site, from the drainage feature that is located adjacent to the Site and flows in a north to south direction. Surface water/sediment sample PMSW-D/PMSD-D was collected downstream of the Site from the same drainage feature as the PM-C samples. Approximate sampling locations are depicted in the figure that accompanies the NYSDEC sampling report (See Appendix M).

All samples were analyzed for volatile organics and metals. The original analytical results are summarized in the analytical tables (reports) contained in Appendix M. The data are tabulated in Tables 3-6 and 3-7 and discussed in the following text.

#### 3.5.1.1 Surface Water Analytical Results

The NYSDEC surface water sampling analytical results are summarized in Table 3-6.

**Volatile Organics**

The volatile organic data revealed that surface water sample PMSW-A exhibited a benzene concentration (10 ug/l) that exceeded the NYSDEC surface water standard (0.7 ug/l). Sample PMSW-C exhibited trichloroethene (51 ug/l) and 1,2-dichloroethene (182 ug/l) that exceeded the NYSDEC surface water guidance values for these compounds (trichloroethene, 3 ug/l and 1,2-dichloroethene, 5 ug/l).

Sample PMSW-A was collected upstream of the Site. Also, benzene was not detected at elevated concentrations in site groundwater, surface soil, or subsurface soil samples. Therefore, the elevated benzene detected in surface water sample PMSW-A is, most likely, not related to the Pelican site

The PMSW-C sample was collected adjacent to and west of the Site, from the drainage feature that flows in a southerly direction between the former Jamestown City Landfill and the Site and ultimately discharges to the Chadakoin River. Both trichloroethene and 1,2-dichloroethene (total) were detected at elevated concentrations in site groundwater and sediment drain samples. Monitoring wells MW-19 and MW-20 are shallow wells screened predominantly in fill material and are located between the Pelican buildings and the drainage feature located west of the Site. Both of these wells exhibited trichloroethene and 1,2-dichloroethene (total) concentrations that were significantly elevated with respect to the

# TABLE 3-6

## PELICAN MANUFACTURING, INC. SITE
## NYSDEC SURFACE WATER SAMPLING RESULTS
## NOVEMBER 4, 1994

| Volatile Organics (ug/l)<br>Parameter | PMSW-A | PMSW-B | PMSW-C | PMSW-D | NYSDEC Surface Water Standard |
|---|---|---|---|---|---|
| Benzene | 10 | <5 | <5 | <5 | 1 |
| 1,2-Dichloroethene | <5 | <5 | 182 | <5 | 5* |
| Trichloroethene | 5 | <5 | 51 | <5 | 11 |

| Metals (ug/l)<br>Parameter | PMSW-A | PMSW-B | PMSW-C | PMSW-D | NYSDEC Surface Water Standard** |
|---|---|---|---|---|---|
| Arsenic | 1 | ND | 200 | 35 | 190***(+50) |
| Chromium | ND | ND | 4 | 12 | 9*** |
| Lead | 27 | 31 | 200 | 31 | 3.2*** |
| Zinc | 2200 | 2300 | 3350 | 2560 | 82.6*** |

*-Indicates NYSDEC Guidance Value
**-Indicates standard calculated assuming a hardness of 100 mg/l.
***-Indicates standard based on propogation of aquatic life and wildlife.
ND-Indicates not-detected at or above the laboratory reporting limit.
(+)-Indicates standard based on human health water source.

groundwater standards. Therefore, the elevated concentrations of trichloroethene and trans 1,2-dichloroethene detected in the PMSW-C sample may be site-related. However, the potential origin of these chemicals from the former Jamestown City Landfill cannot be dismissed.

**Metals**

Surface water analytical results revealed that all four surface water samples exhibited concentrations of lead and zinc that exceeded NYSDEC surface water standards. Sample PMSW-C exhibited the highest concentrations of lead and zinc. The chromium, lead and zinc standards were calculated assuming that the surface water had a hardness of 100 mg/l. Sample PMSW-C exhibited an arsenic concentration that exceeded the surface water standard for propagation of aquatic life and wildlife, Sample PMSW-D exhibited a chromium value that exceeded the NYSDEC surface water standard for propagation of aquatic life and wildlife.

Surface soil and sediment drain samples collected at the Site exhibited elevated concentrations of lead and zinc. The sediment drain samples also exhibited elevated concentrations of chromium. The arsenic, chromium and lead concentrations detected in surface water samples adjacent to (PMSW-C) and downstream of (PMSW-D) the Site were higher than the concentrations detected in the two upstream samples. Lead and zinc concentrations detected in the PMSW-C sample were higher than the levels detected in the two upstream samples. The data indicate that surface water quality in the drainage ditch may be impacted by the Pelican site, with respect to arsenic, chromium, lead and zinc. However, the possibility that the surface water in the drainage ditch is being impacted by the former Jamestown City Landfill cannot be dismissed.

#### 3.5.1.2 Sediment Analytical Results

The NYSDEC sediment sampling analytical results are summarized in Table 3-7.

**Volatile Organics**

Sediment volatile organic data revealed that 1,2 dichloroethene and toluene were detected in sediment samples PMSD-C and PMSD-D, respectively. Neither of these compounds were detected in the two sediment samples collected upstream of the Site. Both of these compounds were detected at elevated concentrations in groundwater and some sediment samples collected from the Site. Considering that neither of these compounds were detected in the upstream samples and both compounds have been detected in site media, the Pelican site is a potential source of these compounds. However, the former Jamestown City Landfill cannot be ruled out as a potential source of these compounds. There are no NYSDEC sediment criteria guidance levels for either of these compounds.

**Metals**

Analytical results revealed that sediment sample PMSD-C, collected from the drainage feature adjacent to the Site, exhibited arsenic, chromium, and zinc concentrations that were

# TABLE 3-7
## PELICAN MANUFACTURING, INC. SITE
## NYSDEC SEDIMENT SAMPLING RESULTS
## NOVEMBER 4, 1993

**Volatile Organics (ug/kg)**

| Parameter | PMSD-A | PMSD-B | PMSD-C | PMSD-D | NYSDEC Sediment Criteria |
|---|---|---|---|---|---|
| 1,2-Dichloroethene | <5 | <5 | 940 | <5 | No criteria |
| Toluene | <5 | <5 | <50 | 85 | 191* |

**Metals (mg/kg)**

| Parameter | PMSD-A | PMSD-B | PMSD-C | PMSD-D | NYSDEC Sediment Criteria** |
|---|---|---|---|---|---|
| Arsenic | 7.5 | 22 | 290 | 35 | 6/33 |
| Chromium | 10 | 19 | 53 | 24 | 26/110 |
| Lead | 210 | 150 | 160 | 165 | 31/250 |
| Mercury | 0.4 | 1.7 | 1.6 | ND | 0.2/2 |
| Zinc | 310 | 225 | 5770 | 260 | 120/280 |

*-indicates derived value. See text section 2.11 for derivation.
**-Indicates lowest effect level/severe effect level
ND-Indicates not-detected at or above the laboratory reporting limit.

elevated with respect to both the two upstream sediment sample concentrations and the NYSDEC sediment criteria concentrations. However, the chromium and zinc concentrations detected in sample PMSD-D, which was collected downstream from the PMSD-C sample, were similar to the upstream sediment sample results. These data indicate that the Site could have had an impact on the drainage ditch sediments with respect to arsenic, chromium and zinc. However, the metals could also have originated in the former Jamestown City Landfill. Based on the PMSD-D data, the impacted area is apparently limited in extent. Although the arsenic, lead and zinc concentrations in the PMSD-D sample exceeded the NYSDEC sediment criteria, the concentrations were similar to upstream concentrations. The arsenic, lead and zinc concentrations in both the upstream (SD-A and SD-B) and downstream (SD-D) samples exceeded the NYSDEC lowest effect level sediment criteria value; the SD-A zinc value exceeded the severe effect level value. These analytical data indicate the potential for upstream sources of arsenic, lead, mercury and zinc at levels that exceed NYSDEC sediment criteria.

The concentrations of arsenic, lead, mercury and zinc in all sediment samples, and chromium in sample PMSD-C, indicate that the sediments have been impacted with respect to the ability to support benthic biota. However, as previously stated, there is the potential for sources of arsenic, lead, mercury and zinc upstream of the Site and, possibly, from the former Jamestown City Landfill. Removal of the sediments adjacent to the Site might not be sufficient to significantly improve long term sediment quality adjacent to or downstream of the Site, considering that there could still be other sources of contaminants.

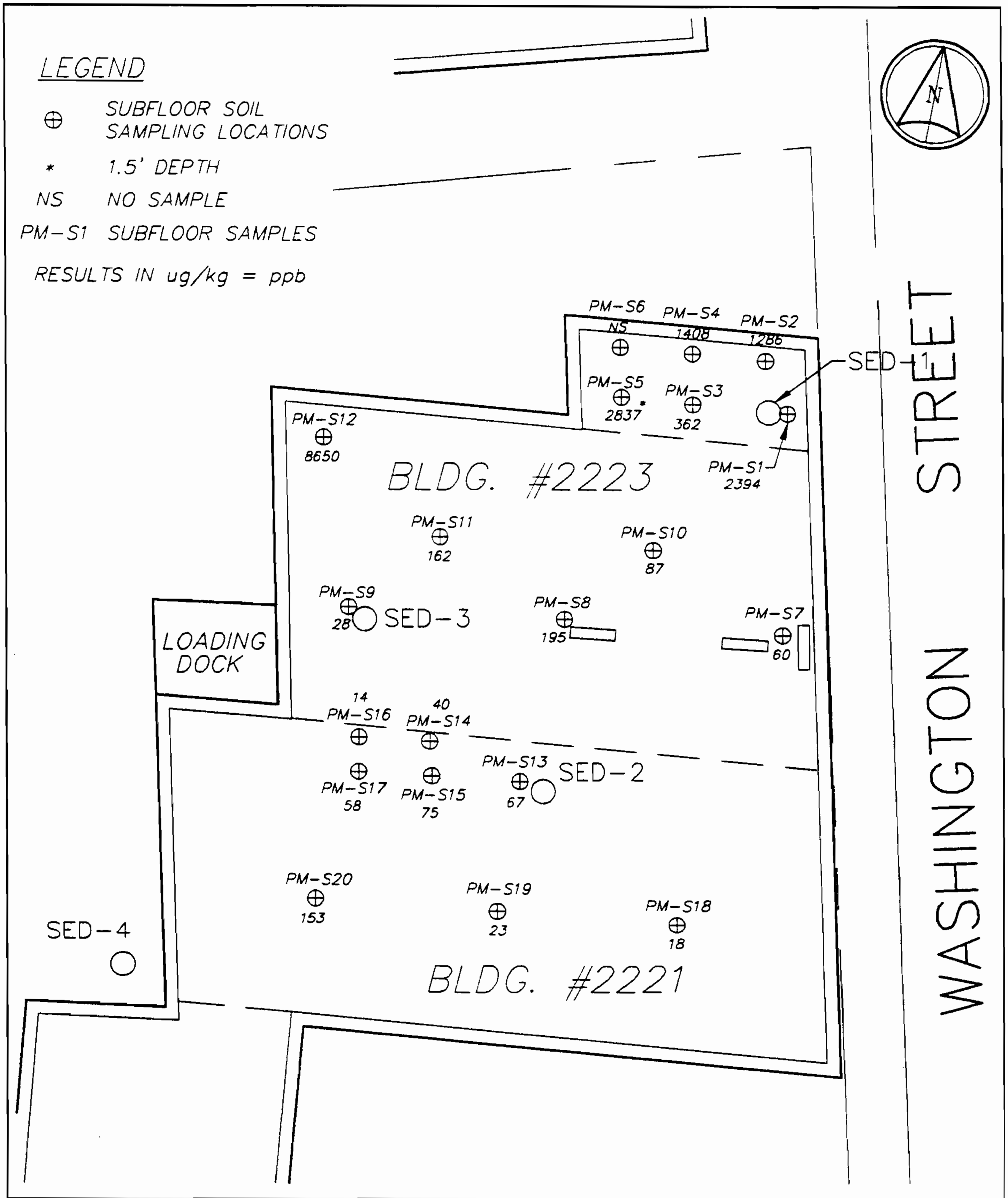
### 3.5.2 Field Gas Chromatography Results

Review of the field gas chromatography results indicate the following. The highest levels of soil contaminant concentrations were encountered beneath the former solvent room (TCE concentrations in the thousand ppb range), with a gradual decrease in magnitude progressing away from the room. This is demonstrated by sub-floor soils exhibiting TCE in the hundreds of ppb in building No. 2223, decreasing to double digits in building No. 2221. Sample PMS-12 in building No. 2223 was an exception in that it exhibited higher than usual concentrations of TCE (6600 ug/kg E) in the first foot with concentrations decreasing with depth.. This sample was located near the northwest corner of building No. 2223 and may indicate an isolated spill in this area. Generally, TCE concentrations were equivalent in magnitude with respect to depth. However, samples from locations PMS-4, PMS-8 and PMS-12 exhibited a decrease in the magnitude of TCE concentrations with depth, while TCE in samples from locations PMS-9, PMS-10, PMS-15, PMS-16 and PMS-17 tended to increase with depth. Anomalies in the vertical and areal extent of the contamination are most likely due to the nonhomogeneity of the fill material beneath the buildings.

Figures 3-3 through 3-5 present total volatiles at one foot intervals beneath the floor slab.

Figures 3-6 through 3-8 present TCE concentrations at one foot intervals beneath the floor slab.

Based on field gas chromatography results, the following samples were selected for confirmation and shipped to Aquatec laboratories either that same day or the following day. At the time of selection, the analyst did not have the exact quantitation of the analytes



**DUNN ENGINEERING COMPANY**

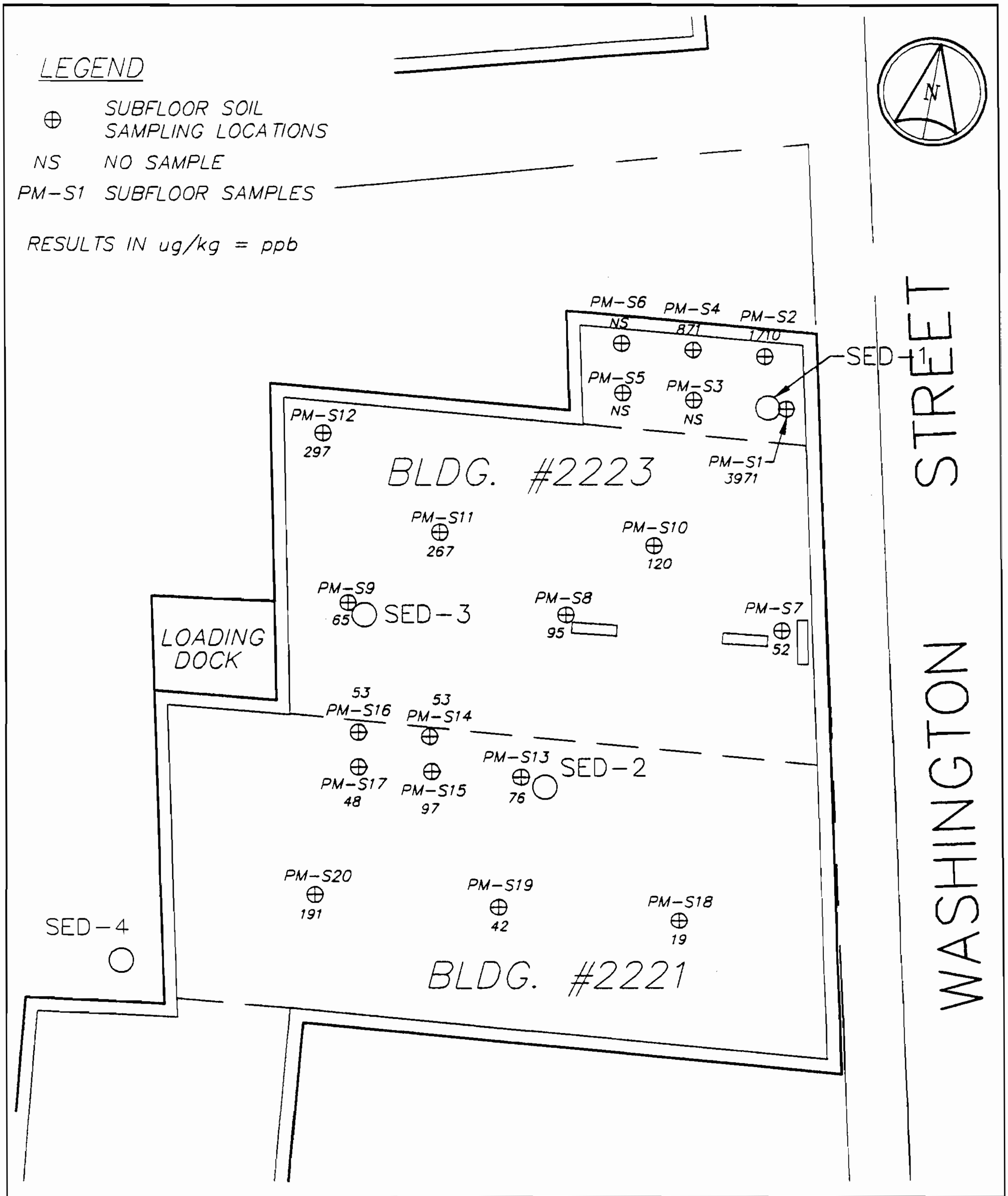
DIVISION OF RUST ENVIRONMENT & INFRASTRUCTURE

**SUBFLOOR SOIL SAMPLES**
**HEAD SPACE ANALYSIS**
**MINIMUM TOTAL VOLATILES 0-1 FT. DEPTH**

PELICAN MANUFACTURING, INC. SITE

City of Jamestown — Chataugua Co., NY

| | | | | |
|---|---|---|---|---|
| PROJECT No. 35120.700 | DATE 7/18/94 | DWG. No. 35120-02 | SCALE 1"=20' | FIGURE No. 3-3 |



**DUNN ENGINEERING COMPANY**

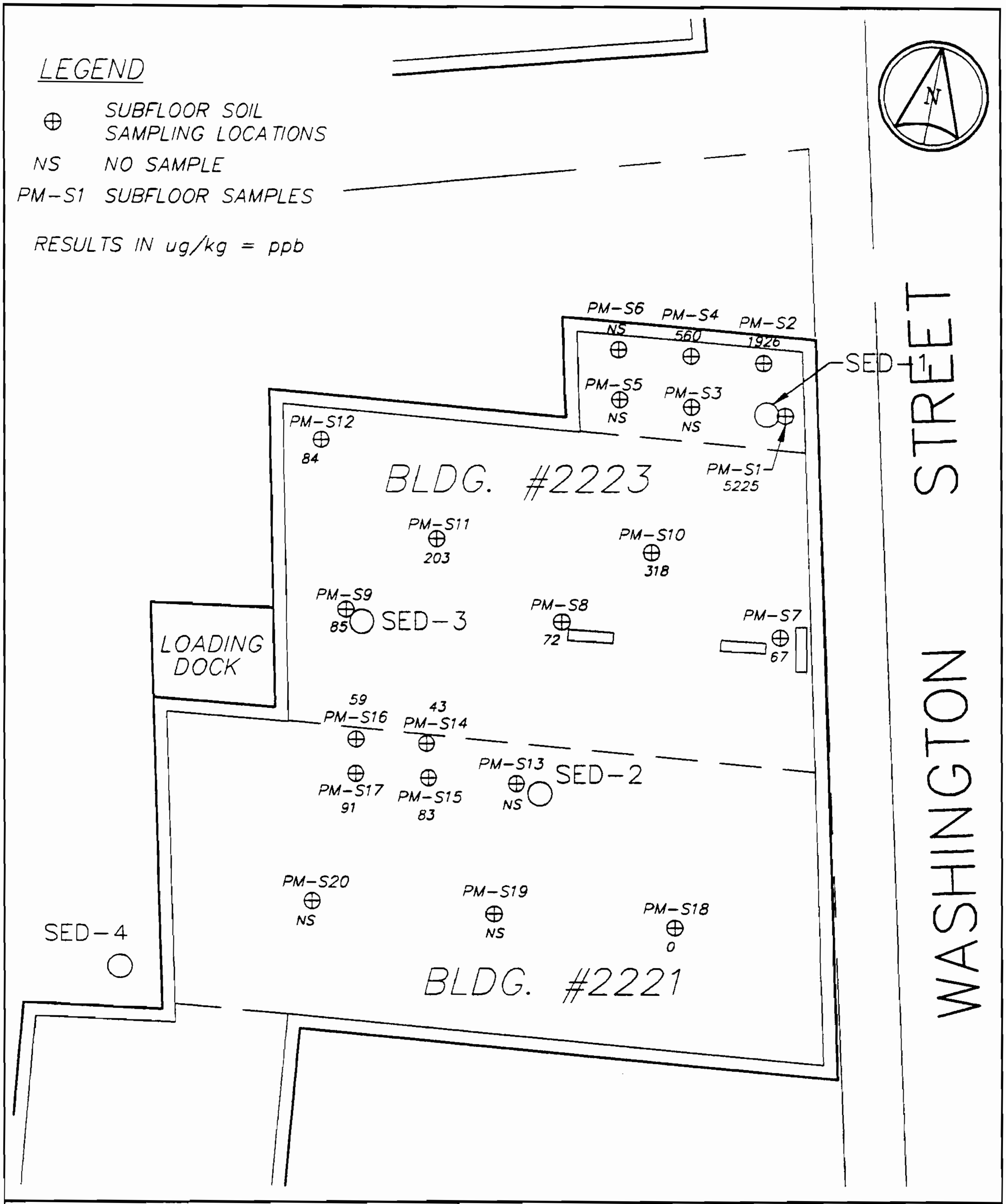
DIVISION OF RUST ENVIRONMENT & INFRASTRUCTURE

**SUBFLOOR SOIL SAMPLES**
**HEAD SPACE ANALYSIS**
**MINIMUM TOTAL VOLATILES 2 FT. DEPTH**

PELICAN MANUFACTURING, INC. SITE

City of Jamestown Chatauqua Co., NY

| | | | | |
|---|---|---|---|---|
| PROJECT No. 35120.700 | DATE 7/18/94 | DWG. No. 35120-03 | SCALE 1"=20' | FIGURE No. 3-4 |



**DUNN ENGINEERING COMPANY**

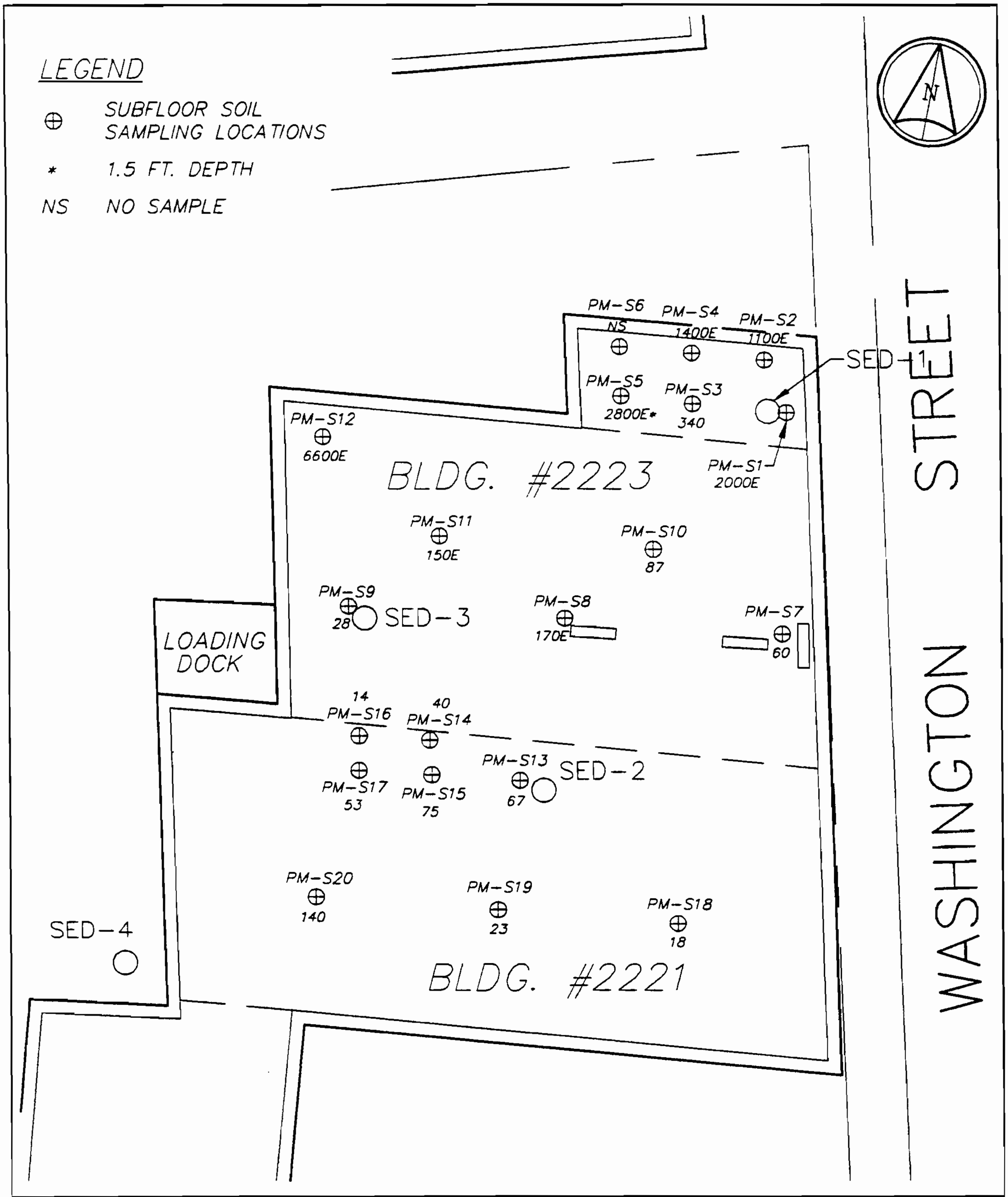
DIVISION OF RUST ENVIRONMENT & INFRASTRUCTURE

**SUBFLOOR SOIL SAMPLES**
**HEAD SPACE ANALYSIS**
**MINIMUM TOTAL VOLATILES 3 FT. DEPTH**

PELICAN MANUFACTURING, INC. SITE

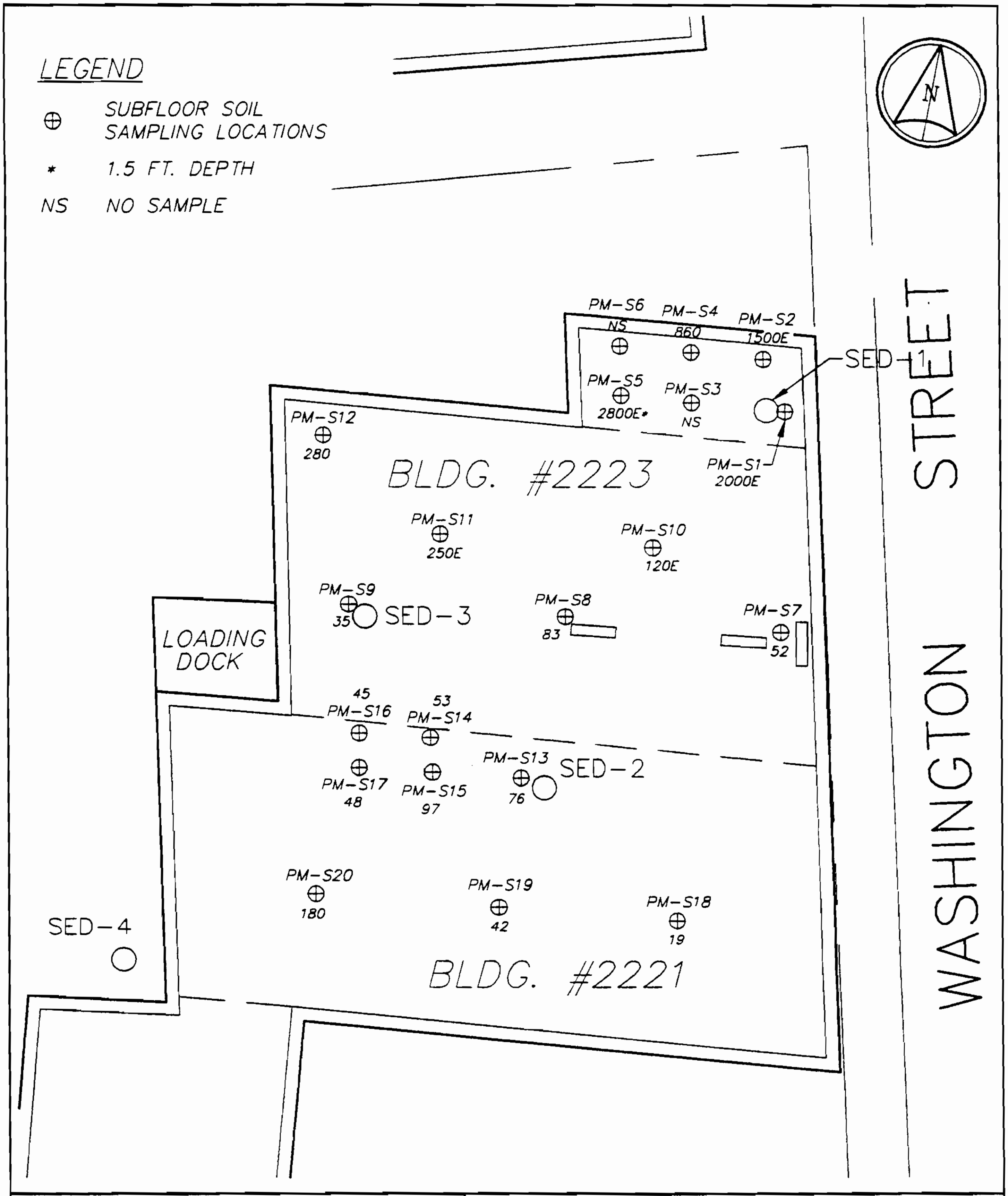
City of Jamestown Chatauqua Co., NY

| | | | | |
|---|---|---|---|---|
| PROJECT No. 35120.700 | DATE 7/18/94 | DWG. No. 35120-04 | SCALE 1"=20' | FIGURE No. 3-5 |



| | |
|---|---|
| **DUNN ENGINEERING COMPANY**<br>DIVISION OF RUST ENVIRONMENT & INFRASTRUCTURE | SUBFLOOR SOIL SAMPLES<br>HEAD SPACE ANALYSIS<br>TRICHLOROETHENE 0-1 FT. DEPTH<br>PELICAN MANUFACTURING, INC. SITE<br>City of Jamestown Chatauqua Co., NY |

| | | | | |
|---|---|---|---|---|
| PROJECT No. 35120.700 | DATE 8/5/94 | DWG. No. 35120-17 | SCALE 1"=20' | FIGURE No. 3-6 |



**DUNN ENGINEERING COMPANY**

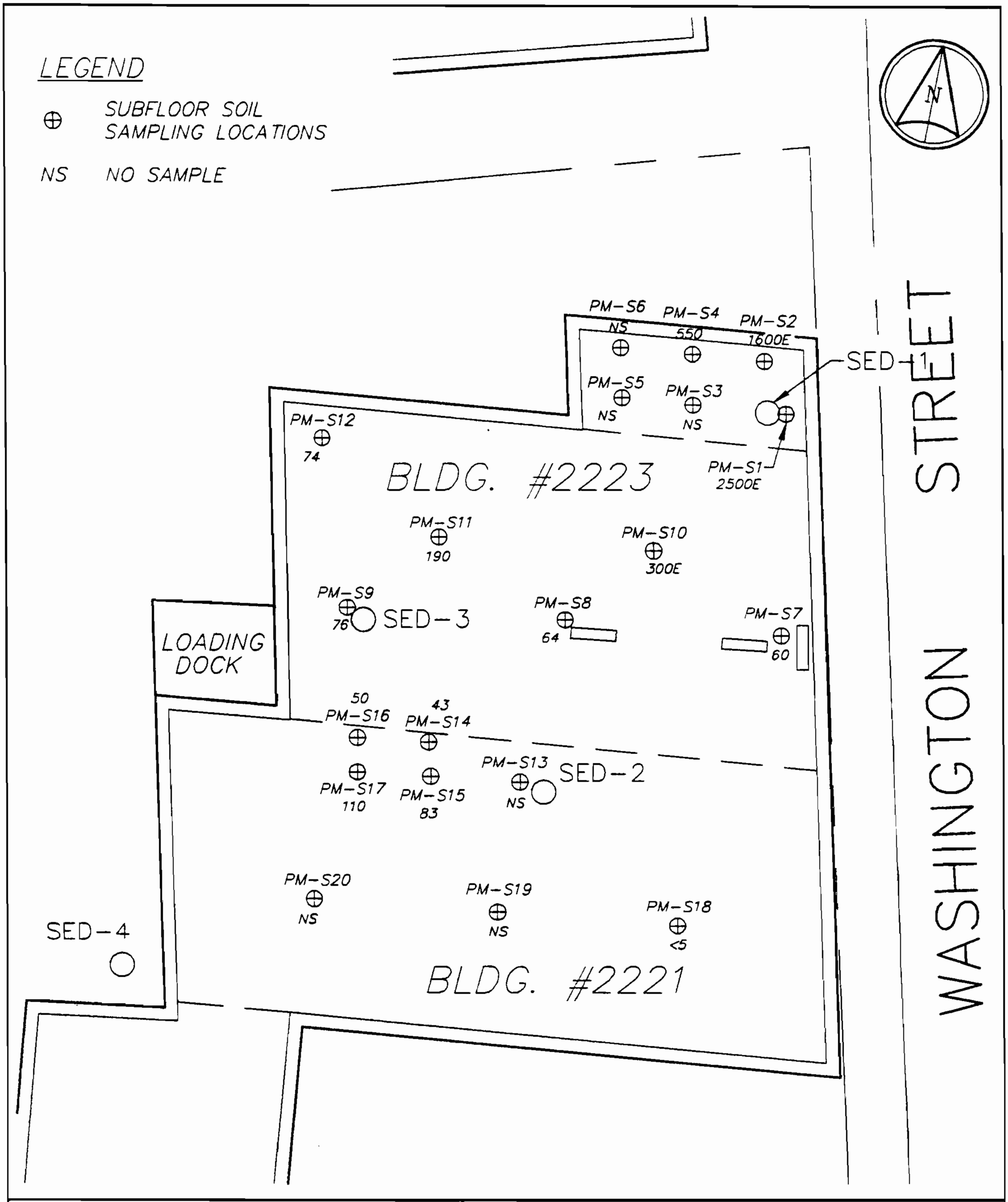
DIVISION OF **RUST** ENVIRONMENT & INFRASTRUCTURE

**SUBFLOOR SOIL SAMPLES**
**HEAD SPACE ANALYSIS**
**TRICHLOROETHENE 2 FT. DEPTH**

PELICAN MANUFACTURING, INC. SITE

City of Jamestown
Chatauqua Co., NY

| | | | | |
|---|---|---|---|---|
| PROJECT No. 35120.700 | DATE 8/5/94 | DWG. No. 35120-18 | SCALE 1"=20' | FIGURE No. 3-7 |



**DUNN ENGINEERING COMPANY**

DIVISION OF RUST ENVIRONMENT & INFRASTRUCTURE

SUBFLOOR SOIL SAMPLES
HEAD SPACE ANALYSIS
TRICHLOROETHENE 3 FT. DEPTH

PELICAN MANUFACTURING, INC. SITE

City of Jamestown | Chatauqua Co., NY

| PROJECT No. 35120.700 | DATE 8/5/94 | DWG. No. 35120-19 | SCALE 1"=20' | FIGURE No. 3-8 |
|---|---|---|---|---|

present. Rather, a selection was made on the basis of the magnitude of the response and, in some cases, the sample with the highest concentration from each sampling location was not selected.

PMS-1, 2ft
PMS-2, 3ft
PMS-3, 6in
PMS-4, 3ft
PMS-7, 3ft
PMS-8, 3ft
PMS-9, 3ft
PMS-10, 3ft
PMS-11, 2ft
PMS-12, 1ft
PMS-13, 2ft
PMS-14, 3ft
PMS-15, 2ft
PMS-16, 3ft
PMS-17, 3ft
PMS-18, 1ft
PMS-19, 2ft
PMS-20, 2ft

The results presented in Table 3-2 are based on a wet weight basis and must be adjusted for percent moisture when comparing them to the analytical laboratory results. Sample homogeneity is a major factor to be considered in the comparison of results between field and analytical laboratories. Sample PMS-12, 1ft is a good example of sample homogeneity and how it can affect results. The original analysis was based on a 10g sample weight (Appendix N, pg 24 of 39) and yielded a result of approximately 900 ug/kg of TCE. The succeeding duplicate analyses, based on 1g sample weights taken from the same sample container, yielded TCE magnitudes ten times higher. In addition, samples exhibiting results above the linear range of the detector employed should be viewed as estimated values and may not compare favorably to analytical laboratory data.

### 3.5.3 Subfloor Soil Sample Analytical Results

Based on the results of the field GC screening, a total of eighteen subfloor samples were submitted for laboratory analysis. All of the samples that were submitted were analyzed for volatile organics; two samples, S-1 and S-2, were analyzed for the complete NYSDEC TCL and TAL analytes. Analytical results are summarized in Tables 3-8 through 3-11.

#### Volatile Organics

The subfloor soil sample volatile organic analytical results are summarized in Table 3-8. The results revealed that the highest volatile organic concentrations were detected at the S1, S2 and S12 locations. Sample S1 exhibited concentrations of 1,1-dichloroethene (1,1-DCE), 1,2-dichloroethene (1,2-DCE), 1,1,1-trichloroethane (1,1,1-TCA) and trichloroethene (TCE) that exceeded the NYSDEC recommended soil cleanup objectives (RSCO). Sample S2 exhibited concentrations of 1,2-DCE, 1,1,-TCA, TCE and tetrachloroethene (PCE) concentrations that exceeded the NYSDEC RSCO. Sample S2 exhibited TCE and toluene concentrations that exceeded the NYSDEC RSCO. TCE was also detected in samples S4, S8, S10, and S11 at concentrations that exceeded the RSCO.

## TABLE 3-8

## PELICAN MANUFACTURING, INC. SITE
## SUBFLOOR SOIL SAMPLES
## VOLATILE ORGANICS
## FEBRUARY 1994

| | PM-S1 | PM-S2 | PM-S3 | PM-S4 | PM-S7 | PM-S8 | PM-S9 | PM-S10 | PM-S11 | NYSDEC |
|---|---|---|---|---|---|---|---|---|---|---|
| Compound | 2/1/94 | 2/1/94 | 2/1/94 | 2/2/94 | 2/3/94 | 2/3/94 | 2/3/94 | 2/8/94 | 2/8/94 | RSCO |
| Methylene Chloride | | | 6 JS | | | | 4 JS | | | 100 |
| 1,1-Dichloroethene | 510 J | | | | | | | | | 400 |
| 1,2-Dichloroethene (Total) | 2600 | 4000 | 30 J | | 8 J | | 16 | 46 | 34 | 300 |
| 1,1,1-Trichloroethane | 5600 | 830 J | | | 7 J | | | | | 800 |
| Trichloroethene | 30000 | 64000 | 570 | 5900 | 130 | 1900 | 300 D | 760 D | 910 D | 700 |
| 1,1,2-Trichloroethane | | | | | | | | | 4 J | --- |
| Tetrachloroethene | 720 J | 1100 J | 5 J | 160 J | 2 J | | 3 J | | 17 J | 1400 |
| Toluene | 240 J | 880 J | 4 J | | | | | | | 1500 |
| Xylene (total) | 270 J | | | | | | | | | 1200 |
| Number of TICs | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NA |

All results expressed in ug/kg (ppb).

Blank space indicates non-detection at or above the laboratory reporting limit.

J indicates that the result reported is below the CRQL and is considered estimated.

S indicates that the result reported is suspected to be laboratory derived.

D indicates that the result reported is from a dilution.

TICs are Tentatively Identified Compounds.

NYSDEC RSCO is the NYSDEC Recommended Soil Cleanup Objective.

- - - Indicates that there is no RSCO

NA indicates not applicable

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## TABLE 3-8 (CONTINUED)

## PELICAN MANUFACTURING, INC. SITE
## SUBFLOOR SOIL SAMPLES
## VOLATILE ORGANICS
## FEBRUARY 1994

| Compound | PM-S12 2/9/94 | PM-S13 2/9/94 | PM-S14 2/9/94 | PM-S15 2/9/94 | PM-S16 2/9/94 | PM-S17 2/9/94 | PM-S18 2/10/94 | PM-S19 2/10/94 | PM-S20 2/10/94 | NYSDEC RSCO |
|---|---|---|---|---|---|---|---|---|---|---|
| Methylene Chloride | | | | | | 6 JS | 11 JS | | 3 JS | 100 |
| 1,2-Dichloroethene (Total) | 280 | 3 J | 2 J | 6 J | 29 | 31 | | | 15 J | 300 |
| Chloroform | 8 J | | | | | | | | | 300 |
| 1,1,1-Trichloroethane | 11 J | | | | | | | | | 800 |
| Trichloroethene | 27000 DV | 120 | 34 | 130 | 200 | 390 | 300 | 81 | 460 | 700 |
| 1,1,2-Trichloroethane | 16 J | | | | | | | | | --- |
| Tetrachloroethene | 160 | 2 J | | | 4 J | 4 J | | | 3 J | 1400 |
| Toluene | 2100 DV | | | | | | 3 J | | | 1500 |
| Xylene (total) | 6 J | | | | | | | | | 1200 |
| Number of TICs | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NA |

All results expressed in ug/kg (ppb).
Blank space indicates non-detection at or above the laboratory reporting limit.
J indicates that the result reported is below the CRQL and is considered estimated.
S indicates that the result reported is suspected to be laboratory derived.
D indicates that the result reported is from a dilution.
V indicates that the result reported is considered estimated due to variance from quality control criteria.
TICs are Tentatively Identified Compounds.
NYSDEC RSCO is the NYSDEC Recommended Soil Cleanup Objective.
- - - Indicates that there is no RSCO.
NA indicates not applicable.

excel:peli3.8xls

The analytical results indicated that the most significant volatile organic contamination in the subfloor soil samples is located beneath the solvent room and in the vicinity of sample S12. However, subsurface soils beneath the floor throughout building No. 2223 appear to be generally impacted with respect to TCE. Refer to Figure 3-9 and 3-10 for total VOC and trichloroethene concentrations, respectively.

Samples S1 and S2 were located beneath the former solvent room. Monitoring well MW-1S is located at the northeast corner of the building adjacent to the solvent room and the floor drain that is located in this room (SED-1 location). The high volatile organic concentrations detected in these samples is a likely source of the elevated volatile organics detected in groundwater from monitoring well MW-1S.

### Semi-Volatile Organics

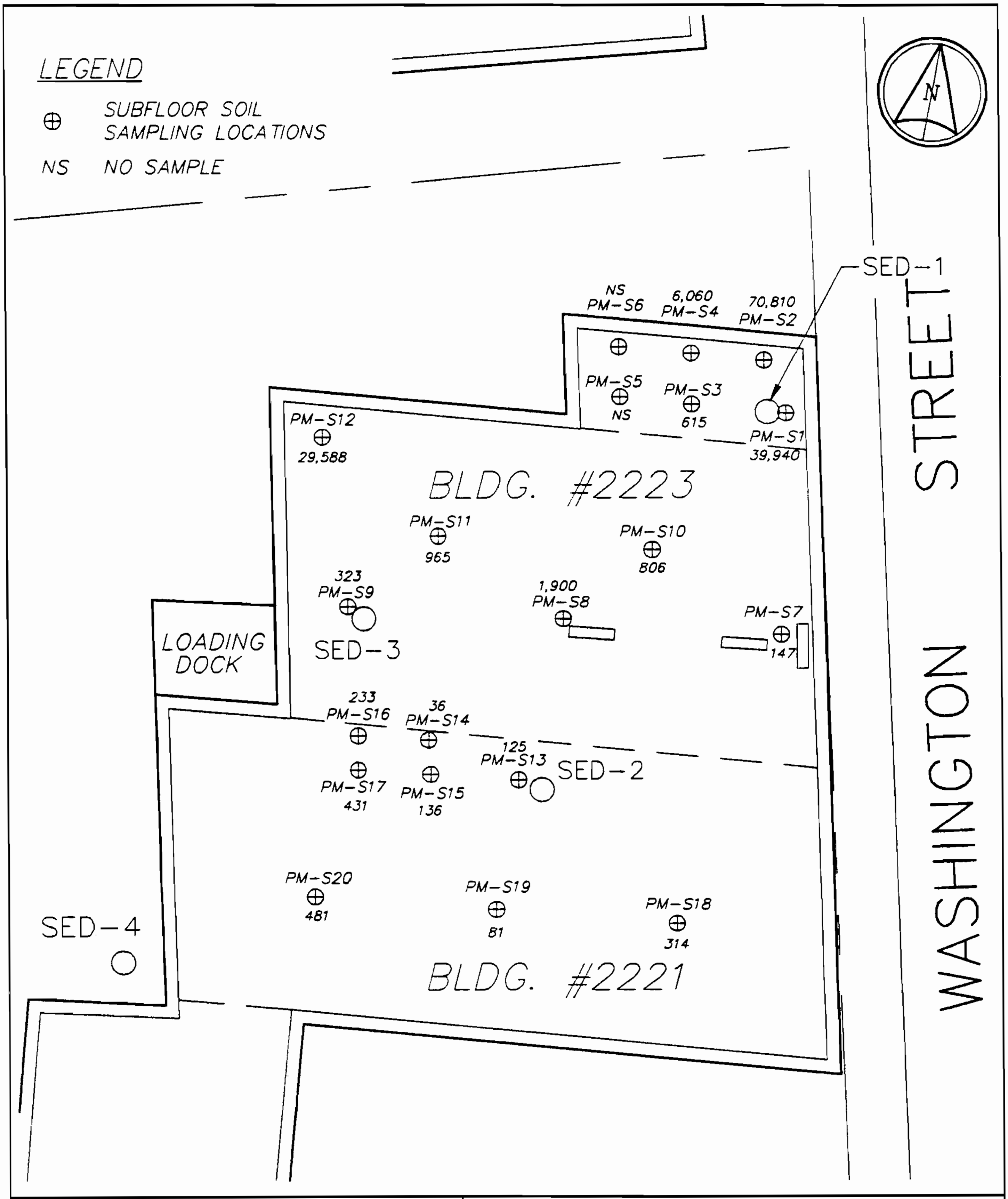
The subfloor soil sample semi-volatile organic analytical results are summarized in Table 3-9. The results from samples S1 and S2 revealed that both samples exhibited concentrations of several polynuclear aromatic hydrocarbons (PAHs) that were elevated with respect to the NYSDEC RSCOs. Seven PAH and six PAH compounds were detected in the S1 and S2 samples, respectively, at concentrations above the NYSDEC RSCOs. The PAH concentrations detected in the S1 and S2 subfloor samples were generally higher than the concentrations detected in the September 1992 sediment sample (SED-1) collected from the drain located in the solvent room. However, the reported concentrations were lower than the levels detected in the October 1992 S-1 surface soil sample collected in the northwest corner of the Site. Considering the nature of the fill material at the Site, the detection of PAH compounds is not unexpected. The data indicate that the solvent room subfloor soils do not represent a significant, additive source of PAHs to the Pelican site.

### Pesticides/PCBs

The subfloor soil sample pesticide and PCB analytical results are summarized in Table 3-10. The results from subfloor samples S1 and S2 indicated that no pesticides or PCBs were detected at concentrations above the NYSDEC RSCOs. With the exception of low concentrations of Endrin and alpha chlordane in the S1 sample, no pesticide or PCB compounds were detected at or above the laboratory reporting limit in either sample. The data indicate that pesticides and PCBs are not a concern in the subfloor samples in the buildings.

### Inorganics

The subfloor soil sample inorganics (metals and cyanide) analytical results for samples S1 and S2 are summarized in Table 3-11. The S1 and S2 subfloor metals concentrations were generally lower than the concentrations detected in the September 1992 SED-1 and SED-3 sediment samples collected from floor drains in the buildings. With the exception of arsenic, zinc, and mercury in both the S1 and S2 samples, and copper in the S2 sample, the subfloor metal concentrations were not elevated with respect to both the NYSDEC RSCOs and typical eastern U.S. background soil concentrations. The chromium, copper and nickel concentrations reported in both the PM-S1 and PM-S2 subfloor samples were elevated with respect to the NYSDEC RSCO. However, with the exception of the S2 copper value, the



**DUNN ENGINEERING COMPANY**

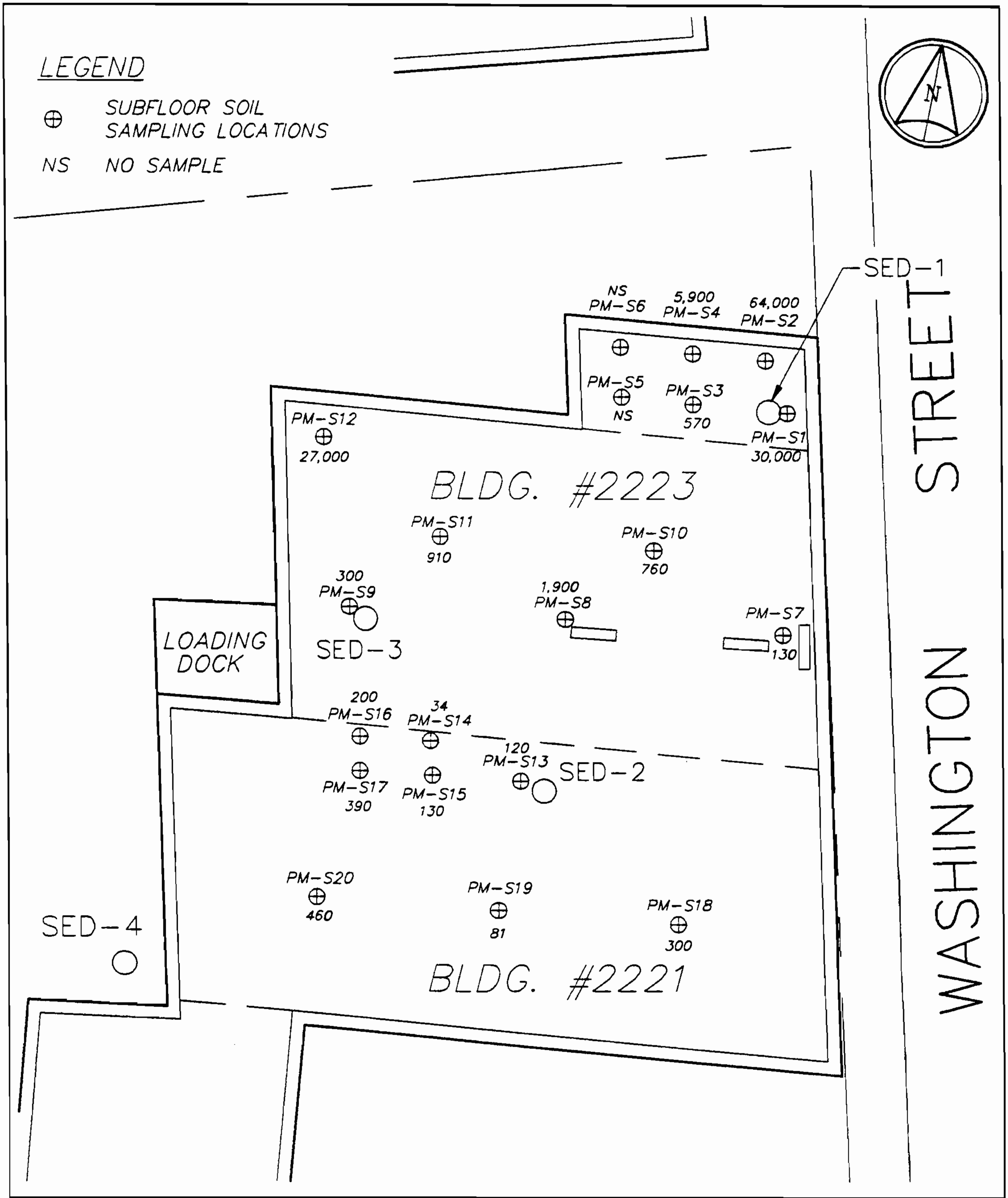
DIVISION OF **RUST** ENVIRONMENT & INFRASTRUCTURE

**SUBFLOOR SOIL SAMPLES**
**TOTAL VOC RESULTS**

PELICAN MANUFACTURING, INC. SITE

City of Jamestown | Chatauqua Co., NY

| | | | | |
|---|---|---|---|---|
| PROJECT No. 35120.700 | DATE 7/18/94 | DWG. No. 35120-23 | SCALE 1"=20' | FIGURE No. 3-9 |



**DUNN ENGINEERING COMPANY**
DIVISION OF RUST ENVIRONMENT & INFRASTRUCTURE

**SUBFLOOR SOIL SAMPLES**
**TRICHLOROETHENE RESULTS**

PELICAN MANUFACTURING, INC. SITE
City of Jamestown Chatauqua Co., NY

| | | | | |
|---|---|---|---|---|
| PROJECT No. 35120.700 | DATE 7/18/94 | DWG. No. 35120-24 | SCALE 1"=20' | FIGURE No. 3-10 |

# TABLE 3-9

## PELICAN MANUFACTURING, INC. SITE
## SUBFLOOR SOIL SAMPLES
## SEMI-VOLATILE ORGANICS
## FEBRUARY 1994

| Compound | PM-S1 2/1/94 | PM-S2 2/1/94 | NYSDEC RSCO |
|---|---|---|---|
| Naphthalene | 400 J | 120 J | 13000 |
| 2-Methylnaphthalene | 260 J | 140 J | 36400 |
| Acenaphthene | 1700 J | 130 J | 50000 |
| Dibenzofuran | 1300 J | 110 J | 6200 |
| Fluorene | 1700 J | 170 J | 50000 |
| Phenanthrene | 27000 | 3200 | 50000 |
| Anthracene | 4700 | 700 J | 50000 |
| Carbazole | 4400 | 330 J | 50000 |
| Fluoranthene | 31000 | 6200 | 50000 |
| Pyrene | 19000 | 3900 | 50000 |
| Benzo(a)anthracene | 6600 | 1700 | 224 |
| Chrysene | 7700 | 2100 | 400 |
| bis(2-Ethylhexyl) phthalate | | 130 JS | 50000 |
| Benzo(b)fluoranthene | 5600 | 1700 | 1100 |
| Benzo(k)fluoranthene | 4900 | 1500 | 1100 |
| Benzo(a)pyrene | 7000 | 2000 | 61 |
| Indeno(1,2,3-cd)pyrene | 3600 J | 1000 | 3200 |
| Dibenz(a,h)anthracene | 1400 J | 420 J | 14 |
| Benzo(g,h,i)perylene | 3000 J | 990 | 50000 |
| Number of TICs | 18 | 19 | NA |

All results expressed in ug/kg (ppb).
Blank space indicates non-detection at or above the laboratory reporting limit.
J indicates that the result reported is below the CRQL and is considered estimated.
S indicates that the result reported is suspected to be laboratory derived.
TICs are Tentatively Identified Compounds.
NYSDEC RSCO is the NYSDEC Recommended Soil Cleanup Objective.
NA indicates not applicable.

# TABLE 3-10

## PELICAN MANUFACTURING, INC. SITE
## SUBFLOOR SOIL SAMPLES
## PESTICIDES / PCBS
## FEBRUARY 1994

| Compound | PM-S1<br>2/1/94 | PM-S2<br>2/1/94 | NYSDEC<br>RSCO |
|---|---|---|---|
| Endrin | 10 J | | 100 |
| alpha-Chlordane | 8.1 JPVN | | 540 |

All results expressed in ug/Kg (ppb).
Blank space indicates non-detection at or above the laboratory reporting limit.
J indicates that the result reported is below the CRQL and is considered estimated.
P indicates that the percent difference between the results from the two analytical columns was greater than 25%.
N indicates presumptive evidence for compound identification.
V indicates that the result reported is considered estimated due to variance from quality control criteria.
NYSDEC RSCO is the NYSDEC Recommended Soil Cleanup Objective.

# TABLE 3-11

# PELICAN MANUFACTURING, INC. SITE
# SUBFLOOR SAMPLES
# INORGANICS
# FEBRUARY 1994

| Analyte | PM-S1 2/1/94 | PM-S2 2/1/94 | NYSDEC RSCO |
|---|---|---|---|
| Aluminum | 10800 | 10900 | SB |
| Antimony | 4.2 U | 5.1 U | SB |
| Arsenic | 14.2 | 13 | 7.5 or SB |
| Barium | 242 | 182 | 300 or SB |
| Beryllium | 0.49 B | 0.51 B | SB |
| Cadmium | 0.41 U | 0.49 U | 1 or SB |
| Calcium | 10100 | 9510 | SB |
| Chromium | 14.2 | 18.6 | 10 or SB |
| Cobalt | 10.3 | 12.4 | 30 or SB |
| Copper | 47.2 | 72.7 | 25 or SB |
| Iron | 22600 | 29200 | 2000 or SB |
| Lead | 264 | 183 | SB |
| Magnesium | 3050 | 3240 | SB |
| Manganese | 754 | 1070 | SB |
| Mercury | 0.4 | 0.26 | 0.1 |
| Nickel | 17.5 | 25.1 | 13 or SB |
| Potassium | 1180 | 1370 | SB |
| Selenium | 0.63 BV | 0.47 B | 2 or SB |
| Silver | 0.83 U | 0.99 U | SB |
| Sodium | 725 B | 267 B | SB |
| Thallium | 0.25 U | 0.24 U | SB |
| Vanadium | 18.7 | 21.5 | 150 or SB |
| Zinc | 168 | 318 | 20 or SB |
| Cyanide | 0.61 U | 0.58 U | --- |

All results expressed in mg/kg (ppm).

U indicates that the analyte was not detected at or above the instrument detection limit (IDL) indicated.

B indicates that the result reported is below the CRDL but above the IDL and is considered estimated.

V indicates that the result reported is considered estimated due to variance from quality control criteria.

SB indicates Site Background.

- - - indicates that there is no RSCO.

reported concentrations were not elevated with respect to typical eastern U.S. background soil concentrations.

The zinc, mercury and copper concentrations detected in the S1 and S2 subfloor samples were less than the SED-1 and SED-3 drain sediment values. However, the arsenic, barium and manganese values detected in the S2 sample were higher than the corresponding metal concentrations detected in the SED-1 sample. The data indicate that the source of the elevated iron, manganese, arsenic and barium concentrations detected in the groundwater from MW-1S is, most likely, not related strictly to either the SED-1 drain sediments or the subfloor soils.

### 3.5.4 Groundwater Sample Analytical Results

In February 1994, DUNN personnel collected groundwater samples from five of the on-site monitoring wells (MW-1D, MW-1S, MW-19, MW-20, MW-22). Refer to Figure 2-2 for these well locations. All groundwater samples were analyzed for the TCL volatile organic and semi-volatile organics following NYSDEC CLP methodologies. Groundwater from four of the monitoring wells was analyzed for the TAL metals on both total matrix and field filtered samples and all five groundwater samples were analyzed for cyanide. The metals and cyanide analyses were also performed following NYSDEC CLP methodologies. Analytical results are summarized in Tables 3-12 through 3-14.

#### Volatile Organics

The February 1994 groundwater sample volatile organic analytical results are summarized in Table 3-12 and presented on Figure 3-11. The results from monitoring wells MW-1S, MW-19 and MW-20 indicate that groundwater from these wells continues to exhibit volatile organic concentrations that significantly exceed NYSDEC groundwater standards. All three wells exhibited vinyl chloride, 1,2-dichloroethene and trichloroethene concentrations that exceeded the groundwater standard. Consistent with the October 1992 data, groundwater from monitoring well MW-1S again exhibited a toluene concentration that exceeded the groundwater standard. The February 1994 sample from this well also exhibited concentrations of ethylbenzene and xylene that exceeded the groundwater standard. Groundwater from monitoring wells MW-19 and MW-20 also exhibited 1,1,1-trichloroethane concentrations, and groundwater from MW-20 a 1,1-dichloroethane concentration, that exceeded the groundwater standard.

The February 1994 volatile organic concentrations from monitoring wells MW-1D and MW-22 were lower than the concentrations detected in the October 1992 samples. With the exception of the MW-1D trichloroethene concentration, that was detected at the groundwater standard of 5 ug/l, volatile organic compounds were not detected above NYSDEC groundwater standards in either of these monitoring well samples.

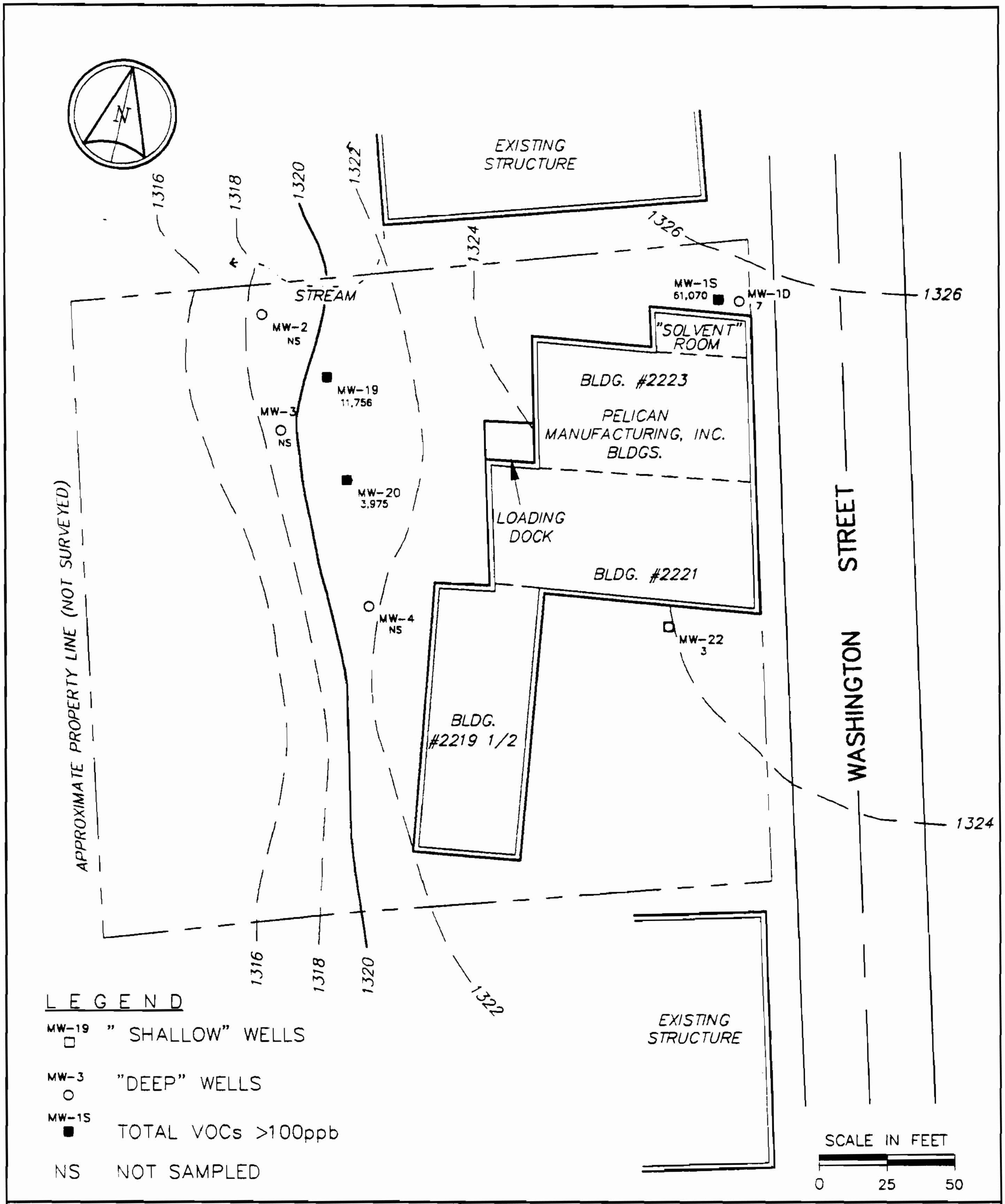
The February 1994 volatile organic analytical results confirm the October 1992 data that indicated significant exceedence of groundwater standards in many of the groundwater monitoring wells screened in the upper, unconfined water bearing zone. Volatile organic concentrations from MW-1D and MW-22 during both monitoring events were considerably

# TABLE 3-12

## PELICAN MANUFACTURING, INC. SITE
## GROUNDWATER SAMPLES
## VOLATILE ORGANICS
## FEBRUARY 1994

| Compound | MW-1S 2/9/94 | MW-1D 2/9/94 | [illegible] | MW-20 2/9/94 | MW-22 2/9/94 | NYSDEC GW STANDARD/GV |
|---|---|---|---|---|---|---|
| Vinyl Chloride | 5500 |  | 770 | 380 |  | 2 |
| 1,1-Dichloroethane |  |  |  | 17 J |  | 5 |
| 1,2-Dichloroethene (Total) | 43000 | 1 J | 10000 | 2900 |  | 5 |
| 2-Butanone |  |  |  |  | 3 JS | 50 (GV) |
| 1,1,1-Trichloroethane |  |  | 76 J | 78 J |  | 5 |
| Trichloroethene | 6600 | 5 J | 910 | 600 |  | 5 |
| Toluene | 4900 | 1 J |  |  |  | 5 |
| Ethylbenzene | 230 J |  |  |  |  | 5 |
| Xylene (total) | 840 J |  |  |  |  | 5 |
| Number of TICs |  |  |  |  |  | NA |

All results expressed in ug/l (ppb).
Blank space indicates non-detection at or above the laboratory reporting limit.
J indicates that the result reported is below the CRQL and is considered estimated.
S indicates that the result reported is suspected to be laboratory derived.
TICs are Tentatively Identified Compounds.
GV indicates a Guidance Value rather than a standard.
NA indicates not applicable.



**DUNN ENGINEERING COMPANY**

DIVISION OF **RUST** ENVIRONMENT & INFRASTRUCTURE

**GROUNDWATER SAMPLES**
**MINIMUM TOTAL VOCs – FEBRUARY 1994**

PELICAN MANUFACTURING, INC. SITE

City of Jamestown

Chautauqua Co., NY

| PROJECT No. 35120.700 | DATE 10/93 | DWG. No. 35120-25 | SCALE 1"=50' | FIGURE No. 3-11 |
|---|---|---|---|---|

lower than the concentrations detected in the MW-1S, MW-19 and MW-20 samples. Considering the location of well MW-22, the absence of elevated concentrations of volatile organic compounds is not unexpected. The lower volatile organic concentrations detected in groundwater from monitoring well MW-1D indicate that the higher concentrations detected in MW-1S have not migrated vertically downward. The October 1992 volatile organic data from monitoring wells MW-2 and MW-3 indicate that volatile organics have not migrated into the lower, semi-confined water bearing zone.

### Semi-Volatile Organics

The February 1994 groundwater samples semi-volatile organic analytical results are summarized in Table 3-13. The results indicate that, with the exception of three phenolic compounds detected in groundwater from monitoring well MW-1S, no semi-volatile organics were detected in any of the other four monitoring well samples. The February 1994 semi-volatile organic data from monitoring wells MW-1D and MW-22 is consistent with the October 1992 data, in that no compounds were detected at or above the laboratory reporting limit.

The February 1994 groundwater sample from monitoring well MW-1S exhibited concentrations of 2-methylphenol (9 ug/l), 4-methylphenol (9 ug/l) and 2,4-dimethylphenol (2 ug/l) that exceeded the groundwater standard of 1 ug/l, which applies to the total of all phenolic compounds. Semi-volatile organics were not detected at elevated concentrations in the downgradient monitoring wells MW-19 and MW-20. Considering that groundwater from monitoring well MW-1S is the only well to exhibit concentrations of even a few semi-volatile organics above the groundwater standard, the data indicate that groundwater at the Site has not been significantly impacted by semi-volatile organic compounds, and that the semi-volatile organic compounds are not a significant concern at the Site.

### Pesticides / PCBs

No groundwater samples were analyzed for pesticides / PCBs during the Second Phase RI.

### Inorganics

The February 1994 groundwater sample inorganics analytical results are summarized in Table 3-14. The samples from monitoring wells MW-1D, MW-1S, MW-19, MW-20 and MW-22 were analyzed for the TAL metal analytes on both total matrix and field filtered samples. The field filtered samples were collected to evaluate the impact of sediments on the total matrix metals concentrations. Metals results from the October 1992 sampling event were elevated, however, field data indicated that the groundwater samples were highly turbid and contained a significant sediment load, which may have contributed to the elevated metal concentrations.

The February 1994 metals data revealed that all four monitoring wells exhibited total matrix aluminum, iron and manganese concentrations that exceeded their respective groundwater standards. However, the field filtered aluminum, iron and manganese concentrations in the MW-1D and MW-20 samples, and the aluminum and iron concentrations in the MW-19

# TABLE 3-13

## PELICAN MANUFACTURING, INC. SITE
## GROUNDWATER SAMPLES
## SEMI-VOLATIILE ORGANICS
## FEBRUARY 1994

| Compound | MW-1S<br>2/9/94 | MW-1D<br>2/9/94 | MW-19<br>2/9/94 | MW-20<br>2/9/94 | MW-22<br>2/9/94 | NYSDEC GW<br>STANDARD/GV |
|---|---|---|---|---|---|---|
| 2-Methylphenol | 9 J | | | | | 1 * |
| 4-Methylphenol | 9 J | | | | | 1 * |
| 2,4--Dimethylphenol | 2 J | | | | | 1 * |
| Naphthalene | 0.6 J | | | | | 10 |
| Di-n-Butylphthalate | 1 JS | | | | | --- |
| Number of TICs | 10 | 1 | 1 | 0 | 1 | NA |

All results expressed in ug/l (ppb).

Blank space indicates non-detection at or above the laboratory reporting limit.

J indicates that the result reported is below the CRQL and is considered estimated.

S indicates that the result reported is suspected to be laboratory derived.

TICs are Tentatively Identified Compounds.

* indicates that the value listed applies to the sum of these compounds.

--- indicates that there is no standard or guidance value.

NA = not applicable.

# TABLE 3-14

## PELICAN MANUFACTURING, INC. SITE
## GROUNDWATER SAMPLES
## INORGANICS
## FEBRUARY 1994

| Analyte | MW-1S | MW-1SF | MW-1D | MW-1DF | MW-19 | MW-19F | MW-20 | MW-20F | MW-22 | NYSDEC GW STANDARD/GV |
|---|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 1080 | 41.6 U | 22100 | 41.8 U | 4600 | 41.7 U | 1090 | 42 U | | 100 |
| Antimony | 21.5 UV | 21.4 UV | 21.4 U | 21.5 U | 21.4 UV | 21.4 UV | 21.6 UV | 21.6 UV | | 3 GV |
| Arsenic | 25.3 | 24.8 | 26.9 V | 3.9 B | 5.9 B | 1.4 U | 4 B | 1.4 U | | 25 |
| Barium | 1000 | 920 | 497 | 132 B | 331 | 246 | 319 | 250 | | 1000 |
| Beryllium | 0.4 U | 0.4 U | 1.4 B | 0.4 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U | | 3 GV |
| Cadmium | 2.1 U | 2.1 U | 2.1 U | 2.1 U | 2.1 U | 2.1 U | 2.1 U | 2.1 U | | 10 |
| Calcium | 175000 | 171000 | 246000 | 69200 | 143000 | 135000 | 126000 | 116000 | | --- |
| Chromium | 4.1 B | 2.6 U | 33.9 | 2.6 U | 16.4 | 2.6 U | 19.7 | 2.6 U | | 50 |
| Cobalt | 4.4 U | 4.4 U | 24.6 B | 4.4 U | 4.4 U | 4.4 U | 4.4 U | 4.4 U | | --- |
| Copper | 3.1 U | 3.1 U | 59.7 | 3.1 U | 31 | 3.1 U | 13.6 B | 3.1 U | | 200 |
| Iron | 20300 | 15300 | 45400 | 18.5 B | 10100 | 5.6 U | 5120 | 9.6 B | | 300 * |
| Lead | 1.8 B | 0.9 U | 55.1 | 0.89 U | 15.2 | 0.9 U | 14.8 | 0.89 U | | 25 |
| Magnesium | 20400 | 19500 | 37500 | 15900 | 26200 | 23200 | 24900 | 23000 | | 35000 GV |
| Manganese | 13700 | 13400 | 1960 | 59.8 | 3640 | 1270 | 479 | 215 | | 300 * |
| Mercury | 0.04 U | 0.04 U | 0.04 U | 0.04 U | 0.04 U | 0.04 U | 0.04 U | 0.04 U | | 2 |
| Nickel | 4 U | 4 U | 47.9 | 4 U | 8.9 B | 4 U | 4 U | 4 U | | --- |
| Potassium | 5140 | 5000 | 7400 | 2990 B | 3410 B | 2040 B | 2200 B | 2280 B | | --- |
| Selenium | 1.1 U | 1.1 U | 5.5 U | 1.1 U | 1.1 U | 1.1 U | 1.1 U | 1.1 U | | 10 |
| Silver | 4.2 U | 4.2 U | 4.2 U | 4.2 U | 4.2 U | 4.2 U | 4.2 U | 4.2 U | | 50 |
| Sodium | 490000 | 483000 | 11600 | 10900 | 163000 | 164000 | 136000 | 135000 | | 20000 |
| Thallium | 5.9 U | 6 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 1.2 U | | 4 GV |
| Vanadium | 3.7 U | 3.7 U | 36.9 B | 3.7 U | 5.9 B | 3.7 U | 3.7 U | 3.7 U | | --- |
| Zinc | 41.5 | 16.7 B | 156 | 11.4 B | 51.2 | 15.9 B | 53.4 | 28.3 | | 300 |
| Cyanide | 5 U | | 5 U | | 5 U | | 5 U | | 5 U | 100 |

All results expressed in ug/l (ppb).

Blank space indicates that the analysis was not performed.

F (in the sample ID) indicates that the sample was field filtered through a 0.45 micron filter.

U indicates that the analyte was not detected at or above the instrument detection limit (IDL) indicated.

B indicates that the result reported is below the CRDL but above the IDL and is considered estimated.

V indicates that the result reported is considered estimated due to variance from quality control criteria.

GV indicates a Guidance Value rather than a standard.

* Combined iron and manganese concentrations may not exceed 500 ug/l

\- - - Indicates that there is no standard or guidance value.

sample, were less than the groundwater standard and considerably lower than the total matrix values. The MW-1D total matrix sample also exhibited an arsenic and lead concentration that exceeded the groundwater standard. However, the field filtered arsenic concentration was an estimated value below the contract required quantitation limit and well below the groundwater standard, and the lead was not detected at or above the instrument detection limit. Although the MW-19 field-filtered manganese value exceeded the groundwater standard, the reported concentration was about one third of the total matrix value.

The field filtered metals data indicate that the total matrix iron, manganese and aluminum in groundwater from monitoring wells MW-1D and MW-20, the aluminum and iron from monitoring well MW-19, and the aluminum from monitoring well MW-1S are, most likely, associated with the sample sediment load. Field turbidity data indicated that groundwater from monitoring well MW-1D was extremely turbid (>1000 NTU).

Groundwater analytical results from monitoring well MW-1S indicate that groundwater at this location has been impacted with respect to iron, manganese, arsenic and barium. Both the total matrix and field filtered iron and manganese concentrations were elevated with respect to the groundwater standard (0.3 mg/l). The total matrix arsenic concentration was slightly above the groundwater standard (0.025 mg/l) and the total matrix barium concentration was at the groundwater standard (1.0 mg/l). The filtered concentrations for both of these compounds were below the respective groundwater standards, but were not significantly different than the total matrix concentrations.

### 3.5.5 Test Pit Sample Analytical Results

Four test pits were excavated on the north and west side of the Pelican buildings. TP-1 was located at the northeast corner of building No. 2223, outside and adjacent to the former solvent room. TP-2 was located at the northwest corner of building No. 2223. TP-3 was located along the west side of building No. 2221, between the above ground septic tank and the suspected drywell. TP-4 was also located along the west side of building No. 2221, west of and perpendicular to the east-west drainage line from the above ground septic tank. Refer to Figure 3-2 for the test pit locations.

Three subsurface soil samples from TP-1 and one sample from each of the other test pits were submitted to the laboratory for volatile organic analysis. Two samples from TP-1 and one from each of the other test pits were submitted to the laboratory for analysis of the TCL/TAL semi-volatile, pesticide/PCB and inorganic analytes. Analytical results are summarized in Tables 3-15 through 3-18.

#### Volatile Organics

The test pit sample volatile organic analytical results are summarized in Table 3-15. The TP-1, 1-2' and 2-3' samples exhibited concentrations of 1,2-DCE, TCE, PCE and toluene that were elevated with respect to their RSCOs. The TP-1, 2-3' sample also exhibited a xylene concentration that was slightly elevated with respect to the RSCO. With the exception of a TCE concentration that was slightly elevated with respect to the RSCO, volatile organics

# TABLE 3-15

# PELICAN MANUFACTURING, INC. SITE
# TEST PIT SOIL SAMPLES
# VOLATILE ORGANICS
# FEBRUARY 1994

| Compound | PM-TP1-1-2'<br>2/1/94 | PM-TP1-2-3'<br>2/1/94 | PM-TP1-3-4'<br>2/1/94 | PM-TP2-2-3'<br>2/1/94 | PM-TP3-2-3'<br>2/2/94 | PM-TP4-3-4'<br>2/2/94 | NYSDEC<br>RSCO |
|---|---|---|---|---|---|---|---|
| Methylene Chloride | | | | | 4 JS | 10 JS | 100 |
| Acetone | | | | | | 200 B | 200 |
| 1,2-Dichloroethene (Total) | 3600 J | 2600 J | 15 J | 33 J | 16 | 50 | 300 |
| Trichloroethene | 490000 | 260000 D | 730 | 380 | 31 | 350 | 700 |
| Tetrachloroethene | 4900 J | 2300 J | 8 J | 4 J | | 3 J | 1400 |
| Toluene | 2300 J | 1800 J | | | | | 1500 |
| Xylene (total) | | 1500 J | | | | | 1200 |
| Number of TICs | 0 | 0 | 0 | 0 | 0 | 0 | NA |

All results expressed in ug/kg (ppb).
Blank space indicates non-detection at or above the laboratory reporting limit.
B indicates that the compound was also detected in the associated method blank.
J indicates that the result reported is below the CRQL and is considered estimated.
S indicates that the result reported is suspected to be laboratory derived.
D indicates that the result reported is from a dilution.
TICs are Tentatively Identified Compounds.
NYSDEC RSCO is the NYSDEC Recommended Soil Cleanup Objective.
NA indicates not applicable.

were not detected at significant concentrations in the TP-1, 3-4' sample. The data indicate that the soils impacted with respect to volatile organic compounds in the vicinity of TP-1 are apparently limited to the upper three feet. The elevated concentrations of volatile organics detected in the TP-1 soil samples provides further evidence that the source of the volatile organic compounds detected in groundwater from monitoring well MW-1S is the area around the solvent room located at the northeast corner of building No. 2223. The potential source(s) include the subfloor soils, drainline sediments and/or shallow soil outside the building. Low concentrations, (below RSCOs), of 1,2-DCE, TCE, and PCE were detected in the TP-2 and TP-4 test pit samples and low concentrations of 1,2-DCE and TCE were detected in the TP-3 test pit sample. The acetone and methylene chloride detected in the TP-4 and the methylene chloride detected in the TP-3 samples are potentially laboratory derived and are not considered to be site-related.

### Semi-Volatile Organics

The test pit sample semi-volatile organic results are summarized in Table 3-16. The analytical results indicated that all of the test pit samples exhibited PAH concentrations of four or more compounds that exceeded their respective RSCOs.

The highest PAH concentrations were detected in the TP-4, 3-4' sample. The test pit logs indicate that the subsurface material at a depth of 3-4' consisted of fill material. The TP-4 3-4' sample exhibited concentrations of the following compounds that were elevated with respect to both RSCOs and the other test pit sample results: benzo(a)anthracene (11,000 ug/kg), benzo(h)fluoranthene (11,000 ug/kg), benzo(k)fluoranthene (10,000 ug/kg), benzo(a)pyrene (13,000 ug/kg), dibenzo(a,h)anthracene (2,400 ug/kg), chrysene (12,000 ug/kg) and ideno((1,2,3-cd)pyrene (5,700 ug/kg).

The TP-1, 1-2' and 2-3' (fill) PAH concentrations were generally consistent with the concentrations detected in the October 1992 subsurface soil samples. The TP-2, 2-3' sample, which consisted of approximately fifty percent native material and fifty percent fill, generally exhibited the lowest PAH concentrations.

Although the PAH concentrations detected in the TP-4 sample were higher than in the other test pits, considering the historical use of the Site as an auto repair shop, the presence of PAH compounds in site soils is not unexpected. In addition, PAH compounds are common in construction and demolition debris (C&D) and other fill materials present at the Site.

### Pesticides/PCBs

The test pit pesticide/PCBs analytical results are summarized in Table 3-17. The results revealed that no pesticides or PCBs were detected in any of the test pit samples at concentrations above the applicable RSCOs.

### Inorganics

The test pit sample inorganic analytical results are summarized in Table 3-18. All test pit samples exhibited concentrations of arsenic, chromium, copper, mercury, nickel and zinc,

# TABLE 3-16

## PELICAN MANUFACTURING, INC. SITE
## TEST PIT SOIL SAMPLES
## SEMI-VOLATILE ORGANICS
## FEBRUARY 1994

| Compound | PM-TP1-1-2'<br>2/1/94 | PM-TP1-2-3'<br>2/1/94 | PM-TP2-2-3'<br>2/1/94 | PM-TP3-2-3'<br>2/2/94 | PM-TP4-3-4'<br>2/2/94 | NYSDEC<br>RSCO |
|---|---|---|---|---|---|---|
| Naphthalene | R | 72 J |  | 25 J | 2200 J | 13000 |
| 2-Methylnaphthalene | R | 82 J |  |  | 810 J | 36400 |
| Acenaphthylene | R | 64 J |  |  |  | 41000 |
| Acenaphthene | R | 62 J |  | 45 J | 2700 J | 50000 |
| Dibenzofuran | R | 62 J |  | 28 J | 2000 J | 6200 |
| Fluorene | R | 48 J |  | 42 J | 2900 J | 50000 |
| Hexachlorobenzene | 990 J | 220 J |  |  |  | 410 |
| Phenanthrene | 3100 J | 1400 | 310 J | 520 | 34000 | 50000 |
| Anthracene | 570 J | 320 J | 82 J | 110 J | 6600 J | 50000 |
| Carbazole | R | 180 J | 33 J | 140 J | 8100 | 50000 |
| Di-n-Butylphthalate | R | 38 JS |  |  |  | 8100 |
| Fluoranthene | 5300 J | 3500 | 880 | 1000 | 47000 | 50000 |
| Pyrene | 4100 J | 1900 | 610 | 700 | 26000 | 50000 |
| Benzo(a)anthracene | R | 1200 | 280 J | 290 J | 11000 | 224 |
| Chrysene | 1900 J | 1500 | 320 J | 360 J | 12000 | 400 |
| bis(2-Ethylhexyl) phthalate | 2200 JS | 78 JS |  |  |  | 50000 |
| Benzo(b)fluoranthene | 1600 J | 1200 | 330 J | 300 J | 11000 | 1100 |
| Benzo(k)fluoranthene | 1500 J | 1600 | 270 J | 260 J | 10000 | 1100 |
| Benzo(a)pyrene | 2300 J | 1400 | 350 J | 340 J | 13000 | 61 |
| Indeno(1,2,3-cd)pyrene | R | 880 | 180 J | 190 J | 5700 J | 3200 |
| Dibenz(a,h)anthracene | R | 360 J | 67 J | 77 J | 2400 J | 14 |
| Benzo(g,h,i)perylene | R | 500 J | 140 J | 200 J | 4400 J | 50000 |
| Number of TICs | 2 | 20 | 12 | 8 | 20 | NA |

All results expressed in ug/kg (ppb).
Blank space indicates non-detection at or above the laboratory reporting limit.
J indicates that the result reported is below the CRQL and is considered estimated.
S indicates that the result reported is suspected to be laboratory derived.
R indicates that the result reported has been rejected and is unusable.
TICs are Tentatively Identified Compounds.
NYSDEC RSCO is the NYSDEC Recommended Soil Cleanup Objective.
NA indicates not applicable.

# TABLE 3-17

## PELICAN MANUFACTURING, INC. SITE
## TEST PIT SOIL SAMPLES
## PESTICIDES/PCBs
## FEBRUARY 1994

| Compound | PM-TP1-1-2' 2/1/94 | PM-TP1-2-3' 2/1/94 | PM-TP2-2-3' 2/1/94 | PM-TP3-2-3' 2/2/94 | PM-TP4-3-4' 2/2/94 | NYSDEC RSCO |
|---|---|---|---|---|---|---|
| Endosulfan II |  | 6 |  |  |  | 900 |
| 4,4'-DDT |  | 12 |  |  | 19 JPV | 2100 |
| Endrin aldehyde | 110 PVN | 5.8 PVN | 13 JPVN | 3.6 JPVN |  | --- |
| alpha-Chlordane | 47 PVN | 1.2 JPVN | 16 PVN |  | 15 JPVN | 540 |
| PCB 1254 |  |  |  |  | 370 J | 1000 (Surface)<br>10000 (subsurface) |

All results expressed in ug/kg (ppb).
Blank space indicates non-detection at or above the laboratory reporting limit.
J indicates that the result reported is below the CRQL and is considered estimated.
P indicates that the percent difference between the results from the two analytical columns was greater than 25%.
N indicates presumptive evidence for compound identification.
V indicates that the result reported is considered estimated due to variance from quality control criteria.
D indicates that the result reported is from a dilution.
NYSDEC RSCO is the NYSDEC Recommended Soil Cleanup Objective.
N/A indicates that the RSCO is not available.
- - -Indicates that there is no RSCO.

# TABLE 3-18

## PELICAN MANUFACTURING, INC. SITE
## Test Pit Soil Samples
## Inorganics
## February 1994

| Analyte | PM-TP1-1-2'<br>2/1/94 | PM-TP1-2-3'<br>2/1/94 | PM-TP2-2-3'<br>2/1/94 | PM-TP3-2-3'<br>2/2/94 | PM-TP4-3-4'<br>2/2/94 | NYSDEC<br>RSCO |
|---|---|---|---|---|---|---|
| Aluminum | 11800 | 11400 | 14100 | 16800 | 12200 | SB |
| Antimony | 11.8 B | 6.7 B | 4.1 U | 3.4 UV | 10 B | SB |
| Arsenic | 24.3 | 22.6 | 12.3 | 12.1 | 74.8 | 7.5 or SB |
| Barium | 179 | 450 | 259 | 236 | 183 | 300 or SB |
| Beryllium | 0.67 B | 0.78 B | 0.61 B | 0.58 B | 0.54 B | SB |
| Cadmium | 0.44 U | 0.63 B | 0.39 U | 0.33 BV | 4.4 | 1 or SB |
| Calcium | 6020 | 6350 | 7750 | 4460 | 9940 | SB |
| Chromium | 28.6 | 22.7 | 17.1 | 19 | 34.6 | 10 or SB |
| Cobalt | 9.7 B | 10.4 | 9 B | 9.6 | 8.7 B | 30 or SB |
| Copper | 230 | 242 | 47.8 | 45.5 | 40.2 | 25 or SB |
| Iron | 46600 | 43200 | 33200 | 27100 | 23000 | 2000 or SB |
| Lead | 650 | 435 | 774 | 142 | 163 | SB |
| Magnesium | 3440 | 3030 | 3170 | 3690 | 4280 | SB |
| Manganese | 582 | 669 | 873 | 630 | 618 | SB |
| Mercury | 0.22 | 0.18 | 0.31 | 0.14 | 0.23 | 0.1 |
| Nickel | 28.6 | 24.9 | 18.7 | 18.8 V | 19.2 | 13 or SB |
| Potassium | 1220 | 1140 | 1560 | 1600 V | 1650 | SB |
| Selenium | 0.64 BS | 1 B | 0.25 U | 0.55 BV | 0.34 BS | 2 or SB |
| Silver | 0.88 U | 0.8 U | 0.79 U | 0.66 U | 0.86 U | SB |
| Sodium | 444 B | 210 B | 157 B | 76.6 B | 79.3 B | SB |
| Thallium | 0.38 B | 0.28 U | 0.27 U | 0.24 U | 0.36 B | SB |
| Vanadium | 29.5 | 25.1 | 25.7 | 30.8 | 24 | 150 or SB |
| Zinc | 507 | 432 | 163 | 244 V | 2490 | 20 or SB |
| Cyanide | 0.57 U | 0.56 U | 0.55 U | 0.56 U | 0.54 U | --- |

All results expressed in mg/kg (ppb).
U indicates that the analyte was not detected at or above the instrument detection limit (IDL) indicated.
B indicates that the result reported is below the CRDL but above the IDL and is considered estimated.
V indicates that the result reported is considered estimated due to variance from quality control criteria.
S indicates that the result was determined by the Method of Standard Additions (MSA).
SB indicates Site Background.
Indicates that there is no RSCO

that exceeded their respective RSCOs. None of the test pit chromium values (17.1-34.6 ppm) were elevated with respect to the upper background concentration limit typically found in eastern U.S. soils (1.5-40 ppm). Copper concentrations in the TP-2, TP-3 and TP-4 samples were just below the upper background concentration limit typically found in eastern U.S. soils (1-50 ppm), as were the nickel concentrations in all test pit samples except the TP-1, 1-2' sample (background soils range 0.5-25 ppm). Lead concentrations in the TP-1, 1-2' sample (650 ppm) and the TP-2 sample (774 ppm) were elevated with respect to the typical lead concentrations in urban soils (200-500 ppm).

The TP-4 sample exhibited the highest arsenic, cadmium and zinc concentrations. Concentrations of these three metals in the TP-4 sample were significantly elevated with respect to their RSCOs and typical eastern U.S. background soil concentrations. Elevated zinc concentrations were also detected in the sediment samples collected by the NYSDEC in November 1993 from the drainageway west of the Site. The data indicate that the Site could potentially represent a source of zinc to the sediments in the intermittent drainageway located adjacent to and west of the Site.

### 3.6 Data Validation Results

All sample analytical data were reviewed to evaluate data quality. Data were validated by experienced DUNN data validators following USEPA validation criteria modified to include NYSDEC ASP CLP requirements. The objectives of the data validation process were to evaluate the validity of the reported sample results and to determine if the data were of sufficient quality, i.e., both valid and usable, to meet project requirements.

Data validation was performed in accordance with a program developed by DUNN, and approved by the Department, which incorporates guidelines established in the USEPA Region 2 SOP No. HW-6, Revision #8, CLP *Organics Data Review and Preliminary Review*, and SOP No. HW-2, Revision #11, *Evaluation of Metals Data for the Contract Laboratory Program (CLP)*. These documents are checklists designed to investigate the degree of accuracy and completeness exhibited by a package of CLP data.

For work performed under NYSDEC ASP (1991) CLP analytical procedures, additions or changes to the general EPA validation procedures were incorporated into the process and the data were assessed according to the NYSDEC-specific requirements.

DUNN validators reviewed the appropriate data and reporting forms as identified in Section 2-10 of this report. After the entire data package had been reviewed, a narrative report and deliverables summary was prepared describing data reduction, reporting and validation procedures. Validation reports are composed of a narrative and the tabulated results of the review. Tabulation consists of the preparation of summary tables of actual sample data and any final note of validation decision or qualification, along with any pertinent footnote references. Additionally, laboratory form "I" sample result sheets are qualified where necessary. These reports provide an indication of the general quality of the data and identify any specific problem areas with the results. The reports also indicate if the data are compliant and usable. DUNN's Data Validation Summary/Usability reports for the analytical results from the Second Phase RI have been provided to the Department under separate cover. Aquatec's Case Narratives and raw data, and DUNN's complete data validation reports are available to the Department upon request.

Validation of the analytical data for the environmental samples collected from the Pelican site during the Second Phase RI revealed that all volatile organic and inorganic data were considered estimated and that all the data are considered valid and useable. Sample PM-TP1-1-2 was improperly analyzed as a medium level soil which resulted in an elevation of the laboratory reporting limits for the semi-volatile organics. Therefore, the results for all semi-volatile compounds that were reported as "non-detect" are unusable. However, several polynuclear aromatic compounds (PAHs) were detected in this sample. Previous environmental data have indicated that, with the possible exception of PAHs, semi-volatile organic compounds are not a concern at the Site. Therefore, the rejection of the non-detect semi-volatile organic results associated with sample TP1-1-2 does not significantly impact the results of the investigation.

In conclusion, the analytical results from the Second Phase RI at the Pelican site are sufficient to meet the needs of the project. Although the semi-volatile compounds that were reported as non-detect in sample TP-1-1-2 are considered unusable, the reported PAH concentrations are valid and are sufficient to meet the needs of the project.

## 3.7 Summary

The Department's November 1993 surface water and sediment sample analytical results indicate that contaminants, in the form of VOCs and metals, exist in these media at locations upstream from the Pelican site. The VOCs detected upstream of the Site are not, however, the same as those detected adjacent to or downstream from the Site. The results indicate that the VOCs in the surface water could have originated, in part, from upstream sources, the former Jamestown City Landfill and/or from the Pelican site. The metals detected in the surface water samples were higher adjacent to and downstream of the Site, indicating that the Pelican site is a potential source of these contaminants, as is the former Jamestown City Landfill. VOCs were not detected in the sediment samples collected upstream of the Site, but were present in the samples collected adjacent to and downstream of the Site. Since these VOCs were also detected in site media, the Pelican site may represent the source of these contaminants, as may the former Jamestown City Landfill. The metals contained in all sediment samples have been impacted with respect to their ability to support benthic biota. Since metals are common to all sediment samples, their origin is problematic.

Subfloor soil sample volatile organic analytical results indicate that the subfloor soil samples in the solvent room in building No. 2223 represent a potential continuing source of volatile organic contamination. The data confirmed that this area could be a source of the elevated volatile organic concentrations detected in groundwater from monitoring well MW-1S. Semi-volatile organic and pesticide/PCB analytical results from the S1 and S2 subfloor samples indicate that neither class of compound is a concern in the solvent room subfloor samples. The metals data indicate that arsenic, copper, mercury and zinc concentrations were elevated with respect to RSCOs in at least one of the two subfloor samples (S1 or S2) collected from beneath the solvent room. However, the arsenic concentrations were not significantly elevated with respect to typical background eastern U.S. soil concentrations.

The data indicate that the subfloor samples do not represent a significant source of metals contamination.

The February 1994 groundwater sampling analytical results confirmed, and were generally consistent with, the results obtained from the samples collected and analyzed in October 1992. Groundwater from monitoring wells MW-1S, MW-19 and MW-20 continue to exhibit elevated concentrations of volatile organics. The February 1994 semi-volatile organic analytical results indicate that semi-volatiles are not a concern in the groundwater. Filtered metal analytical results indicate that, with the exception of iron, manganese, arsenic and barium in groundwater from monitoring well MW-1S, the elevated total matrix groundwater metal concentrations are, most likely, related to the sample sediment loads.

The volatile organic concentrations detected in the TP-1 samples indicate that the shallow soils located adjacent to the northeastern corner of building No. 2223 represent an area contaminated with volatile organic compounds. Concentrations detected in this area also represent a potential source of groundwater contamination. Pesticide/PCB test pit data indicated that these compounds are not a concern on the exterior of the Pelican buildings. Although the semi-volatile organic analytical data indicated that PAHs were detected at concentrations that exceeded RSCOs, considering the nature of the fill material at the Site and the use of the Site as an automotive shop, the reported concentrations are not unexpected. The metals data indicated that all test pit samples exhibited concentrations of arsenic, chromium, copper, mercury, nickel and zinc that exceeded their RSCOs. The data revealed that the TP-4 sample exhibited the highest arsenic, cadmium and zinc concentrations and that these concentrations were significantly elevated with respect to both their RSCO and typical background eastern U.S. soil concentrations. Site soils may represent one potential source of the elevated zinc concentrations detected in the sediment samples collected from the drainage feature located adjacent to (west of) the Pelican site.

# 4.0 GEOLOGY AND HYDROGEOLOGY

## 4.1 Regional Setting

### 4.1.1 Physiography

In southwestern New York, including the Jamestown area, the dominant physiographic feature consists of the Appalachian Uplands which is the northern extent of the Appalachian Plateau. The Appalachian Uplands were formed by dissection of the uplifted flat lying sandstones, shales and siltstones of the Middle and Upper Devonian Catskill Delta. Relief is high to moderate with maximum dissection evidenced in the Catskill Mountain area to the east. In the western portion of the province, the plateau surface consists of relatively flat-topped divides.

In the Jamestown area, the uplands consist of rolling, irregular-shaped hills that rise about 700 feet above the valley floors. The uplands are dissected by many narrow, steep-sided valleys containing swift flowing streams. The southeastern section of the Jamestown area, however, consists of high steep-sided hills and very deep, steep-sided valleys. An escarpment, northwest of Jamestown, drops abruptly to the lowlands along Lake Erie. The lowest altitude in the Jamestown region is approximately 1,230 AMSL feet in the Conewango Creek Valley located approximately four miles southeast of the Site. The highest altitude is greater than 2,100 feet in the uplands located beyond the Conewango Creek Valley to the southeast (Crain, 1966).

The Pelican site is located in the Chautauqua Lake valley which is generally low-lying and flat. A glacial moraine of moderate relief, upon which the City of Jamestown is established, is located east of the Site.

### 4.1.2 Geology

#### 4.1.2.1 Glacial History

Continental glaciers made repeated advances into Chautauqua County during the Pleistocene Epoch. The ice sheet that affected the region was part of the Lake Erie lobe of the Laurentide ice sheet. The glacier advanced and retreated several times in response to slight climatic variations which occurred over a period of approximately two million years. Locally, advancement occurred from the northwest as indicated by the orientation of glacial striations on bedrock surfaces and drumlin and drumlin-like depositional and erosional features. The deposits that are found regionally have been dated and belong to the Woodfordian stage of the late Wisconsin glacial period. The entire county, with the exception of the southeast corner, displays evidence of glaciation. Although the ice margin is presumed to have oscillated across portions of Chautauqua County throughout the Pleistocene, no deposits have been recognized regionally that are older than the Kent Moraine which is considered to be late Wisconsin in age. Earlier deposits were either eroded or reworked during the last major ice advance which is believed to have occurred approximately 20,000 years ago.

The leading edge of the ice front was apparently irregular as it responded to variations in the local topography; thus, minor expansion and contraction of the ice margin within a particular valley may not have occurred in an adjacent valley (Muller, 1963). Maximum erosion generally occurred in preglacial "through valleys" and lowlands that were oriented roughly parallel to the direction of glacial flow. In these low lying areas, ice accumulation was thickest, resulting in increased flow and glacial scouring. Ice accumulation was thinner in the upland areas and in the stream valleys that were oriented transverse to the direction of glacial flow. Consequently, erosion was less effective in these areas (Cadwell, 1988).

The maximum extent of Wisconsin glaciation is represented by the Kent Moraine which crosses the extreme southeastern corner of Chautauqua County. Glacial recession from the Kent Moraine ice margin occurred at least 14,000 years ago as suggested by radiocarbon dating of genetically related marl and peat deposits (Muller, 1963). During this retreat, lakes were impounded in the valleys between the former ice margin and the ice sheet. These ice margin or ice contact deposits are extremely heterogeneous in both lateral and vertical dimension. Sand and gravel (outwash) deposits were formed in the valleys by south-flowing water released as the ice melted. Glacial lacustrine silt and clay deposits were formed in the pre-glacial lakes. Two additional ice margins have been mapped in the Chautauqua Lake region. Both are believed to be associated either with stabilized ice margins or minor ice readvances along a progressively receding ice margin. The Clymer and Findley Lake Moraines are significant topographic features representing these two principal ice margin positions which occurred during late Wisconsin glacial retreat.

The Clymer Moraine forms the drainage divide in the western half of Chautauqua County. The City of Jamestown is situated on this moraine as it extends eastward, southeast of Chautauqua Lake. In this area, the moraine is breached by the Chadakoin River and, east of Falconer, the moraine is breached by Cassadaga Creek.

The Findley Lake Moraine lies approximately four to seven miles north of the Clymer Moraine. This feature corresponds with another, somewhat younger ice margin which occurred during the waning period following Kent glaciation. In the Chautauqua Lake valley, associated morainal deposits include massive kame delta and terrace sediments which constrict Chautauqua Lake at Bemus Point and Stow.

Removal of existing soils (unconsolidated materials) and deep scouring of local rock formations occurred during periods of glacial advance. In the Cassadaga Creek valley, glacial scouring has created as much as 600 feet of vertical relief within less than one-half mile of horizontal distance along the bedrock/glacial sediment interface. Regionally, the depth to bedrock is approximately 300 to 500 feet along the centers of the through valleys and within several tens of feet, or less, from the surface in the upland areas.

The eroded bedrock and soil materials were transported and deposited beneath the glacier during glacial advance asa thin mantle of relatively dense till. This dense material, termed "lodgement till" is prevalent on the upland areas located adjacent to the three major stream valleys which converge in the Jamestown area. Subsequent deposition of heterogeneous (clay through boulder-sized) sediments was associated with the processes that accompanied glacial retreat. The glacial valleys of Conewango Creek, Cassadaga Creek and Chautauqua Lake became accumulation zones for massive deposits of sand, gravel, silt and clay.

Anderson (1982) defines the coarse grained deposits as valley fill aquifers. As the ice melted, enormous quantities of water and sediment were discharged from the glacier. Lowlying areas in the region were flooded as meltwaters became impounded between the retreating glacier and associated moraine or ice contact deposits. Fine-grained silt and clay was deposited in deeper portions of proglacial lakes where low energy depositional environments prevailed. Sand and gravel accumulations deposited under relatively high energy fluvial environments formed as kame terraces and deltas and outwash gravels in the valley fill deposits. Coarse grained sediments were also deposited in areas where the ice stagnated for a period of time.

#### 4.1.2.2 Surficial Deposits

In Chautauqua County, four-fifths of the area is dominated by a broad and maturely dissected plateau. A narrow, low relief lake plain borders Lake Erie along the northern boundary of the County. Most of the unconsolidated deposits in the plateau region have been developed from glacial till while the broad, flat-bottomed valleys are filled with both outwash sand and gravel and silt and clay deposits of former glacial lakes. Deep valleys created by extensive scouring and erosion by the glacial ice were filled with thick deposits of till, glacial outwash, and/or glaciolacustrine silt and clay.

The Pelican site is situated within the Chautauqua Lake valley at the base of the Jamestown terminal moraine, and within close proximity to the broad valleys of the Cassadaga Creek and Conewango Creek. The valleys in this area contain deep deposits of glacial till, glacial outwash, and glaciolacustrine silt and clay and glacial till exceeding 600 feet in total thickness at some locations. Surficial deposits found in the upland area to the east and southeast generally consist of thin layers of glacial till directly overlying bedrock.

#### 4.1.2.3 Bedrock

The bedrock underlying Chautauqua County consists of Late Devonian age sedimentary rocks (Rickard and Fisher, 1970). The region is characterized by predominantly gray shales and siltstones which are typically interbedded with layers and lenses of gray sandstone, siltstone and conglomerate. Overall, these clastic rocks are relatively fine-grained and represent subaqueous deltaic deposition in shallow seas which existed approximately 350 million years ago (Frimpter, 1974).

Bedrock underlying the Site is estimated to be approximately 212 feet below the ground surface on the basis of information reported from well # 206-914-1, located immediately south of the Site (Crain, 1966). The actual bedrock unit underlying the Site has not been confirmed by drilling. A review of the local stratigraphy and published information of mapped outcrops in the Jamestown area indicates that the bedrock unit presumably underlying the unconsolidated sediments at the Site is the Northeast Shale, the uppermost member of the Canadaway Formation (Tesmer, 1963).

The Northeast Shale crops out fairly extensively in the northern portions of Chautauqua County. Where it has been observed, its total thickness reportedly varies from 400 to 600 feet (Tesmer, 1963). Lithologically the Northeast Shale is a sequence of mostly medium gray shales interbedded with occasional, thin light gray siltstone layers that are approximately one to four inches thick (Tesmer, 1974).

### 4.1.3 Hydrology

#### 4.1.3.1 Surface Water

The Allegheny River Basin includes nearly all of Chautauqua County with the exception of a very small section in the northern part of the county which is part of the Erie-Niagara drainage system. In the eastern two-thirds of the county, the principle drainage system for the upland areas is Conewango Creek and its associated tributaries. Conewango Creek generally flows to the south through a broad, flat valley ranging between one and one-half and three miles wide with sloping sides rising 200 to 300 feet above the valley floor. Cassadaga Creek, another important drainage system, connects the Cassadaga Lakes to the Chadakoin River. The Cassadaga Creek Valley is characterized as level, poorly drained, one to two miles wide, with abrupt slopes rising 200 to 300 feet above the valley floor. Chautauqua Lake is drained by the Chadakoin River which flows eastward, meandering in a narrow valley through Jamestown, into Cassadaga Creek, approximately five miles to the east of the Site, and ultimately draining into Conewango Creek approximately three miles north of Frewsburg. The majority of the southwestern part of the county is drained by French Creek, while drainage along the northern escarpment and the lake plain is primarily to the north into Lake Erie by means of many small streams.

Surface drainage at the Site is generally to the west and south toward the Chadakoin River. Historic records indicate that a series of drainage canals and ditches were connected to the City of Jamestown's storm water collection system and served to drain the eastern part of the city. Some of these ditches still exist while others have been filled in or have been diverted to other natural and man-made ditches at and in the vicinity of the former Jamestown City Landfill located to the west of the Site. Filling on both the landfill and the Pelican site in combination with the surface drainage system has resulted in standing water on the western portion of the Site.

#### 4.1.3.2 Groundwater

Based on information obtained from well logs from previous investigations and DUNN's recent investigation, the water table is at shallow depth (i.e., less than five feet) due to the presence of low-permeability deposits beneath the Site and the base level at the Chadakoin River. The Jamestown Aquifer may be present beneath the low-permeability deposits at the Site. If present, the Jamestown Aquifer is located more than 50 feet below the ground surface at the Site.

Yields of aquifers in the Chautauqua Lake valley, Cassadaga Creek valley and Conewango Creek valley range from one gallon per minute (gpm) to greater than 1,000 gpm (Frimpter, 1974 and Anderson, 1982). The greatest yield potential is from sand and gravel deposits confined under layers of low-permeability glaciolacustrine silt and clay.

Regional well logs indicate that wells are either screened in a low yielding bedrock aquifer or a moderate to high yielding sand and gravel aquifer located approximately 70 feet below the surface (E&E, 1988). The two wells closest to the Site are 206-914-1 and 206-914-2. Well 206-914-1 (P. Petrino), approximately 316 feet in depth, is screened in shale from 212 to 316 feet and yields a non-potable (saline) supply of groundwater. Well 206-914-2 (Bendo, Inc.) is located approximately 1,800 feet to the south of the Site. This artesian well, proposed for commercial use and reportedly abandoned, had a total depth of 67 feet. The well was screened in gravel and yielded 44 gallons per minute (Crain, 1966) in this area. Approximately one mile west of the Pelican site, a north-south cross section through four seep wells (207-915-4, 207-915-1 (projected west), 206-915-2 and 206-915-1) indicates a depth to bedrock (from the Pelican site elevation of 1320 +/-) of more than 200 feet. The valley fill along this section consists predominantly of glaciolacustrine silt and clay, with no evidence of the presence of the Jamestown Aquifer in this area.

Two to three miles east of the Site, the Jamestown Aquifer is an artesian aquifer which extends from Hartson Swamp up the Cassadaga Creek valley to the vicinity of Towerville Corners (Crain, 1966). It is composed of outwash sand and gravel, deposited in the Cassadaga glacial valley downstream from the melting ice front. Outwash deposition was followed by the formation of a glacial lake, in which a confining layer of silt and clay was deposited above the sand and gravel. The thickness of this overlying confining layer ranges from 80 feet in the Hartson Swamp area to 140 feet in the vicinity of Towerville Corners. The elevation of the top of the Jamestown Aquifer ranges from approximately 1140 to 1210 feet above mean sea level in this area (Crain, 1966). Approximately one mile west of the Pelican site, a north-south cross section through four deep wells (207-915-4, 207-915-1, (projected west), 206-915-2 and 206-915-1) indicates a depth to bedrock (from the Pelican site at elevation 1320 ±) of more than 200 feet. The valley fill along this section consists predominantly of glacio-lacustrine silt and clay, with no evidence of the presence of the Jamestown Aquifer in this area.

The closest public water supply source (City of Jamestown) lies mainly within buried glacial deposits underlying the Cassadaga Creek valley. The city's municipal wells are located approximately three and one-half miles to the northeast of the Site and pump from Jamestown Aquifer, a 20 to 50 foot thick sand and gravel aquifer which is more than 100 feet below ground surface (E&E, 1988). This aquifer is recharged almost entirely by infiltration through sand and gravel deposits where streams cross the relatively permeable valley fill deposits. This aquifer is believed to be hydraulically separated from the sand and gravel deposits underlying the Site by a groundwater divide located to the east of the Site. The direction of regional groundwater movement west of the Clymer moraine is presumed to be to the west-southwest, discharging to the Chadakoin River. Shallow groundwater flow at the Site is also presumed to discharge into the Chadakoin wetlands and River.

## 4.2 Local Setting/Site Conditions

### 4.2.1 Site Topography

The Site is located in a generally level area at an average elevation of about 1320 feet above mean sea level. Site elevations range from approximately 1316 to 1326 feet above mean sea level. Within a one-half mile radius of the Site, elevations range from 1300 feet to over 1600 feet above mean sea level. West of the Pelican buildings, the ground surface slopes gradually to the west, eventually dropping off the edge of the fill into a north-south drainageway. Runoff from the Site generally drains toward the west into the wet area that borders the former Jamestown City landfill and Chadakoin River wetland Although the landfill is relatively well-drained, as a result of man-made surface and subsurface drainage channels, ponded areas have been observed on the landfill following periods of moderate to high rainfall. One of these areas is located northwest of the Pelican site.

### 4.2.2 Site Geology

#### 4.2.2.1 Surficial Soils

The eastern portion of the Site overlies Chenango gravel soils, formed on a terrace of kame gravel of glacial outwash origin. The soil is very well to excessively drained. West of the Pelican buildings, the ground slopes down approximately ten feet to the wet area which overlies Carlisle muck soil. This is a very poorly drained soil and is formed mostly of plant debris, reportedly overlying lake sediments. Some demolition debris and other miscellaneous materials have been dumped over the western slope of the Site, which has extended the original fill further into the wet area and drainageway which form the western border of the Site.

#### 4.2.2.2 Overburden Materials

The Pelican site lies at the base of the Jamestown terminal moraine (Clymer Moraine) to the east, with the Chautauqua Lake valley located to the west. A glacial lake was created in the valley when drainage in the glacial valley was blocked by the Clymer Moraine. The valley fill sediments are comprised of ice-laid deposits of till, melt-water (outwash) deposits of sand and gravel (lacustrine), lake deposits of silt and clay, and relatively recent deposits of muck (Crain, 1966). An outlet was cut through the moraine by the Chadakoin River draining the former glacial lake from the present Chautauqua Lake valley. A man-made dam maintains the lake at its present elevation.

The Site is underlain by a 1.5 to 9.5 feet thick layer of fill. The fill consists of rubble, brick, and cinders in a clayey silt matrix. A one to five foot layer of muck underlies the fill in the central and southern portion of the Site. Muck is an example of a recent deposit formed by the decay of organic material. These deposits continue to form in the wet areas bordering the Site on the west, in the drainageways and in the Chadakoin River wetlands. Below these units are mixed deposits of morainal material; deposits of sand, gravel, lake-laid silt and clay, and till occurring as irregular masses and layers. A layer of glacial till of fairly uniform texture and composition was encountered in the lower portion of each of the borings drilled by DUNN, suggesting a relatively continuous layer. At boring D-3 the layer of sand beneath the top of the till may be either totally enclosed within the till or may represent an area where the initial deposition of till was relatively thin.

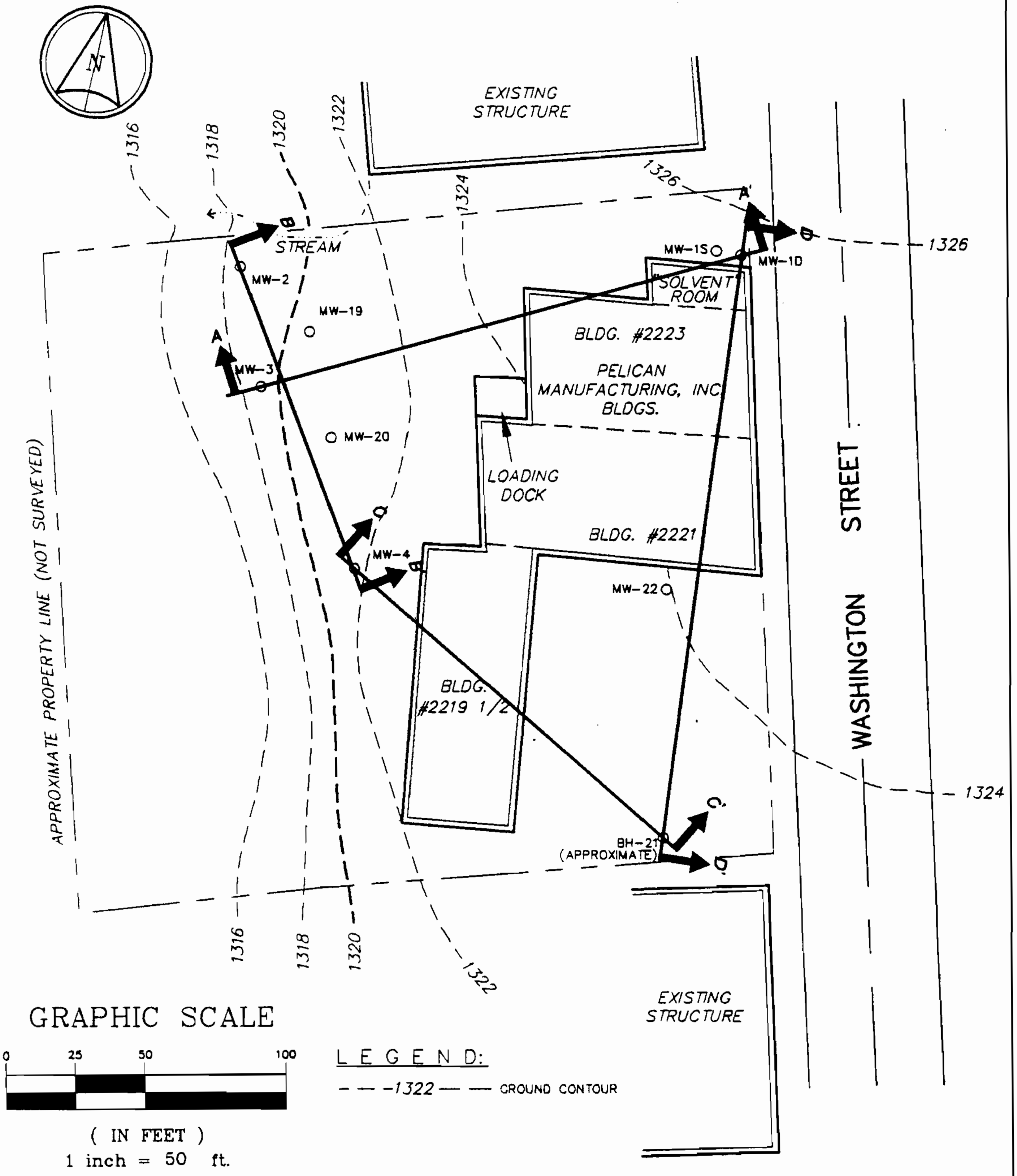
Geologic cross-sections across the Site were prepared from the information obtained from the subsurface borings, and are presented on Plate 1. Locations of the cross-sections are indicated on Figure 4-1. The morainal deposits underlying the Pelican site are not uniform or laterally extensive, and cannot be stratigraphically or hydraulically correlated between borings with any degree of certainty.

### 4.2.3 Site Hydrology

Both an upper, unconfined water bearing zone and a lower, semi-confined water bearing zone were encountered during the subsurface investigations at the Site. The upper water bearing zone consists of fill, muck, and sand and gravel, as described below. The lower water bearing unit is comprised of an apparently thin, laterally continuous, sand and gravel layer beneath the eastern portion of the Site. The zones are separated by a semi-confining material composed of lower permeability deposits. The lower groundwater bearing zone exhibits artesian properties due to the overlying semi-confining materials. When this "leaky aquitard" is penetrated, and more direct communication with the semi-confined aquifer is established, a positive upward hydraulic gradient and artesian conditions result as the hydrostatic pressure equilibrates. Due to the heterogeneity of the mixed deposits, vertical hydraulic gradients may vary significantly at any given location on the Site, depending on the specific vertical variation in the hydraulic conductivity of the deposits penetrated by a well or boring.

The upper water bearing zone is comprised of fill, muck, and an "outwash" sand and gravel unit screened from four to nine feet below the ground surface in MW-19 and MW-22. The screen in monitoring well MW-20 was installed five to ten feet below ground in fill and muck. MW-1S, located in the northeastern portion of the Site, is screened from 6.2 to 13.0 feet below ground, and extends into the upper portion of the mixed morainal deposits. The upper water bearing zone extends approximately 25 feet below ground at MW-1D, where the screen is installed from 18 to 28 feet below ground. The lower portion of the screen and the remainder of the boring, sealed prior to installing the well, was located within a dense till deposit composed of silty clay and gravel. The till acts as a hydraulic barrier to underlying hydrostatic pressure at this location.

Groundwater level elevation data was collected on October 13, 1992 and February 8, 1994. The data are presented in Tables 4-1 and 4-2 respectively. Groundwater elevation contour maps of the upper, unconfined water bearing zone are presented on Figure 4-2 and 4-3 respectively. The groundwater levels within the upper, unconfined zone were almost identical at the time of the two measurements. Water levels were generally three to seven feet below the ground surface across the Site. The groundwater flow direction was again, almost identical during both measurements, and was to the west-southwest toward the north-south drainageway that borders the Site on the west. In the northern portion of the Site, groundwater flow subtly mimics the topography, and is directed in a westerly direction toward a small stream in the northwest corner of the Site. The groundwater flow in the central portion of the Site is in a west-southwest direction, and is affected by the presence of the Pelican buildings. The buildings effectively limit natural recharge of the groundwater, causing a slight redirection of flow to the west. Storm sewers and sanitary sewer lines that may be present under the buildings could also effectively reduce recharge to the groundwater by acting as lateral drains. Reduced recharge in an area generally results in an artificial lowering of groundwater levels and may affect the horizontal groundwater gradient, as shown on the contour map. Groundwater flow in the southern portion of the



**DUNN ENGINEERING COMPANY**

DIVISION OF RUST ENVIRONMENT & INFRASTRUCTURE

**LOCATION OF GEOLOGIC CROSS – SECTIONS**

PELICAN MANUFACTURING, INC. SITE

City of Jamestown

Chautauqua Co., NY

| | | | | |
|---|---|---|---|---|
| PROJECT No. 35120.700 | DATE 7/94 | DWG. No. EC-119_5 | SCALE 1"=50' | FIGURE No. 4-1 |

# TABLE 4-1

## PELICAN MANUFACTURING , INC. SITE
## GROUNDWATER ELEVATIONS
## OCTOBER 13, 1992

| Well | Water Level From Measuring Point (ft) | Measuring Point Elevation | Groundwater Elevation |
|---|---|---|---|
| | | | |
| MW-1S | 5.54 | 1324.74 | 1319.20 |
| | | | |
| MW-1D | 5.72 | 1325.02 | 1319.30 |
| | | | |
| MW-2 | Artesian* | 1321.30 | >1321.30 |
| | | | |
| MW-3 | Artesian* | 1322.23 | >1322.23 |
| | | | |
| MW-4 | 1.06** | 1324.11 | 1323.05 |
| | | | |
| MW-19 | 5.49 | 1321.49 | 1316.00 |
| | | | |
| MW-20 | 6.70 | 1322.08 | 1315.38 |
| | | | |
| MW-22 | 8.46 | 1327.50 | 1319.04 |

* Flowing over top of PVC riser
** Also artesian, head above ground within PVC riser

excel:peli4-1.xls

## TABLE 4-2

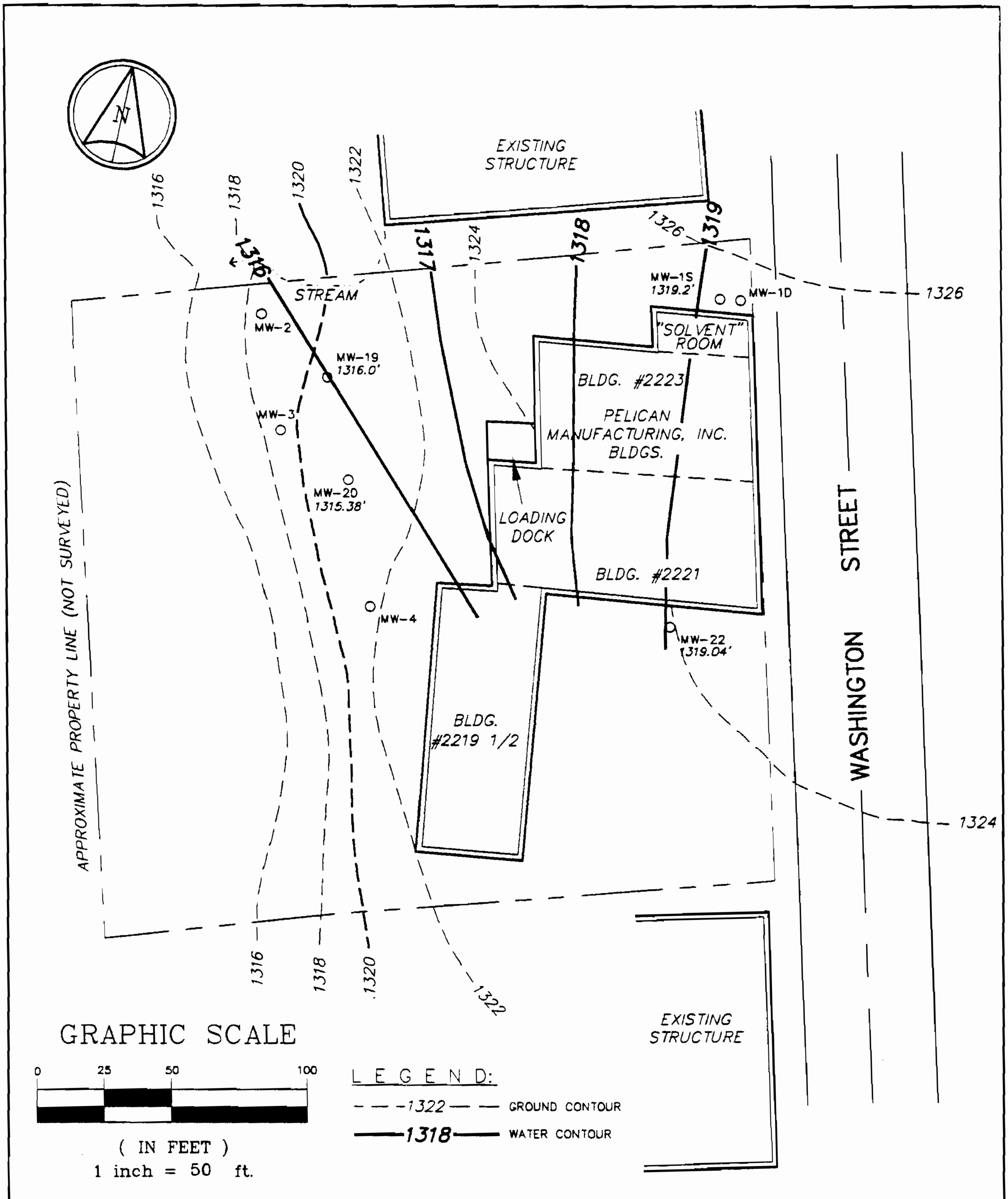
## PELICAN MANUFACTURING, INC. SITE
## GROUNDWATER ELEVATIONS

### FEBRUARY 8, 1994

| Well | Water Level From Measuring Point (ft) | Measuring Point Elevation | Groundwater Elevation |
|---|---|---|---|
| | | | |
| MW-1S | 5.62 | 1324.74 | 1319.12 |
| | | | |
| MW-1D | 5.67 | 1325.02 | 1319.35 |
| | | | |
| MW-2 | NM | 1321.30 | NA |
| | | | |
| MW-3 | NM | 1322.23 | NA |
| | | | |
| MW-4 | NM | 1324.11 | NA |
| | | | |
| MW-19 | 5.50 | 1321.49 | 1315.99 |
| | | | |
| MW-20 | 6.76 | 1322.08 | 1315.32 |
| | | | |
| MW-22 | 8.45 | 1327.50 | 1319.05 |

NM = Not Measured
NA = Not Available

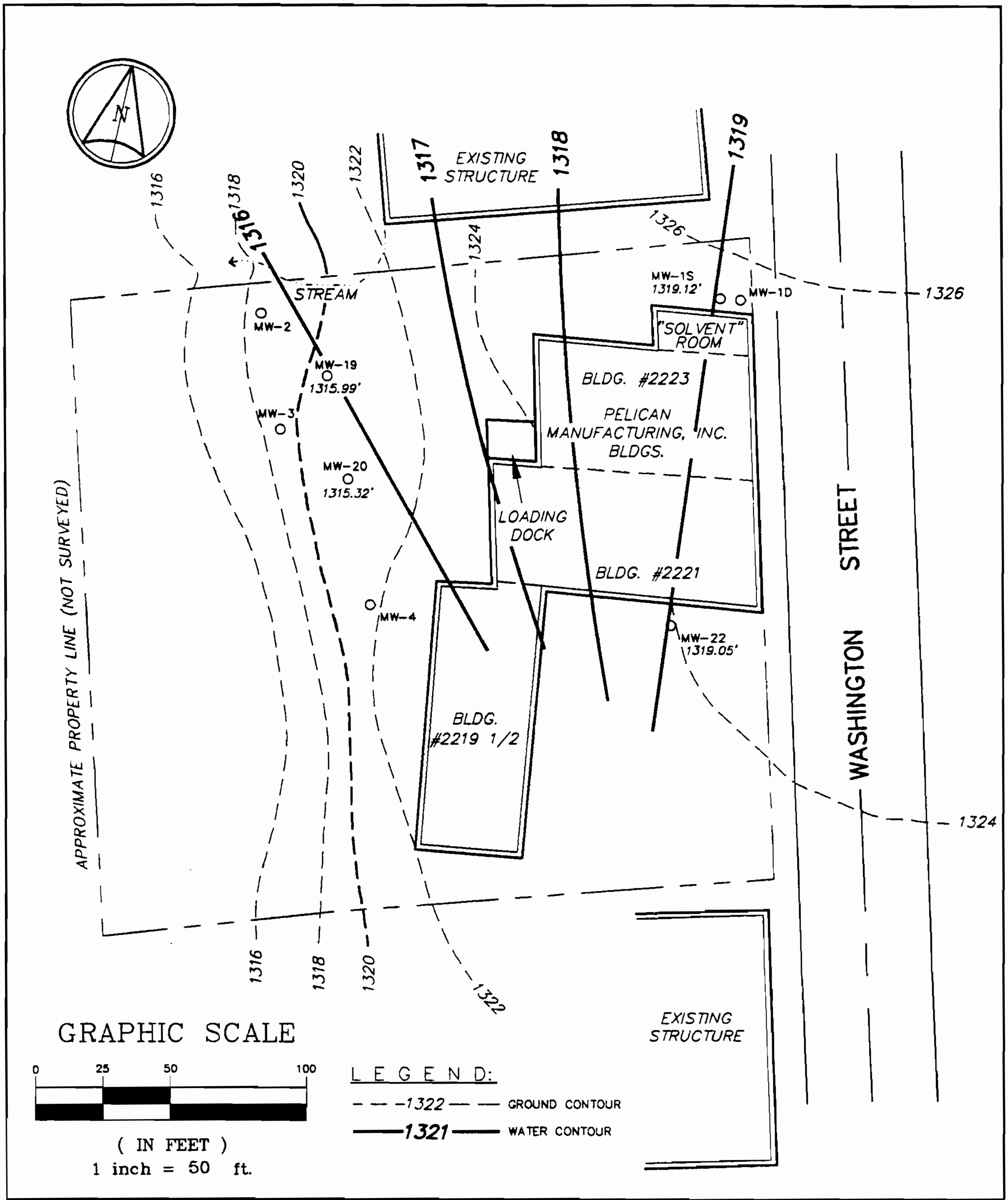
excel:peli4-2.xls



**DUNN ENGINEERING COMPANY**
DIVISION OF RUST ENVIRONMENT & INFRASTRUCTURE

**GROUNDWATER CONTOUR MAP**
**UPPER, UNCONFINED WATER BEARING ZONE**
**WATER LEVEL ELEVATIONS – OCTOBER 13, 1992**
PELICAN MANUFACTURING, INC. SITE
City of Jamestown
Chautauqua Co., NY

| | | | | |
|---|---|---|---|---|
| PROJECT No. 35120.700 | DATE 7/94 | DWG. No. EC-119_4 | SCALE 1"=50' | FIGURE No. 4-2 |



**DUNN ENGINEERING COMPANY**

DIVISION OF **RUST** ENVIRONMENT & INFRASTRUCTURE

**GROUNDWATER CONTOUR MAP**
**UPPER, UNCONFINED WATER BEARING ZONE**
**WATER LEVEL ELEVATIONS – FEBRUARY 8, 1994**
PELICAN MANUFACTURING, INC. SITE

City of Jemestown Chautauqua Co., NY

| | | | | |
|---|---|---|---|---|
| PROJECT No. 35120.700 | DATE 7/94 | DWG. No. 35120-16 | SCALE 1"=50' | FIGURE No. 4-3 |

Site is to the southwest and apparently reflects input to the north to south flow in the drainageway bordering the Site on the west.

The horizontal groundwater flow velocity was calculated for the direction of groundwater flow observed at the Site. Groundwater flow velocity is calculated by a modification of Darcy's Law to account for the effective porosity of the screened material. The average linear velocity of the overburden groundwater flow is calculated by:

$$v = Ki/n$$

where K is the hydraulic conductivity (feet/day), i is the horizontal hydraulic gradient (feet/feet) and n is the effective porosity.

The geometric mean hydraulic conductivity for the unconfined water bearing zone was estimated to be 6.46 feet/day in Section 2-8. Horizontal hydraulic gradients in the overburden range from 0.019 to 0.022 feet/feet for the northern portion of the Site and from 0.037 to 0.057 feet/feet in the central portion of the Site. The higher gradients in the central part of the Site result from the previously described influence of the Pelican buildings. The effective porosity is the ratio of the void space through which groundwater flow occurs to the total volume of the mass. For glacial till, Fetter (1980) estimates 10 to 20% effective porosity. Using these values with the above equation results in calculated velocities of 0.61 to 1.4 feet/day in the northern portion of the Site, and 1.2 to 3.7 feet/day in the central portion of the Site.

The fine-grained layers within the mixed morainal deposits underlying the fill and muck act locally as a leaky aquitard, as demonstrated by the hydrologic conditions encountered during penetration of this unit at MW-1D, MW-2, MW-3, MW-4, and at E&E's boring BH-21, as described below.

At MW-1D, artesian conditions were encountered at 40.5 feet. The borehole was sealed to 28 feet below ground with a mixture of bentonite, sand and cement placed in the bottom of the borehole and allowed to set prior to well installation. The lower portion (3 feet) of the well was screened in the dense till unit. At BH-21, boring log information indicates that artesian conditions were encountered upon penetrating the lower, confining zone at a depth of 55 feet below ground. Coarse-grained material filled the augers along with the rising water level. The boring was then plugged and abandoned.

Artesian conditions occurred in DUNN's boring D-2 overnight, after advancing the augers to 23 feet and collecting soil samples to 27 feet below ground. The screen in Well MW-2 was set at 14 to 23 feet below ground, through a soft, silty clay unit and into till at the bottom. No seal was installed at the bottom of the boring, which allowed the hydrostatic pressure from the lower water bearing zone to equilibrate overnight. The water level rose above the ground surface, having previously been at a depth of eight feet during drilling. A similar situation occurred at MW-4, where the boring was advanced to a depth of 30 feet and artesian conditions were encountered. Sand was placed from the bottom of the boring up to 29 feet. The well screen was set at 19 to 29 feet below ground within a thin coarse to fine sand unit apparently overlain and confined by a dense till. From an initial water level of approximately 20 feet below ground during drilling, the water rose to a level approximately one foot above the ground surface. Artesian conditions were encountered at 33 feet below ground at D-3 prior to installing the well. After flushing the augers, the sand pack was installed from 29.6 to 33 feet below ground and a screen was set from 19.6 to 29.6 feet below ground.

The sand packs and screens in wells MW-2, MW-3, and MW-4 act as conduits for the equilibration of hydrostatic pressure in the mixed deposits, resulting in the artesian conditions in those wells. As a result of sealing the bottom of boring D-1D, within a dense confining layer in the mixed deposits, artesian conditions are not present in MW-1D.

### 4.2.4 Results

#### 4.2.4.1 Analytical Results

Based upon the analytical results from the groundwater sampling event performed by DUNN during the First Phase RI, impacts on groundwater quality appear to be restricted to the upper groundwater bearing zone. Groundwater standards were exceeded only in samples collected from wells completed in this zone. The only exception was in artesian well MW-2, screened in the lower, semi-confined water bearing zone. A detection of 1,2-dichloroethene (total= 6 ug/l) was slightly greater than the groundwater standard of 5 ug/l.

#### 4.2.4.2 Interpretation of Site in General

The available geologic and hydrogeologic information indicates that a hydraulic connection between the Site and the Jamestown Aquifer is unlikely. Logs of deep wells one mile west of the Pelican site reveal no evidence of the Jamestown Aquifer, in addition, the borings performed at the Site imply a different geologic and hydrogeologic setting in the Chautauqua Lake valley than in the Cassadaga Creek valley, where the City of Jamestown obtains its municipal water supply from the Jamestown Aquifer.

Artesian conditions were encountered at the Pelican site at approximately 50 feet below ground, at an elevation of approximately 1275 feet above mean sea level. This is, at a minimum, 65 feet higher than the Jamestown Aquifer horizon. Additionally, the thick clay and silt confining layer that overlies the Jamestown Aquifer in the Cassadaga Creek valley was not encountered in any of the Site borings. DUNN's additional subsurface work reconfirms E&E's interpretation of a mounded water table under the moraine to the east, producing groundwater flow direction away from the moraine toward the Site. In addition, the mounded water table within the moraine produces a high hydraulic head in confined aquifers in areas adjacent to the moraine, such as at the Pelican site. E&E (1988) documented unconfined water table conditions east of the Site in the Jensen-Haglund well installed at an elevation 100 feet above the Site. These data confirm that groundwater flow within the upper, unconfined water bearing zone at the Site, and east of the Site, is toward the west. Based upon flowing conditions at well 206-914-2, the potentiometric surface for the uppermost gravel layer in this boring is above the ground surface of the Site (E&E, Crain). This suggests that the potential for contamination of the deeper, confined or semiconfined water bearing zones is minimal due to upward gradients and documented artesian conditions. Groundwater from the upper, unconfined water bearing zone is expected to eventually discharge to the Chadakoin River and associated wetlands.

### 4.2.5 Conclusions

The Jamestown Aquifer, if it exists beneath the Site, will not be affected by any on-site impacts to groundwater. Current mapping of this aquifer indicates that, at its closest point, it is approximately 2.7 miles east of the Site and that artesian conditions are present within this aquifer (Crain, 1966). Artesian conditions within the deeper deposits in this region, including the Jamestown Aquifer, preclude significant downward migration of contaminants originating at the ground surface. The absence of contaminants in the deeper deposits investigated at the Site, which exhibit artesian conditions, has been confirmed by the analysis of groundwater samples from wells screened in these deposits. In addition, the groundwater flow direction, in the upper, unconfined water bearing zone is west, away from the Jamestown Aquifer and the municipal supply wells to the east. Furthermore, the geologic literature and borings at the Site indicate that the geologic setting in the Chautauqua Lake valley, where the Site is located, is significantly different from that in the Cassadaga Creek valley, where the Jamestown Aquifer is located. These differences result in the hydrologic separation of the Site from the Jamestown Aquifer. This hydrologic separation is confirmed by the conditions documented in Crain (1966) and E&E's 1988 report.

# 5.0 SCREENING OF ALTERNATIVES (FIRST AND SECOND PHASE FS)

## 5.1 Introduction

The purpose of the Feasibility Study for the Pelican site is to identify and analyze remedial alternatives for the Site that are consistent with the objectives of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Sec. 121 as well as New York State Department of Environmental Conservation (NYSDEC) Technical and Administrative Guidance Memorandum (TAGM), No. HWR-4030, dated September 13,1989 and revised May 15,1991. The primary objective of Sec. 121 and TAGM 4030 is to select a remedial alternative that is protective of human health and the environment. In addition, the selected remedy shall, to the extent practicable, comply with Applicable or Relevant and Appropriate Requirements of Federal laws and regulations (ARARs) and New York State Standards, Criteria and Guidelines (SCGs), as described in Section 2.13 of this document. Section 121 of CERCLA and New York State program guidance both express a preference for remedial technologies which permanently and significantly reduce the toxicity, mobility or volume of hazardous substances.

In this portion of the feasibility study, various remedial technologies, which may have application at the Pelican Site, have been identified and preliminarily evaluated. The remedial technologies have been selected and evaluated based on the nature and extent of site contamination as described in Sections 2 and 3.

The primary concerns identified during the Remedial Investigation at the Pelican site are:

- the potential for exposure of humans and the environment to site contaminants considering the current use of the Site and potential future uses of the Site;
- the potential for migration of such contaminants from the Site;
- the actual or potential impacts of the contaminants on off-site receptors; and
- the proper treatment and disposal of waste materials generated during the remedial program.

## 5.2 Remedial Action Objectives

Remedial Action Objectives (RAOs) for the Pelican site are as follows:

- minimize or reduce to acceptable levels the potential for human exposure to any environmental media containing site-related contaminants;
- minimize the potential for off-site migration of any site-related contaminants that may result in a significant human exposure or adverse environmental impact; and

- permanently contain, treat and/or dispose of contaminated site media in a manner consistent with State and Federal regulations.

Remedial action objectives for the Pelican site have been selected to minimize or reduce to acceptable levels the potential for human exposure to, or environmental damage due to:

- the contaminants of concern (COC) identified during previous investigations performed at the Site, chemicals used by previous businesses operating at the Pelican site, and contaminants identified during the RI;
- the environmental media that have been impacted by the use and disposal of chemical wastes at the Site, including surface and subsurface soil, groundwater, surface water and sediment; and
- the sediments contained in the sewer lines and septic tank (subsequently referred to as "contained sediments").

Note: The surface water and wetland areas immediately west of the Site have not been addressed in this FS since these environmental resources have potentially been affected by waste materials released from one or more nearby potential source areas. Any contaminants found in surface water or wetlands adjacent to the Pelican site cannot be solely attributed to the Site. Moreover, the remedial program that will be selected for the Pelican site will reduce future off-site migration of contaminants from the Site which will further reduce any impact the Site may have on surface water and adjacent wetlands.

## 5.3 Contaminants of Concern

### Nature of Contamination

As described in Sections 2 and 3 of the RI report, numerous soil, groundwater, and sediment samples were collected at the Pelican site to characterize the nature and extent of contamination. The primary COC were selected based on common risk assessment practices (EPA, 1989) with consideration given to the toxic properties of the individual chemicals, frequency of detection, common "background" levels, site activities/history, and the overall quality of the data. A certain degree of professional judgement was also used in the selection process. All chemical contaminants detected during investigations at the Site were considered in the COC selection process. Volatile organic compounds (VOCs), including 1,1,1-trichloroethane, trichloroethene, 2-dichloroethene, vinyl chloride, toluene, and possibly tetrachloroethene and carbon tetrachloride were identified as potential COC based on historical use of the Site, previous sampling results and the known breakdown products of trichloroethene.

### 5.3.1 Soil

The following COC were detected in on-site soils:

- trichloroethene;
- 1,2-dichloroethene (cis and trans);
- 1,1, 1-trichloroethane;
- tetrachloroethene; and
- acetone.

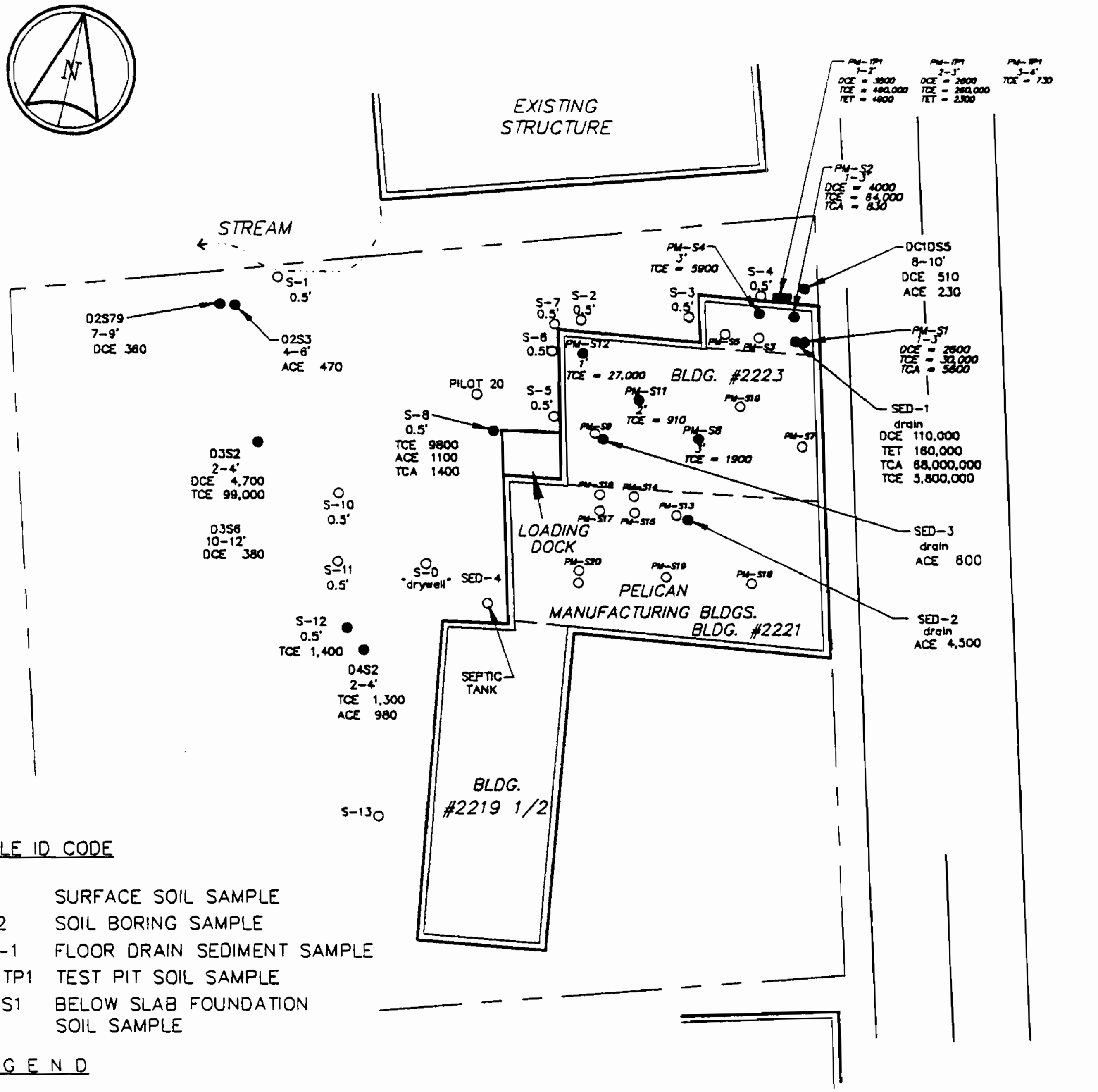
Other contaminants present in the soil, but not considered to pose a significant environmental threat attributable to the Pelican site are:

- toluene;
- xylene;
- 2-butanone (MEK);
- ethylbenzene; and
- pesticides.

The volume of soil to be remediated has been calculated based on the NYSDEC Recommended Soil Cleanup Objectives and the cleanup goals proposed in this FS. The proposed cleanup goals are consistent with NYSDEC program guidance and are considered protective of public health and the environment. The volume of soil that may require remediation includes:

- surficial soil (above the water table) that contains VOCs at concentrations greater than the NYSDEC "Recommended Soil Cleanup Objectives" ("hot spots") - estimated at 300 cubic yards;
- soil beneath the floor of the buildings that contains VOCs at concentrations greater than the NYSDEC "Recommended Soil Cleanup Objectives" - estimated at 650 cubic yards; and,
- all soil on-site that contains VOCs at concentrations greater than the NYSDEC "Recommended Soil Cleanup Objectives", including the hot spots, soil beneath the buildings, and soil below the water table - estimated at 7000 cubic yards.

The sampling locations where these compounds were detected are shown in Figure 5-1 and the areas requiring remediation are shown on Figure 5-2.



## SAMPLE ID CODE

| | |
|---|---|
| S-1 | SURFACE SOIL SAMPLE |
| D3S2 | SOIL BORING SAMPLE |
| SED-1 | FLOOR DRAIN SEDIMENT SAMPLE |
| PM-TP1 | TEST PIT SOIL SAMPLE |
| PM-S1 | BELOW SLAB FOUNDATION SOIL SAMPLE |

## LEGEND

| | |
|---|---|
| ● | SAMPLE LOCATION THAT EXCEEDS SOIL CLEANUP GOALS |
| ○ | SAMPLE LOCATION THAT DOES NOT EXCEED SOIL CLEANUP GOALS |

NOTE:

Concentrations are reported in ppb.

| COMPOUND ABREVIATIONS | | SOIL CLEANUP GOALS |
|---|---|---|
| 1,2-DCE (Total) | DCE | 245 |
| Trichloroethene | TCE | 700 |
| 1,1,1-TCA | TCA | 760 |
| Tetrachloroethene | TET | 1,400 |
| Acetone | ACE | 110 |

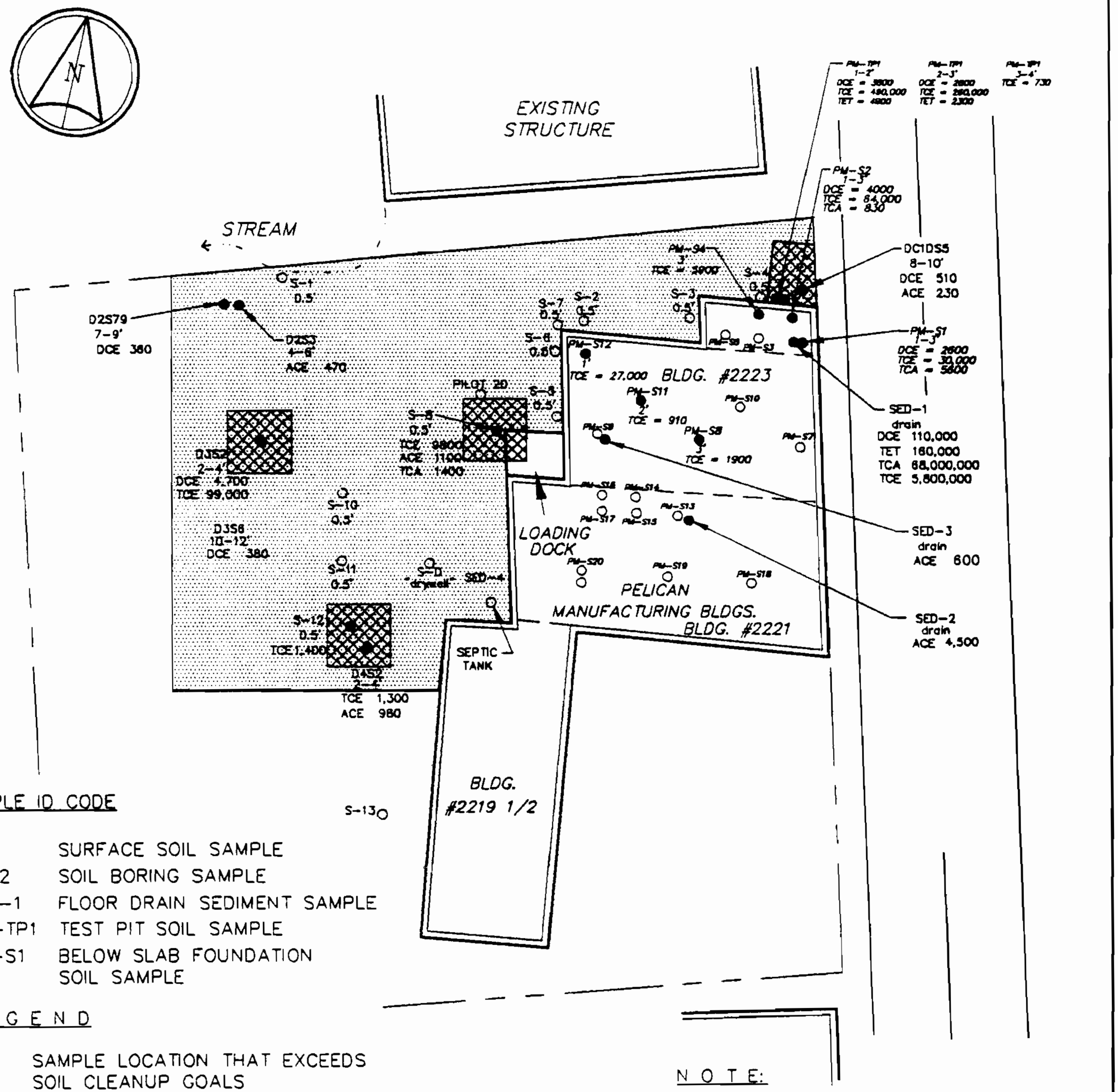
**DUNN ENGINEERING COMPANY**
DIVISION OF RUST ENVIRONMENT & INFRASTRUCTURE

**SOIL/SEDIMENT SOIL CLEANUP GOAL EXCEEDENCES**

PELICAN MANUFACTURING, INC. SITE

City of Jamestown — Chautauqua Co., NY

| | | | | |
|---|---|---|---|---|
| PROJECT No. 35120.700 | DATE 7/94 | DWG. No. A9438_1 | SCALE 1"=50' | FIGURE No. 5-1 |



SAMPLE ID CODE

| | |
|---|---|
| S-1 | SURFACE SOIL SAMPLE |
| D3S2 | SOIL BORING SAMPLE |
| SED-1 | FLOOR DRAIN SEDIMENT SAMPLE |
| PM-TP1 | TEST PIT SOIL SAMPLE |
| PM-S1 | BELOW SLAB FOUNDATION SOIL SAMPLE |

LEGEND

- ● SAMPLE LOCATION THAT EXCEEDS SOIL CLEANUP GOALS
- ○ SAMPLE LOCATION THAT DOES NOT EXCEED SOIL CLEANUP GOALS
- ▒ APPROXIMATE AREAL EXTENT OF SURFACE AND SUBSURFACE SOIL TO BE REMEDIATED (Alternative A5)
- ▩ APPROXIMATE AREAL EXTENT OF SURFACE SOIL "HOT SPOTS" TO BE REMEDIATED (Alternative A3 & A4)

NOTE:

Concentrations are reported in ppb.

| COMPOUND ABREVIATIONS | | SOIL CLEANUP GOALS |
|---|---|---|
| 1,2-DCE (Total) | DCE | 245 |
| Trichloraethene | TCE | 700 |
| 1,1,1-TCA | TCA | 760 |
| Tetrachloraethene | TET | 1,400 |
| Acetone | ACE | 110 |

**DUNN ENGINEERING COMPANY**
DIVISION OF RUST ENVIRONMENT & INFRASTRUCTURE

**SOIL/SEDIMENT SOIL CLEANUP GOAL EXCEEDENCES AND AREAS OF SOIL TO BE REMEDIATED**
PELICAN MANUFACTURING, INC. SITE
City of Jamestown
Chautauqua Co., NY

PROJECT No. 35120.700
DATE 7/94
DWG. No. 35120-12
SCALE 1"=50'
FIGURE No. 5-2

### 5.3.2 Groundwater

The following COC were detected in groundwater samples collected from on-site monitoring wells:

- trichloroethene;
- 1,2-dichloroethene (cis and trans);
- vinyl chloride;
- 1,1,1-trichloroethane; and
- toluene.

Samples collected from monitoring wells MW-1D, MW-22 and MW-3 during the first phase of the Remedial Investigation were analyzed for the complete list of organic compounds on the NYSDEC Target Compound List (TCL) and the list of inorganics on the NYSDEC Target Analyte List (TAL). All other groundwater samples were analyzed for the volatile fraction of the TCL only (VOCs). Several VOCs, including tri-, di- and mono-chloroethene (vinyl chloride) and toluene were detected at concentrations above New York State groundwater quality standards in the new "upgradient" monitoring wells MW-1S and MW-1D, and also in monitoring wells MW-19 and MW-20 which were installed by previous investigators. The "upgradient" wells (MW-1S and MW-1D) and monitoring wells MW-19 and MW-20 are all screened in the upper, unconfined water bearing zone.

The new downgradient wells (MW-2, MW-3 and MW-4) are all screened in a lower, semi confined water bearing zone. No site-related COC were detected in these wells at concentrations above New York State groundwater quality standards.

Groundwater samples collected from monitoring wells MW-1S, MW-1D, MW-19, MW-20 and MW-22 during the second phase of the Remedial Investigation were again analyzed for VOCs. The second round of analyses confirmed the presence of vinyl chloride, 1,2-dichloroethene, and trichloroethene in MW-1S, MW-19, and MW-20 at concentrations above New York State groundwater quality standards. Several other VOCs were also detected in these monitoring wells.

Based on the analysis of the groundwater samples and soil samples collected from beneath the floor of the building No. 2223, it appears that the VOCs detected in the "upgradient" wells are attributable to previous leaks, spills, or discharges at the Site. The groundwater contamination appears to be limited to the upper, unconfined water bearing zone composed primarily of man-placed fill. The contaminated zone is approximately 12 feet thick and covers an area measuring approximately 200 feet by 140 feet.

### 5.3.3 Sediments

During the First Phase RI, sediment samples were collected from three floor drains located in the Pelican buildings and a septic tank located at the rear of the building. The sediments contained numerous VOCs at levels in excess of NYSDEC Recommended Soil Cleanup Objectives. Although the sediments are presently contained within the drains and septic tank and isolated from the environment, there is a potential for leakage or discharge into the environment which may eventually cause or contribute to soil and groundwater contamination. For this reason, it is recommended that the sediments be remediated.

The following COC were detected in sediment samples collected from the floor drains and septic tank:

- trichloroethene;
- 1,2-dichloroethene (cis and trans);
- 1,1,1 -trichloroethane;
- tetrachloroethene; and,
- carbon tetrachloride.

Other contaminants present in the sediments, but not considered a significant environmental threat are:

- xylene;
- toluene;
- PCBs; and,
- pesticides.

## 5.4 Exposure Pathways

Media identified as having been impacted during previous studies at the Site included soil and groundwater. The current RI confirmed contamination of the soil and groundwater at the Site and determined that the sediment contained within the building drainage system and in the septic tank were also contaminated. Although surface water flowing through and adjacent to the Site, and sediments in the surface water bodies (wet area and drainageway), were determined to have been impacted, the source(s) of the contaminants in these areas were not identified.

Near-surface soil contamination was detected primarily in the north-northwest portion of the Site and beneath the floor of building No. 2223. Comparison of the analysis of soil and groundwater samples indicate that trichloroethene and 1,2-dichloroethene (both cis and trans isomers) are the COC that are most likely to leach from the soil and enter the groundwater.

Dermal contact with contaminated surface soil was the most readily apparent exposure pathway followed by inhalation of volatiles released from such soil.

Groundwater is not used as a source of potable water at the Site and was not initially considered as an exposure pathway. However, the potential for groundwater to discharge to nearby surface waters and the potential for future residential use of the property dictated that groundwater exposure also be evaluated. Groundwater in the upper, unconfined water bearing zone underlying the Site flows generally to the west towards the former Jamestown City Landfill. Contaminants dissolved in groundwater may discharge into the wet areas and drainageway located immediately west of the Site. People wading in the drainageway could be exposed to dissolved VOCs due to dermal contact with the water. This exposure pathway was evaluated in the human health evaluation included with this RI/FS. The VOCs dissolved in the groundwater will volatilize into the air and people in the very immediate vicinity may be exposed due to inhalation of the volatiles. Due the low concentrations of VOCs in the groundwater and the relatively small amount of groundwater that discharges into the drainageway, the concentration of VOCs in the air is not expected to pose a significant exposure pathway.

Contaminated groundwater that does not discharge into this drainageway is expected to continue to migrate westward and commingle with the groundwater beneath the former Jamestown City Landfill

Potentially contaminated sediments within the buildings are not readily accessible and direct human exposure to contaminants in the sediment is unlikely. An above-ground septic tank was also discovered during the RI and, although contaminated with toluene and xylene, it does not present a readily accessible exposure pathway. However, if left uncontrolled, the contaminants in the contained sediments may ultimately be released into the environment to adversely affect soil and/or groundwater quality.

### 5.5 Remedial Action Objectives

Based on the above information, the remedial program for the Pelican site will include three elements to address the following: surface/subsurface soil, groundwater, and contained sediment. Preliminary remedial action objectives for each of the contaminated media are as follows:

- The concentrations of VOCs in surface soil should be reduced to a level that reduces to acceptable levels the risks associated with dermal contact, ingestion of contaminated soil or inhalation of volatiles released from the soil.

- The remedial program should prevent future leaching of contaminants present in soil into the groundwater at concentrations that exceed New York State groundwater quality standards.

- The levels of COC in groundwater should be reduced to a level that complies with current New York State groundwater quality standards. The concentration of COC in groundwater should also be controlled in a manner that prevents further contamination of other on or off site groundwater bearing zones and surface water in excess of applicable standards.

- The contained sediments should be removed to eliminate the potential for a future release into the environment.

In developing the remedial program for the Pelican site, the remedial action objectives for groundwater quality may not be attained due to other practical considerations affecting the selection of the remedy (potential for human exposure, cost). In addition, the remedial action objectives for surface water quality may not be attained due to other sources of contamination surrounding the Site.

## 5.6 Development of Cleanup Goals

Specific cleanup goals for the contaminated soil and groundwater at the Pelican site have been selected in accordance with the October 1991 NYSDEC draft document entitled "Cleanup Policy and Guidelines - Volume 1," prepared by the Cleanup Standards Task Force. This document establishes the overall cleanup goals for NYSDEC remedial programs as well as guidance on how site conditions, existing state and federal statutory requirements, technical feasibility and cost effectiveness will be taken into consideration in determining the appropriate remedial action. This document contains environmental media standards and criteria for air, water, soils and aquatic sediments and the methodologies for developing them. Additionally, TAGM HWR-4046 entitled, "Determination of Soil Cleanup Objectives and Cleanup Levels," REVISED January, 1994, describes the procedures for determining site-specific cleanup goals for contaminated soil. The policy and guidance provided in these documents has been used to establish cleanup goals for the Pelican site.

Based on an analysis of the specific COC present at the Pelican site and potential routes for human and environmental exposure, the general cleanup goals for the Pelican site are:

- to treat the contaminated soils in a manner that allows the unrestricted use and occupancy of the Site for existing and potential future land uses;

- to treat the contaminated soil on the Site in an effort to prevent further deterioration of groundwater quality, to preclude additional impacts on adjacent groundwater and/or surface water, and to ultimately restore groundwater quality beneath the Site to comply with New York State groundwater quality standards; and,

- to remove the contained sediment in a manner that eliminates the potential for future releases and the potential for human and/or or environmental exposure.

### 5.6.1 Proposed Cleanup Goals for Soil

Cleanup goals for soil designed to protect groundwater quality may be derived using the NYSDEC model which is based on soil/water partitioning theory. Contaminants adsorbed to the soil and sediment will undergo adsorption-desorption reactions when water comes in contact with the contaminated soil or sediment. The NYSDEC model assumes that the soil contaminants will desorb from the soil and infiltrating precipitation will reach equilibrium with the soil as it passes through the vadose zone. The equilibrium concentration reached during infiltration can be predicted if certain physical characteristics of the soil contaminants and the soil are known. The critical physical characteristics of the contaminants include: the water/organic carbon partition coefficient ($K_{OC}$) and the solubility(s) of the contaminant. The critical physical characteristic of the soil is the fraction of organic carbon ($f_{OC}$).

A two-step approach is used to calculate the cleanup goals for soil. First, groundwater quality standards (or guidance criteria values) are used to "back" calculate the maximum allowable contaminant concentration in the soil. The calculation is based on the partitioning of the contaminant between the soil and water at equilibrium. The allowable soil concentration ($C_S$) is determined by the following relationship:

$$C_S = f_{OC} \times C_W \times K_{OC} \qquad \text{(eq. 1)}$$

where

$f_{OC}$ = fraction of organic carbon in soil (assumed to be 1 percent)

$C_W$ = groundwater or drinking water standard or criteria

$K_{OC}$ = organic carbon partition coefficient

The value for the organic carbon partition coefficient ($K_{OC}$), was obtained from the "Superfund Public Health Evaluation Manual," USEPA, October, 1986. Once the allowable soil concentration was determined using equation 1, a contaminant-specific soil cleanup goal was determined by multiplying the derived allowable soil concentration by a factor that takes into account dilution and attenuation of the contaminant as it moves with the groundwater. For the purposes of this FS, a dilution and attenuation factor of 100 has been used.

The soil cleanup goal was calculated as follows:

Soil Cleanup Goal = Cs x DAF

where;

DAF = Dilution and attenuation factor taken from Appendix C of TAGM HWR-4046.

The proposed cleanup goals for the COC present in soil are summarized in Table 5-1.

### 5.6.2 Proposed Cleanup Goals for Groundwater

According to 6 NYCRR Parts 700-750, any discharge to the waters of New York State shall not cause or contribute to an exceedance of the Ambient Water Quality Standards and Guidance Values for Surface Waters and Groundwaters provided therein. The proposed cleanup goals for groundwater are based on the New York State groundwater quality standards (6 NYCRR Part 703), and have been developed only for those parameters that are COC and attributable to the Pelican site. The proposed cleanup goals for the COC present in groundwater are summarized in Table 5-2.

### 5.6.3 Proposed Cleanup Goals for Sediment

The "sediments" at the Site are currently contained within the building drainage system and the septic tank and there is little potential for human exposure. However, the contaminants, if not remediated, may enter the environment with leakage/discharges from the building drainage system and the septic tank, and eventually adversely affect groundwater. The proposed cleanup goals for sediment were developed using the same procedures as for soil, as discussed in Section 5.6.1. The proposed sediment cleanup criteria are considered sufficient to protect public health and the environment if sediments were allowed to remain in place. The proposed sediment cleanup goals developed for the Pelican site are the same as those for soil presented in Table 5-1.

## 5.7 Remedial Technologies

### 5.7.1 Remedial Technology Identification

In accordance with NYSDEC and USEPA guidance documents (NYSDEC, 1989; revised 1990) (USEPA, 1988), alternative remedial technologies that may have application at the Pelican site have been identified and evaluated. The types of remedial technologies that have been considered include removal, isolation/containment, contaminant separation, treatment/destruction, and control technologies. The technologies that may be suitable for the Pelican site are:

## TABLE 5-1

## PELICAN MANUFACTURING, INC. SITE
## PROPOSED CLEANUP GOALS
## FOR
## SOIL AND SEDIMENT

| Contaminant of Concern | Groundwater Quality Standards (ug/l) | Koc | Foc (%) | Dilution and Attenuation Factor | NYSDEC Recommended Soil Cleanup Objective (3) (ug/kg) | Proposed Cleanup Goals for Pelican Site |
|---|---|---|---|---|---|---|
| Cis 1,2-Dichloroethene | 5 | 49 (1) | 0.01 | 100 | 245 (2) | 245 |
| Trans 1,2-Dichloroethene | 5 | 59 | 0.01 | 100 | 300 | 300 |
| Trichloroethene | 5 | 126 | 0.01 | 100 | 700 | 700 |
| 1,1,1- Trichloroethane | 5 | 152 | 0.01 | 100 | 760 | 760 |
| Tetrachloroethene | 5 | 277 | 0.01 | 100 | 1400 | 1400 |
| Acetone | 50 | 22 | 0.01 | 100 | 110 | 110 |

(1) Source: "Superfund Public Health Evaluation Manual, "USEPA, October, 1986

(2) Cleanup objective independently calculated.

(3) Source: "Revised TAGM- Determination of Soil Cleanup Objectives and Cleanup Levels, " NYSDEC, Jan. 1994.
The recommended soil cleanup objectives are designed to protect groundwater quality.

# TABLE 5-2

## PELICAN MANUFACTURING, INC. SITE
## PROPOSED CLEANUP GOALS FOR GROUNDWATER

| Contaminant of Concern | Cleanup Objectives (1) (ug/l or ppb) | Proposed Cleanup Goals for Pelican Site (ug/l or ppb) |
|---|---|---|
| Vinyl Chloride | 2 | 2 |
| 1,2 - Dichloroethene (Total) | 5 | 5 |
| 1,1,1 - Trichloroethane | 5 | 5 |
| Trichloroethene | 5 | 5 |
| Acetone | 50 | 50 |

(1) Cleanup objectives based on 6 NYCRR, Parts 700-705.

- Mechanical Technologies;
- Thermal Treatment Technologies;
- Physical/Chemical Treatment Technologies;
- Biological Treatment Technologies;
- Solidification Technologies; and
- Isolation, Removal, and Disposal Technologies.

## 5.7.2 Remedial Technologies for Soil

### 5.7.2.1 Mechanical Technologies

Physical treatment and separation of differing size fractions of soil do not destroy or alter contaminants, but instead serve as preparatory steps for essentially all other treatment technologies. Physical treatment and separation can serve to increase the efficiency of treatment by producing more concentrated and/or consistent influent streams for subsequent treatment.

**Screening and Grinding:** Numerous options are available for preparation of materials prior to treatment, storage, or disposal, including screening or grinding particles to size, stabilization to reduce free water, liquid or gas reagent application, or other options as needed to modify particular characteristics of the waste stream.

**Dewatering/Drying:** The water content of a solid or sludge stream can be reduced through the use of a filter press, centrifuge, or drying beds. Solids and sludges can also be dewatered in-situ using well points, temporary covers, consolidation under a surcharge load, electro-osmosis, or wick drains. Dewatering and drying may be required as a pre-treatment step for a number of other processes (incineration, land disposal, or stabilization).

**Soil Excavation:** Depending upon the volume of contaminated soil material to be remediated, excavation and removal for off-site disposal may be a feasible alterative for the Pelican site. Excavation and off-site disposal also depends upon the nature of the soil, the types and concentration of the contaminants, and current restrictions on land disposal of hazardous wastes.

### 5.7.2.2 Thermal Treatment Technologies

A variety of thermal technologies are available for destruction of volatile organics in soils. Thermal treatment could be employed either at off-site RCRA permitted facilities or on-site. Thermal treatment at an off-site commercial facility would entail long transport distances and could result in implementation delays due to a lack of capacity at existing facilities.

Regardless of the type of thermal treatment employed, residuals would be generated in the form of air emissions, process wastewater, and residual solids. Exhaust gases resulting from thermal treatment are typically passed through a secondary combustion chamber to further destroy organics not combusted in the primary chamber, as well as products of incomplete combustion. Hydrochloric acid, NOx, and particulates must be removed from the exhaust gases. Certain metals (e.g., arsenic, lead, and mercury) may also be contained in the exhaust gas and, depending on their concentration, can pose difficulties in treatment and result in unallowable emissions. Process wastewater can be treated by conventional techniques (discussed later in this section) and may also require temporary storage in cooling ponds prior to recycling or surface discharge. Solid residuals from off-site thermal treatment may also require disposal in a regulated landfill. Solid residuals from on-site treatment could be disposed of in the original excavation. Thermal treatment technologies that are available to treat the contaminated soil after the soil has been excavated (ex-situ treatment) include:

**Rotary Kiln Incineration:** The rotary kiln incinerator is an established technology that has been used in the treatment of a variety of organic wastes. A solid or sludge waste feed is treated in a combustion chamber at 2000-2600°F for appropriate residence times (several minutes to an hour or more) to assure the necessary destruction removal efficiency (DRE). A secondary combustion chamber or afterburner is typically required to destroy organics volatilized into the exhaust stream and is maintained at a temperature of approximately 2200°F. Certain materials may pose extreme operational problems. For example, toxic metals, such as mercury and lead, if present, may volatilize resulting in emissions that may be difficult to control; fluorine, released during combustion, reacts to produce hydrofluoric acid which rapidly corrodes refractory material in the kiln.

**Infared Thermal Treatment:** Destruction of organics in soil can also be accomplished using Infrared Thermal Treatment. Infrared Thermal Treatment destroys organics by subjecting the soil/sludge feed to temperatures of approximately 1600°F for residence times ranging from 5 to 50 minutes. This process uses infrared radiation to heat soils as they pass through the system on a conveyor. The organics are vaporized and driven off the soil. The volatiles driven off the soil (off-gases) must be treated in an afterburner as with a rotary kiln unit. A mobile unit was tested under the EPA Superfund Innovative Technology Evaluation (SITE) program and successfully destroyed organic chemicals at the Peak Oil Refinery in Florida (USEPA, 1990), In order to efficiently operate infrared treatment equipment, soil particle sizes must be no greater than one to two inches in diameter. Also, waste material is conveyed via a system of metal conveyor belts and, therefore, soils must be firm and cohesive enough to not leak through or spill off the conveyor belt. Materials with excess water content will require dewatering prior to being fed into the unit.

**Low-temperature Thermal Desorption:** This process has been demonstrated to be effective in the removal of volatile organics from soils. The process involves heating and agitating soils to vaporize the organics. The off-gases are either incinerated in an afterburner or captured for recovery. This process has been employed successfully by Canonie (Soiltech) at the Wide Beach Site in western New York State to remove PCBs from soil at levels as high as 80 ppm. Therefore, it is expected that this technology will also be effective in destroying volatile organic compounds present at the Pelican site which have a higher vapor pressure and are even more volatile than PCBs.

### 5.7.2.3 In-Situ Thermal Treatment Technologies

Thermal treatment technologies that may be applied to the contaminated soil in-place (in-situ treatment) include:

**Vitrification:** This innovative process treats soils by passing an electric current through the soil generating enough heat until the soil fuses into a vitreous mass. Organics are either burned or volatilized; metals are immobilized in the glass-like matrix. Organic emissions can be controlled by means of a hood over the treatment area. Soils must be thoroughly dewatered before treatment in order to reduce energy requirements, which are extensive even under the most favorable circumstances (USEPA, 1990).

**Thermally Enhanced Vapor Extraction:** The rate of recovery of volatile and semi-volatile organic compounds from soil using active or passive soil venting can be enhanced by heating the soil. The soil may be warmed by injecting warm air or steam, or even the exhaust gas from a combustion unit used to treat the extracted soil vapors.

**Radio-Frequency Ground Heating:** The utilization of radio frequency (RF) energy for in-ground heating has been patented for several years (IITRI, Chicago) and has reportedly been applied successfully for the recovery of jet fuels and other materials with low to moderate boiling points. Electrodes are inserted vertically into the ground on approximately 5-10 foot centers. A canopy or tent is spread over the ground and ducted to a condenser to recover any vapors. Power is applied to the electrodes for a period of weeks to months to heat the ground which volatilizes the organics from the soil. Volatile contaminants pass upward to the vapor recovery system for reuse or destruction. The approach has similarities to steam or hot air-stripping of soil, but has the advantage that the heat delivery is provided without the need to pump process fluids, either gases or liquids, through the soil mechanically, which may be difficult to control when the soil has low permeability and/or is nonhomogeneous. Issues that remain to be addressed with the technique are (1) the fate of vapors that condense in the colder zones around buildings and just under the pavements of roads and parking lots and (2) the impact of grounded metal piping in the heated zones.

### 5.7.2.4 Physical/Chemical Treatment Technologies

Physical/chemical treatment technologies include aeration, solvent extraction, soil washing, alkaline dechlorination, UV oxidation and adsorption. These processes may be used to chemically destroy the contaminants of concern, or they may be used to separate or recover/concentrate certain fractions by causing changes in physical or chemical states. Physical/chemical processes represent an alternative to thermal treatment and also offer additional pre-treatment methods that could potentially reduce the cost or magnitude of other treatment methods.

**Soil Vapor Extraction:** Volatile and some semi-volatile constituents can be removed from soil by increasing the movement of clean air through the soil, which increases the rate at which the contaminants would normally volatilize from the soil or water. The process, known as soil vapor extraction, involves the application of negative pressure to a well point which draws fresh air into the soil and the VOCs from unsaturated soil. This process is not applicable to contaminated soil below the water table and may be less effective with soil having low permeability.

As discussed above, vapor extraction may be enhanced by heating the soil. Heated air or steam is supplied underground through a network of delivery pipes, and the organic compounds that are driven off the soil are collected at one or more extraction points. There has been concern for several years that such processes might spread, rather than remove, plumes of vaporizable contaminants. Recent research has shown that the net flows are toward rather than away from the region being heated, due largely to the influence of local water tables.

This technology would increase the rate of removal of the volatile organic compounds present at the Pelican site. This technology has been successful even with organic compounds having relatively low boiling points and relatively low vapor pressures.

As also discussed above, the energy efficiency of stripping systems has been improved by recovering heat from the incineration of the recovered organics.

**Aqueous Phase Extraction:** This process, also known as soil washing, uses an aqueous leaching solution to remove contaminants from a solid matrix for subsequent recovery and treatment. Surfactants or chelating agents may be added to increase recovery. Both the aqueous solution and the washed media typically require further treatment or disposal. This process is most applicable to removal of water soluble organics from coarse granular soils where limited natural organic carbon is present to interfere with the washing process (USEPA, 1989). Soil washing can be applied both to excavated soils in above-ground reactors and to soils in-situ. The net effect of in-situ soil washing would be to increase the rate and the degree to which the contaminants of concern are removed from the soil. The use of chemical agents to increase the mobility of the contaminants also increases the risk that contamination may be spread uncontrollably into the environment. Therefore, groundwater cut-off and/or recovery systems are generally used in conjunction with in-situ soil washing.

**Chemical Oxidation and Reduction:** Alkaline Dechlorination uses polyethylene glycolates (PEGs) to reduce the chlorine content of compounds. This treatment process is presently in or near full scale application at the Industrial Waste Transformer Site in Texas. In general, alkaline dechlorination involves applying PEGs and alkaline reagents to soils in a heated reactor (300° to 1400°F depending on the process) from 12 to 24 hours. Treated soils are passed through a centrifuge and soil washing system to recover the PEGS. The treated soil is alkaline and must be neutralized and may contain trace levels of the original waste constituents. Excessive amounts of chlorinated organic compounds (>5%), high water content (>20%), and high levels of natural organics in soil tend to impede this process since large quantities of reagents are needed (USEPA, 1985).

In addition to the use of chemicals to promote contaminant oxidation, it has been found that oxidizing conditions can be created in waste streams at elevated temperatures and pressures above the triple point of water (3200 psi, 374°C). Systems operating at 3700 psi and 400°C+ with gaseous oxygen addition have been demonstrated to oxidize pulp mill sludges and even PCBs in less than four minutes exposure. The process is still being developed. Energy efficiency and the durability of the reactor vessels must be proven over very long runs. Nevertheless, this is a new process whose destruction/removal efficiency (DRES) have been shown to exceed 99.9999% for compounds as difficult to destroy as dioxins.

**Organic Solvent Extraction:** This is a complex system that uses a carrier solution (the solvent) to leach constituents from a waste. Those constituents are recovered in subsequent steps of the process through distillation; the solvent solution is then recycled (EPA, 1988c). A commercially available process called Basic Extraction Sludge Technology (BEST) uses triethylamine as the leaching agent. The BEST process is currently in various stages of application on a number of remediation projects. The process generates wastewater, solid residuals, and the recovered organic contaminants that may require subsequent treatment, recycling, or disposal. Solvent extraction may be applicable to treatment of soils, sludges and sediments as a means of reducing the volume of sediments requiring incineration or disposal. Particle sizes must be small enough that the waste may be pumped and, therefore, some pre-treatment may be required.

### 5.7.2.5 Biological Treatment Technologies

Biological degradation of the organic contaminants of concern occurs in the subsurface through natural processes. The application of biological treatment technology discussed below entails the acceleration of the processes that would normally occur in nature but at very slow rates. Degradation of chemicals may be brought about by the action of either aerobic or anaerobic microorganisms. The technology may be applied in-situ, or ex-situ (soil is excavated and treated in above-ground reactors). Prior to application of a biological treatment technology, substantial pilot testing would be required. Such testing may be problematic, since the fate of the contaminants (volatilization, sorption, or actual biodegradation) can be difficult to determine. Biological treatment technologies that may have application at the Pelican site include:

**Landfarming:** This process, also called composting, employs farming methods to provide moisture and nutrients, mix, and control the soil conditions. This technique has been successfully employed by several firms in the remediation of hydrocarbon containing soils, even polynuclear aromatic hydrocarbons (PAHs). In some cases it has been found that the addition of hydrocarbons such as corn oil can help to extract the toxic PAHs from the soil matrix and make them more available for bacterial consumption. While most composting systems deal with soil that has been removed and is processed on impermeable pads (ex-situ), there is also an opportunity to conduct such processes in-situ using common farming techniques, but under cover, to provide water, atmosphere, and temperature control. In some limited areas where the contamination is not very deep, the opportunity for such remediation is present. Photolysis and aerobic biodegradation may both serve to reduce contaminant concentrations. The process may be enhanced in a number of ways including periodic tilling, nutrient addition, maintenance of an optimal soil moisture content, use of a "greenhouse" type cover over the treatment area, or inoculation of the area with soil bacteria specifically cultured to destroy the contaminants of concern. Pilot testing of this process would be required to assess its effectiveness.

**Slurry Reaction:** Contaminated soil can be excavated and treated in aerated reaction tanks. The soil material is maintained in suspension either by mechanical mixing or by aeration. Soil slurries with a density greater than five to ten percent solids are difficult to maintain in suspension. To maintain slurries at these densities, large reaction vessels are required which is a potential problem for the Pelican site particularly if long retention times are needed. After treatment it would be necessary to thicken, dewater and dispose of the treated solids.

**In-Situ Biological Treatment:** Nutrients and oxygen can be applied to increase the rate of in-situ natural biological degradation. These additives are typically introduced through a recirculating system of extraction and injection wells. This process has been applied for degradation of petroleum hydrocarbons on numerous sites with generally good results. Reductive dechlorination of chlorinated compounds occurs naturally and has been shown to be an effective process in the degradation of highly chlorinated organic chemicals in stream sediments. As such, anaerobic processes show promise as a means for reducing the degree of chlorination and possibly the overall concentrations of contaminants of concern in the sediments. In-situ anaerobic activity may in some cases be enhanced by addition of nutrients and by sealing the soils to limit disturbance and promote anaerobic degradation.

### 5.7.2.6 Solidification Technologies

**Solidification:** Solidification can be performed in-situ either by blending cementing agents with soil or water using common excavation equipment, discs or plows, or by injecting the reagents into the subsurface through augers or other specialized equipment. Solidification can also be performed on excavated material by blending the reagents in pug mills, portable batch plants, or other mixing vessels. When added to a waste, cementing agents immobilize the contaminants in a low permeability, solidified matrix.

The reagents most commonly used for solidification are portland cement, cement kiln dust, fly ash, and lime. The amount of cementing agents needed ranges from 10% for lightly contaminated soils to 100% or more for oily waste. Certain reagent/waste combinations may not be compatible and thus may not be capable of achieving one or more of the functions above. Bench or pilot scale solidification tests are typically required to select the proper reagent(s), determine optimum mixing ratios, and assess setting and curing behavior (USEPA, 1986a). The desired end product is a non-brittle, structurally strong, monolithic mass with low permeability and an alkaline pH.

Hydrocarbons, particularly chlorinated compounds such as are present at the Pelican site, may interfere with the solidification process, in particular the function of binding compounds. In addition, curing produces heat which may generate volatile emissions requiring control.

Binding agents such as asphalt or polyethylene may also be used to solidify waste material. Rather than chemically reacting with the waste constituents, the binder serves to simply encapsulate the material. Existing applications of this process, however, mainly involve the use of asphalt to solidify petroleum contaminated soils.

A number of firms manufacture chemical additives or fixation agents that enhance long-term binding, reduce leachability of the solidified constituents, or result in a destruction of contaminants. Such additives would have to be individually evaluated for effectiveness and compatibility with the soil and the contaminants of concern at the Pelican site.

### 5.7.2.7 Isolation, Removal and Disposal Technologies

Waste and contaminated soil could be isolated at the Pelican site and controlled in order to limit direct human and environmental contact, and migration of contaminants of concern. In addition, consideration will be given to the excavation and off-site disposal of the contaminated soil.

**Capping:** Capping consists of placement of one or more layers of natural or synthetic materials of low permeability to limit infiltration and/or cover and isolate the area of interest. A cap may also include transmissive layers intended to channel away infiltration which penetrates the cover. Capping is generally intended to limit erosion, eliminate direct contact with wastes, and reduce infiltration of precipitation, thereby reducing leachate. Typical materials include locally-available soil and natural clay, bentonite-amended soil, flexible membrane liners (FML), filter fabrics, and sand or gravel (for subsurface drainage). To prevent the accumulation of water in the underlying waste or contaminated soil, caps are designed to less permeable than the underlying soil.

Two general types of caps are commonly constructed; clay caps and composite (clay and synthetic) caps each provide advantages and disadvantages. Clay caps are simple and inexpensive to construct and maintain and provide good infiltration control. Composite caps are more expensive and difficult to construct; however, they provide a very high degree of infiltration control. The specific design of a cap depends upon site-specific conditions, such as precipitation and surface flooding potential, depth to groundwater, characteristics of subsurface soils and groundwaters, and the nature of the waste materials. The cap required for a particular application also depends on applicable regulatory requirements, such as those associated with NYSDEC solid and hazardous waste regulations, or RCRA regulations 40 CFR Part 264. RCRA regulations for hazardous waste closures require that the cap consist of multiple layers of clay and synthetic materials. The RCRA cap includes two liners, a mechanism to allow drainage of any infiltration water that passes through the upper liner, and a gas venting system. These caps require long-term maintenance to assure their performance.

**Excavation and Off-Site Disposal:** The most contaminated soil at the Pelican site is located near the surface and can be excavated. Storage of excavated soil material may be required on a temporary basis to allow time to chemically classify and separate material, prior to transporting the soil to off-site facilities for treatment and/or disposal. For the Pelican site, excavated materials could be stockpiled on-site and covered to await treatment/disposal. Commercial facilities are permitted for the disposal of hazardous and industrial (non-hazardous) wastes. Hazardous waste disposal facilities typically utilize double or triple lined containment cells and are increasingly limited in the types of solid waste they are allowed to accept based upon land disposal restrictions under RCRA and TSCA and operating permit constraints. Materials that are not regulated as a RCRA Characteristic or Listed waste can be placed in industrial landfills where operating permit allows. Land disposal restrictions prevent disposal of wastes that exceed regulatory concentration limits, as measured by the Toxic Characteristics Leaching Procedure (TCLP).

## 5.7.3 Remedial Technologies for Groundwater

### 5.7.3.1 Physical/Chemical Treatment Technologies

Physical/chemical technologies that may be applicable to treatment of contaminated groundwater collected at the Pelican site include filtration, phase separation, aeration/stripping, adsorption and ion exchange, and ultraviolet (UV) oxidation. With the exception of UV oxidation, these processes generally do not destroy the contaminants; rather they separate or concentrate the contaminants by causing changes in physical or chemical states. Physical/chemical technologies may be effective as pre-treatment methods which could potentially reduce the cost or magnitude of other treatment methods.

The following physical/chemical processes are potentially applicable for treatment of the contaminated groundwater on-site.

**Particulate Removal:** Particulates suspended in a liquid waste stream can be removed by filtration through a granular media or by settling in quiescent tanks. Groundwater containing high concentrations of particulate matter would likely need to be filtered prior to performing any additional treatment. Chemical flocculates such as alum are also typically added to aid settling. This process is appropriate for situations requiring primary treatment of turbid water from excavation or other on-site actions.

**Gravity Clarification:** Settleable solids may be recovered with the groundwater. These solids must be removed to prevent damage to treatment equipment. Settleable solids may be removed from the influent by means of gravity clarification. The recovered solids will be removed from the clarifier for proper treatment and disposal. The clarified groundwater would be suitable for additional treatment.

**Aeration/Stripping:** Volatile and some semi-volatile constituents can be removed from liquid streams by creating turbulence or mixing to expedite the natural aeration process. Recovered groundwater from the Site could be treated in air stripping towers, or sparge tanks. The method used would be dependent on the volume of water to be treated, and the concentration of contaminants of concern in the recovered groundwater. Emission controls may be required to prevent volatiles released from the groundwater from being released into the atmosphere. Emissions of volatiles present in the groundwater may be controlled using vapor phase carbon adsorption or catalytic oxidation.

**Adsorption and Ion Exchange:** These technologies are used to remove constituents from a liquid or vapor phase by passing the flow over or through a media which concentrates the constituents. Adsorption and ion exchange both operate on this same principle; however, ion exchange is more readily reversible. Granular activated carbon (GAC) is the most commonly used adsorbent, although synthetic resins are also available for some constituents not adsorbed by GAC. Adsorption by GAC is commonly applied to remove a wide range of organics and metals from aqueous and vapor streams. GAC could be used at the Pelican site to remove hazardous constituents from contaminated groundwater or from exhaust air from an air stripper, should an on-site groundwater treatment system be chosen. GAC equipment is compact and could be used on-site. A GAC system can be designed to operate with little maintenance and without the need for a full-time operator. Spent GAC must be either regenerated or disposed of by incineration or land disposal.

**Ultraviolet (UV)-Oxidation:** This process destroys dissolved organic contaminants in industrial wastewaters and groundwaters using chemical oxidation. The UV light is a catalyst in the chemical oxidation of organic contaminants in water. Many organic compounds absorb UV light and thus undergo a change in their chemical structure or they may become more reactive with chemical oxidants. The ultimate end products of this process are carbon dioxide, inorganic salts, and water.

UV oxidation has advantages over other treatment technologies because it destroys the contaminants. There are different chemical oxidants that can be used with UV light to destroy contaminants based on the particular contaminant(s) of concern. Peroxidation Systems, Inc. uses hydrogen peroxide and UV light to break down TCE (trichloroethene) and BTX (benzene, toluene and xylene), as well as several other organic compounds. Keystone Environmental Resources, Inc. uses ozone with UV light to destroy pentachlorophenol, phenolics and other select organics.

**Catalytic Oxidation:** This process destroys pollutants in gaseous waste streams. Catalytic oxidation could be used at the Pelican site to treat vapors recovered from a soil vapor extraction system or to treat the exhaust gas from an air-stripper used to remove VOCs from the groundwater. Typically a precious metal catalyst, such as platinum or palladium, is used in conjunction with heat to destroy organic contaminants in the waste stream.

ARI Technologies, Inc. (ARI) has developed a catalytic oxidizing system (Econ-Abator) that does not require a precious metal catalyst and has a lower heat requirement to sustain the process. Instead, ARI's system uses a more rugged low-temperature, non-precious metal catalyst and a recuperative heat exchanger which decreases the amount of energy needed to maintain the process.

### 5.7.3.2 Biological Treatment Technologies

Groundwater may also be treated biologically under aerobic or anaerobic conditions. The groundwater to be treated is extracted and placed in tanks. Nutrient addition, atmosphere and temperature control would be employed to maximize the biodegradation of contaminants. Similar results may be achieved at a conventional sewage treatment plant depending on the nature and concentration of the contaminants. The types of contaminants present in the groundwater and the anticipated flow rates must be compatible with treatment plant operations and permit conditions. Pre-treatment may be necessary depending on the levels of contamination in the groundwater, and permission must be obtained from the plant operator.

### 5.7.3.3 Isolation, Removal and Disposal Technologies

Groundwater contamination at the Pelican site could be isolated and controlled to limit human and environmental exposure, and off-site migration. A variety of technologies exist to control migration of contaminants and groundwater and are described below.

**Groundwater Interceptor Trenches:** Groundwater may be recovered by excavating trenches roughly perpendicular to the direction of groundwater flow and sufficiently deep to intersect the water table. The trenches are filled with granular media into which the contaminated groundwater discharges. Pumps are used to remove the contaminated groundwater and to depress the water table, thus, intercepting the lateral flow of groundwater. In some cases, one wall of the trench can be lined with a flexible membrane liner (FML) to reduce inflow (such as from a clean area not requiring remediation). Coarse sand, crushed stone or pea gravel is typically used as backfill for the recovery trench. The backfill must meet both drainage and filtration requirements to function effectively over the long term. If surrounding soils are rich in fines, and pea gravel backfill is used, it may be necessary to lay overlapping sheets of filter fabric on the trench walls prior to backfilling to prevent the fines from migrating into and plugging the gravel backfill. Conventional methods of excavating a cut-off trench in unconsolidated materials involve either an open-cut excavation or a trench supported by sheeting and bracing. An alternative technique involves excavating the trench under a dense and viscous "biopolymer" solution which supports the trench walls. Pea gravel fill is placed through the polymer solution. A reagent is added to break down the polymer, and the trench is flushed to remove the residual polymer and prevent biological growth. Liquids are withdrawn from a recovery trench by pumping from sumps located in the trench. It may be necessary to install perforated piping at the base of the trench in order to transmit water to these sumps.

**Gradient Control Wells:** A system of extraction wells can be used to control hydraulic gradients and groundwater migration. Recovered water can be treated and reinjected or otherwise disposed of as discussed herein. The principal concerns with a recovery system are adequacy of capture and the cost to treat the groundwater to acceptable levels. Dissolved salts, minerals and certain bacteria in the water can cause clogging and necessitate frequent reconditioning of wells and piping systems.

**Grout Curtains:** Fixed, subsurface barriers can be formed by injecting a liquid slurry or emulsion of grout through boreholes arranged in a pattern of two or three adjacent rows. The injected fluid fills the pores and fissures of the aquifer and greatly reduces the permeability of the grouted area. Grouts typically used are neat portland cement, cement-bentonite, and chemical resins.

**Sheet Piling:** Although not completely water tight, cut-off walls can be constructed by driving interlocking steel sheet piles into the ground. Sheeting is frequently used as a temporary measure during construction to contain or divert groundwater and/or leachate. Depending on the degree to which subsurface conditions are corrosive, the steel sheeting may last many years. Precoating of the piles prior to driving is also an option to extend their useful life. The depth of sheeting is limited by the mechanical ability to drive the sheeting. Sheet piling is not suitable for buried obstructions or rocky soils that could damage the sheeting during installation. Sheet piling could only be used in unconsolidated soils. Sheeting is also not recommended for groundwater containing high concentrations of salts or extreme pH as these conditions decrease the life of the sheeting. Recent modifications to the design of sheet pile interlocks allow grout to be injected at the interlock to reduce the amount of leakage that may occur between sheets.

**Cut-Off Walls:** Low permeability walls can be installed in the subsurface to restrict groundwater flow. Cut-off walls are typically used in conjunction with extraction wells or recovery trenches to dewater a zone and capture groundwater flow. Cut-off walls can be installed either in a continuous excavation followed closely by placement of slurry (see slurry trenches, below) or other fill having low permeability. Cut-off walls are also constructed by excavating the wall in discrete sections ("panels") and pouring the panels individually (diaphragm wall method). Excavation using hydraulic excavation equipment (backhoe) is capable of installing trenches at depths of 60-70 feet. Excavation to greater depths typically requires the use of a clamshell. A cut-off wall at the Pelican site could be readily installed using generally available excavation equipment. The most commonly used type of cut-off wall is constructed using the slurry trench method. The excavated trench is backfilled with native soils amended with bentonite or other expansive clay. Slurry walls are typically excavated through unconsolidated deposits with a backhoe. The excavation is kept full of bentonite and water slurry of sufficient density to prevent collapse of the trench walls. During construction of slurry walls in permeable soil, the slurry infiltrates surrounding soils and forms a filter cake of bentonite at the trench walls which acts to further reduce permeability of the wall. Excavated spoils from the trench, which are free of rocks and high levels of chemicals, are suitable for trench backfill. The suitability of soils for fill and the required amounts of bentonite or other clays is determined by geotechnical tests and compatibility testing with dissolved and nonaqueous phase chemicals. Soil-bentonite slurry walls have been widely applied in construction and waste site remediation (D'Appolonia, 1980) (Geo-Con, 1985).

**Discharge/Disposal of Contaminated Groundwater:** During operation of remedial system(s), contaminated groundwater could be generated from a number of sources including dewatering of excavated soil, and operation of groundwater recovery systems. The treatment processes required will be determined by the type and concentration of contaminants and the anticipated rate at which groundwater will be recovered.

**On-site Discharge:** Extracted groundwater could be treated on-site using method(s) described previously. The treated groundwater could then be reinjected upgradient from the Site in an attempt to flush additional contamination out of the soil, thus reducing the treatment time, or it could be reinjected downgradient or discharged to nearby surface water.

**Off-Site Discharge:** Recovered groundwater could be discharged to the City of Jamestown sewage treatment plant. Discharge would be subject to the approval and conditions set by the city.

### 5.7.4 Remedial Technologies for Sediment

Technologies that may be used to isolate the sediments from the environment or to recover the sediment for treatment are discussed below. The ex-situ treatment processes discussed in Section 5.7.2 for the treatment of soil are also applicable to the treatment of sediment that may be removed from the floor drains and septic tank/cesspool located at the Pelican site.

**In-Place Abandonment of the Drain Pipes:** Drain abandonment may be accomplished by isolating contaminated sections of the drainage system that are no longer needed. The identified lines are then filled with a grout or quick setting slurry mix. This isolation technology does not destroy or alter contaminants, but serves to isolate and contain contaminated sediments from further migration.

**Removal of the Drain Pipes:** Portions of the floor drains that are not a necessary part of the drainage system may be totally removed. Once removed, the contaminated pipe sections and sediments would require proper disposal.

**Mechanical Sediment Removal:** Commercially available sewer cleaning equipment is equipped with knife and hook attachments for cutting, scraping and loosening of sediments in drainage pipes. These technologies are effective in removing heavy accumulations of sediments in drains without using water, thereby minimizing the possible escape of disturbed sediments. Removal is typically done manhole to manhole.

**Hydraulic Flushing:** Hydraulic flushing ("jetting") is an alternative for removing moderate amounts of loose sediments. The technique consists of flushing the interior of the drains using a high pressure, low volume water jet (pressures of 2000-10,000 psi are possible). The mobilized sediments and the wash water are flushed back to an access manhole where they are removed using a vacuum truck or a trash pump. The technique is most effective for relatively small sediment thickness. Contaminants mobilized during the cleaning process may leak from the line being cleaned and contribute to soil and groundwater contamination.

**Vacuum Removal:** Vacuum techniques are commonly used in conjunction with the hydraulic method. Sediment is removed from the pipe using vacuum trucks equipped with hoses and nozzles designed to fit in the pipe. For this technique to work efficiently, the vacuum truck is usually located within 25 feet of the access manhole. Vacuum technologies move the sediments directly from the drains to the transport vehicle, eliminating the need for large amounts of water and limiting exposure and vapor emissions at the work zone.

## 5.8 Initial Screening of Potentially Applicable Remedial Technologies

A range of treatment technologies potentially applicable to remediation of the Pelican site have been identified and briefly described in Section 5.7. In this section of the FS, the technologies will be initially evaluated to eliminate from further consideration those technologies and processes that may be of limited effectiveness or which may not be implementable at the Site.

### 5.8.1 Screening Criteria

The list of potentially applicable technologies has been screened to better focus the second phase of the FS on those technologies that offer the greatest promise of being effective and implementable at the Pelican site. USEPA program guidance requires that alternative remedial technologies be initially screened using the criteria of effectiveness, implementability and cost (USEPA, 1988a). NYSDEC program guidance emphasizes proven performance of technologies and eliminates cost from consideration (NYSDEC, 1989). The screening criteria used in this phase of the FS are anticipated effectiveness and implementability. The anticipated effectiveness of the technology is an assessment of the ability of the technology to contribute to a remedial program that is protective of public health and the environment and capable of meeting the stated cleanup objectives. In assessing the effectiveness of each technology, the demonstrated performance of each technology has been considered. Implementability is an assessment of the feasibility and the ease with which the technology may be applied at the Pelican site. Implementability takes into consideration such practical factors as: Are the wastes constituents present at the Pelican site compatible with the technology? Is there sufficient room at the Pelican site to install and/or operate the technology? Is the use of the technology compatible with surrounding land uses? Will application of the technology unacceptably interfere with other ongoing uses of the Site? What permitting and other regulatory requirements apply to use of the technology? Does the technology require resources of a type or in a quantity that is not readily available at the Site? Are there experienced contractors that can provide, install, and operate the technology? At this initial phase of the screening process, the relative costs of the alternative technologies will not be used as a primary factor.

### 5.8.2 Screening of Remedial Technologies for Soil and Sediment

The technologies that may have application in the remediation of contaminated soil and sediment from the Site have been initially evaluated. The technologies that appear to be difficult to implement due site-specific constraints at the Pelican site or that have not been demonstrated to be effective when applied to similar chemical contaminants in a similar setting have been eliminated from further consideration. The results of the initial evaluation are presented in Tables 5-3 and 5-4, and summarized below:

#### 5.8.2.1 Mechanical Technologies

Mechanical technologies alone may not effectively detoxify or destroy the contaminants present in the soil and sediment, but would be effective as a necessary pre-treatment method used in conjunction with a treatment process that would remove/destroy the contaminants of concern. Screening, grinding (size reduction), and dewatering/drying of soil and sediment may have potential application at the Pelican site and will be retained for further consideration.

#### 5.8.2.2 Thermal Treatment Technologies

Thermal treatment technologies are readily applicable to the treatment of VOCs in soil and sediment. Due to the limited amount of space available at the Site, use of thermal treatment technology on-site is not considered implementable. In addition, the total volume of contaminated soil is too small to justify the use of a mobile on-site treatment unit. However, off-site, commercial units are available that can accept contaminated soil and sediment from the Site. Given the relatively small volume of soil that is contaminated and the volatile nature of the organic contaminants, both rotary kiln incineration and low-temperature

# TABLE 5-3
# PELICAN MANUFACTURING, INC. SITE
# REMEDIAL TECHNOLOGY IDENTIFICATION AND SCREENING FOR SOIL REMEDIATION

| Technology | Description | Screening |
|---|---|---|
| Mechanical Processes | | |
| Screening and Grinding | Numerous options are available for preparation of materials prior to treatment, storage, or disposal including screening or grinding particles to size. | Effectiveness: These material preparation and sizing technologies are widely used and have proven to be effective in similar circumstances.<br>Implementability: Implementation of this technology utilizes commonly available equipment and services. Due to limited space at the Site, use of this technology at the Site may be impractical.<br>Comments: Soils and sediments may require pre-remedial preparation and, therefore, these technologies will be retained for consideration. |
| Dewatering/Drying | Water content can be reduced from soils or sediments using a filter press, centrifuge, or drying beds. | Effectiveness: All of these dewatering/drying technologies are proven effective. They do not reduce the volume or toxicity of the wastes.<br>Implementability: Due to limited space at the Site, use of this technology at the Site may be impractical.<br>Comments: Excavated soils may require dewatering prior to treatment in order to meet moisture content limitations, so this technology is retained as a possible supplement to other technologies. |

# TABLE 5-3
# PELICAN MANUFACTURING, INC. SITE
# REMEDIAL TECHNOLOGY IDENTIFICATION AND SCREENING FOR SOIL REMEDIATION

| Technology | Description | Screening |
|---|---|---|
| Soil Excavation | Generally available construction equipment is used to excavate the contaminated soil. | Effectiveness: Excavation equipment comes in many varieties and could effectively excavate any contaminated material at the Site. This technology does not reduce the volume of the contaminants, but excavation removes the source.<br>Implementability: Excavation equipment is readily available and implementable. Limited access to the Site and the existing buildings will be constraints during excavation.<br>Comments: Excavation technologies will be retained for further consideration. |
| Thermal Treatment | | |
| Low Temperature Desorption | Excavated contaminated soil would be treated by low temperature heating in a rector. The volatilization of the low boiling point contaminants such as the VOCs and some semi-VOCs is enhanced. The volatile emissions would then be treated. | Effectiveness: This is an innovative technology that has been proven effective in the removal of VOCs. Its ability to treat higher boiling point compounds is questionable. This technology is most effective with soils of a relatively large particle size.<br>Implementability: Several vendors can provide mobile low temperature desorption units. Treatability studies would be necessary to prove the ability to remove the Site contaminants given the specific conditions at the Site. Due to limited space at the Site, the technology could not not be employed on the Site. |
| Low Temperature Desorption (cont'd) | | Comments: The application of this technology is promising but, due to space limitations at the Site, will not be given further consideration. |

# TABLE 5-3
# PELICAN MANUFACTURING, INC. SITE
# REMEDIAL TECHNOLOGY IDENTIFICATION AND SCREENING FOR SOIL REMEDIATION

| Technology | Description | Screening |
|---|---|---|
| Rotary Kiln | Rotary kilns are commercially available for the incineration of the contaminated soil. | Effectiveness: Rotary kiln incinerators have been demonstrated to be highly effective in the treatment of contaminated soils. "DREs" >99.99% are common.<br>Implementability: This technology could not be used on-site, but could be used at a permitted off-site facility.<br>Comments: Highly effective means of destroying contaminants in the soil. |
| Vitrification | Soils or sediments are fused into a pool of molten glass produced using electrodes to create extremely high temperatures. The process yields a glass (slag) solid. | Effectiveness: This technology is potentially effective for volatile organics, semi-volatile organics and pesticides.<br>Implementability: The process requires large amounts of equipment and requires a great deal of energy to operate. Operation is very much subject to site conditions. Due to space limitations and the building covering much of the Site, this technology could not be used at the Site. It will not be given further consideration. |
| Vitrification (cont'd) | | Comments: Although this technology would be potentially effective, the amount of soil and sediment to be treated does not warrant the use of such a potentially complicated process. It is not retained for further consideration. |

## TABLE 5-3
## PELICAN MANUFACTURING, INC. SITE
## REMEDIAL TECHNOLOGY IDENTIFICATION AND SCREENING
## FOR SOIL REMEDIATION

| Technology | Description | Screening |
|---|---|---|
| Thermally Enhanced Vapor Extraction | Volatile and some semi-volatile organic compounds are vaporized in-situ through heating of the soil using radio frequency (RF)energy. | Effectiveness: The advantage of this technology is that it does not entail the use of process gases or liquids, but it is a highly experimental process that is influenced by site conditions such as soil type, moisture content, etc. This technology does not have a high degree of proven ability in similar applications.<br>Implementability: This technology is easily set-up at a site, but it requires specialized equipment and expertise to successfully operate. Space limitations at the Site and the existing building are constraints that will make implementation of this technology difficult.<br>Comments: Since this technology has questionable effectiveness and a low degree of implementability, it will not be retained for further consideration. |
| **Physical/Chemical Processes** | | |
| Soil Vapor Extraction | Volatile and semi-volatile constituents can be removed from soil by increasing the rate at which air moves through the soil. | Effectiveness: Vapor extraction has been proven effective many times for the removal of VOCs from soil under similar circumstances. The shallow depth to groundwater will interfere with in-situ application of this technology.<br>Implementability: This is a commonly used technology and could easily be implemented at the Site, using available equipment and services. to groundwater will interfere with in-situ application of this technology. |

# TABLE 5-3
# PELICAN MANUFACTURING, INC. SITE
# REMEDIAL TECHNOLOGY IDENTIFICATION AND SCREENING FOR SOIL REMEDIATION

| Technology | Description | Screening |
|---|---|---|
| Soil Vapor Extraction (cont.) | | Comments: The use of in-situ vapor extraction technology will be retained for further consideration. |
| Aqueous Phase Extraction (Soil Washing) | This technology, better known as soil washing, is a method of leaching organic contaminants from a solid media such as soil. Water, or water in conjunction with surfactants and/or chelating agents, is used to leach the contaminants from the soil. The contaminants are recovered by pumping groundwater. | Effectiveness: The effectiveness of this technology is highly dependent on soil type. The soil at the Pelican site is a heterogeneous mixture of coarse and fine grained material. Since this technology is most appropriate for homogeneous, coarse grained soil, its ability to effectively treat all of the contaminated soil is questionable.<br>Implementability: Treating a heterogeneous soil will require a high degree of pre-treatment processing. The fine grained soil will require more intensive treatment to achieve clean-up levels. These factors make the implementability of this technology suspect. The limited amount of space and the small quantity of soil to be remediated render the Site unsuitable for the application of this technology. |
| Solidification | Solidification is the stabilization or fixation of wastes through the addition of a chemical agent that forms a solid mass of significantly lower hydraulic conductivity and leachability than the untreated waste. Solidifying agents such as lime, Portland cement, bentonite, asphalt and polymers will immobilize toxic substances but will not change their toxicity. | Effectiveness: This technology is capable of immobilizing contaminants found in soil, thereby minimizing their release to the surrounding environment and reducing the potential for human intake. Past performance has shown the technology to be effective provided the soil conditions are satisfactory. This technology would be applicable to the soil contaminated with low concentrations of VOCs. |

# TABLE 5-3
# PELICAN MANUFACTURING, INC. SITE
# REMEDIAL TECHNOLOGY IDENTIFICATION AND SCREENING FOR SOIL REMEDIATION

| Technology | Description | Screening |
|---|---|---|
| | | Implementability: Soil solidification is commonly used in the stabilization of soil contaminants. Due to the limited amount of space at the Site, application of this technology on-site does not appear feasible.<br>Comments: The technology may be useful as a means of pretreatment if soil is excavated for off-site disposal. |
| Chemical Oxidation (Alkaline Dechlorination) | This technology reduces the chlorine content of compounds in soil through the use of polyethylene glycolates (PEG). The process takes place in a closed batch reactor system and produces no toxic emissions. | Effectiveness: Alkaline dechlorination is a relatively new technology, but has shown some promise on certain organic compounds including PCBs. This technology would not be effective on metals.<br>Implementability: The availability of small scale alkaline dechlorination systems is unknown. The PEG can be recovered but requires disposal when remediation is complete. Space limitations at the Site preclude the use of this technology.<br>Comments: This technology may be effective and implementable for certain site contaminants. It would not be an acceptable process for treatment of wastes on-site. It will not be retained for further consideration. |
| Organic Solvent Extraction | This technology removes contaminants from solid media through the use of organic solvents. The process requires reaction vessels, chemical feed systems, and solvent recovery units. | Effectiveness: Various commercial processes that this technology have been pilot tested with varied and limited results. The ability to recover and recycle solvents is crucial to the cost effectiveness of this technology. There are also concerns over |

# TABLE 5-3
# PELICAN MANUFACTURING, INC. SITE
# REMEDIAL TECHNOLOGY IDENTIFICATION AND SCREENING FOR SOIL REMEDIATION

| Technology | Description | Screening |
|---|---|---|
| Organic Solvent Extraction (cont'd) | | the effects of residual amounts of solvents remaining treatment.<br>Implementability: This technology is potentially implementable from a technological standpoint, but because of its limited application, it is not considered to be a proven technology and has a low degree of desirability.<br>Comments : the questionable effectiveness and the relatively low degree of implementability makes this technology one that is not worthy of further consideration. |
| **Biological Treatment** | | |
| Bioremediation (including slurry reaction, in-situ biological, treatment, and land farming) | Bioremediation is the treatment of contaminated soil through microbial decomposition. The growth of native or introduced microorganisms is promoted to allow the digestion of the organic contaminants. Nutrients and oxygen may be added to enhance the biological activity. This treatment may be applied in-situ or to the soil after it has been excavated. | Effectiveness: This technology is most effective in removing non-halogenated organics (e.g. toluene, xylenes). It is not proven for the majority of the COC. It may be inhibited by halogenated organics and high concentrations of some metals. It is a technology that is sensitive to a number of variables. Where site conditions have been appropriate, this technology has been applied successfully. This technology is considered a permanent remedy that would reduce the toxicity and volume of the waste.<br>Implementability: Due to space limitations, ex- situ application of bioremediation at the Site is impractical. In-situ treatment is also impractical due to space limitations and the location of the building. |

## TABLE 5-3
## PELICAN MANUFACTURING, INC. SITE
## REMEDIAL TECHNOLOGY IDENTIFICATION AND SCREENING FOR SOIL REMEDIATION

| Technology | Description | Screening |
|---|---|---|
| Bioremediation (cont'd) | | Comments: Due to lack of space, this technology will not receive further consideration. |
| Isolation, Removal and Disposal | | |
| Capping | This technology involves the construction of a low permeability cap over the areas of contaminated soil. This will serve to reduce infiltration and the resulting leaching of contaminants into the groundwater where it may be transported to off-site areas. A cap will essentially eliminate the potential for human exposure to the contaminated soil. | Effectiveness: If properly maintained, this technology would reduce surface infiltration and will also reduce the risk potential by preventing exposure to contaminated soil and by reducing the spread of contaminants off-site. This technology will not reduce the volume or toxicity of the waste.<br>Implementability: This technology involves readily available construction materials and techniques. The thickness of the cap is restricted by existing site usage and the need to maintain site drainage.<br>Comments: Since this technology is easily implemented and may have an appreciable effect on reducing risk and the spread of contaminants off-site, it is retained for further consideration. Use of a cap will significantly enhance the effectiveness of soil vapor extraction technology. |
| Temporary On- Site Storage (tank/bulk containers, storage sacks, drums, buildings, waste piles | Certain remedial alternatives require temporary storage of contaminated material prior to disposal. This technology consists of containers or containment structures capable of storing these materials. | Effectiveness: Storage technologies are commonly used and are proven effective for containerizing contaminated materials. This technology does not reduce the volume or toxicity of the contaminants but will temporarily immobilize them. |

# TABLE 5-3
# PELICAN MANUFACTURING, INC. SITE
# REMEDIAL TECHNOLOGY IDENTIFICATION AND SCREENING FOR SOIL REMEDIATION

| Technology | Description | Screening |
|---|---|---|
| Temporary On- Site Storage (tank/bulk containers, storage sacks, drums, buildings, waste piles (cont'd) | | Implementability: Tanks, bulk containers, storage sacks and drums could be easily implemented for temporary storage. A building or a waste pile liner requires more space and construction considerations. Any container will require decontamination or disposal after use.<br>Comments: Tanks , bulk containers, storage sacks , drums and buildings will be considered for temporary storage of contaminated materials. The substantial volume of contaminated materials requiring disposal (e.g., liners) associated with waste piles renders them impractical as a means for temporary storage. Waste piles will not be retained for further consideration. |
| Off-Site Landfill | Solid materials, including treatment residues, would be disposed of at an off-site landfill if the materials have the proper chemical content and level of pretreatment, and comply with land disposal restrictions. | Effectiveness: Off-site landfilling has been commonly used and is proven effective for most contaminants present in the site soil.<br>Implementability: Off-site landfilling would require excavation and transport of contaminated material which could be easily implemented. Pretreatment or testing may be required to demonstrate compliance with land disposal restrictions.<br>Comments: This technology may provide the quickest means of eliminating the potential hazards associated with the contaminated soil. |

# TABLE 5-4
# PELICAN MANUFACTURING, INC. SITE
# REMEDIAL TECHNOLOGY IDENTIFICATION AND SCREENING
# FOR SEDIMENT REMEDIATION

| Technology | Description | Screening |
|---|---|---|
| In Place Abandonment | Contaminated sediments would be incapsulated in the abandoned drain lines by filling the pipes with grout. | Effectiveness: Does not reduce the toxicity of the contaminated sediment. Contaminants still have the potential to leak from sewer lines.<br>Implementability: Can be easily implemented using readily available equipment and materials. Bench scale testing would be required to determine the chemical compatibility of the gout.<br>Comments: Would not eliminate the potential for a future release. May be a viable alternative if the contaminated sediments are first removed. |
| Removal of Drain Lines and Septic Tank | Drain lines would be cleaned, excavated and removed. Contaminated sediment would be removed before the lines are excavated. The septic tank would also be cleaned and removed. All contaminated material would be taken off-site for treatment and disposal. | Effectiveness: Removing the contaminated sediment from the drain lines and the septic tank, and removing the drain lines and the septic tank from the Site would be highly effective in eliminating this potential source of contamination.<br>Implementability: This alternative is implementable but would involve significant disturbance to the interior of the building.<br>Comments: Would eliminate the potential for a future release. |

## TABLE 5-4
## PELICAN MANUFACTURING, INC. SITE
## REMEDIAL TECHNOLOGY IDENTIFICATION AND SCREENING FOR SEDIMENT REMEDIATION

| Technology | Description | Screening |
|---|---|---|
| Mechanical Cleaning | Contaminated sediment would be removed mechanically from the drain lines and septic tank. | Effectiveness: Would remove the bulk of the sediment, but would leave a residue. Avoids the use of water that may cause contaminants to leak out of the drain lines and the septic tank.<br>Implementability: Mechanical cleaning may be performed using readily available sewer cleaning equipment.<br>Comments: Would leave a residue that may be a potential source of groundwater contamination. May be sufficient cleaning if the lines and tank are removed. |
| Hydraulic Flushing | High pressure water would be used to remove sediment from the interior of the drain lines and the septic tank. Wash water would be removed using a vacuum truck. | Effectiveness: Is commonly used to clean sewers and is expected to be highly effective in removing loose sediments. Use of high pressure water may spread contamination if the drain lines and/or septic tank leak.<br>Implementability: Equipment designed to do this work is readily available.<br>Comments: Expected to be highly effective in cleaning drain lines and the septic tank. The lines and tank may be sufficiently clean to abandon in-place or return to service. |

## TABLE 5-4
## PELICAN MANUFACTURING, INC. SITE
## REMEDIAL TECHNOLOGY IDENTIFICATION AND SCREENING FOR SEDIMENT REMEDIATION

| Technology | Description | Screening |
|---|---|---|
| Vacuum Removal | Vacuum hoses are used to remove sediment from the drain lines and the septic tank. Does require the use of water. | Effectiveness: Expected to be highly effective in removing loose sediments. May leave a residue that may be a continuing source of contamination. Presents minimum potential for spreading contamination during cleaning.<br>Implementability: Equipment needed to perform work is readily available. Controls of vapors emitted by vacuum truck may be required.<br>Comments: Lines and septic tank may be sufficiently clean to abandon in-place or remove. Air quality may be adversely affected during cleaning. |

thermal desorbtion are retained as thermal treatment technologies that may have application in treatment of contaminated soil removed from the Pelican site.

### 5.8.2.3 Physical/Chemical Treatment Technologies

**Vapor Extraction Technology:** Vapor extraction is a well-proven technology that has been demonstrated to be effective in the removal of volatile organic contaminants from soil. Typically the technology is applied to the soil in-place. If applied in-situ, vapor extraction may not be suitable for remediation of the contaminated sediments. In-situ treatment of the soil may be enhanced if the groundwater table is first lowered in an effort to increase the thickness of the unsaturated soil. In-situ vapor extraction will be retained for further consideration.

**Aqueous Phase Extraction (Soil Washing):** This technology is not well-suited to a heterogeneous soil mixture with both coarse and fine grained particles. In addition, the limited space available at the Site is a significant constraint to use of such technology either in-situ or ex-situ. Soil washing will not be retained for further consideration.

**Chemical Oxidation:** Chemical oxidation is capable of destroying chlorinated compounds in soil. The small amount of contaminated soil present at the Site does not justify the use of a mobile on-site treatment unit, and the technology is not commercially available at off-site facilities. Also, operation and maintenance of chemical treatment technologies require skilled technicians and are more labor intensive, thus making implementation more difficult than other equally effective technologies. Chemical oxidation will be eliminated from further consideration in favor of processes that are considered to be more readily implementable and effective.

**Solvent Extraction:** The solvent extraction process is still in the developmental stage, and due to the limited amount of space available at the Pelican site cannot be readily implemented. Therefore, solvent extraction will not be retained for further consideration.

### 5.8.2.4 Biological Treatment Technologies

The volume of contaminated soil and sediment and the space available are not sufficient to make on-site biological treatment, whether in-situ or ex-situ, a viable option. Off-site biological treatment of soil is not readily available on a commercial basis. Biological treatment technologies will not be retained for further consideration.

### 5.8.2.5 Solidification Technologies

Solidification is commonly used for soil contaminated with inorganics, but can also be used to treat organic contaminants. The contaminants of concern are not destroyed, but would be isolated from the environment in a solidified matrix having low permeability. Use of this technology on-site is seriously constrained by the limited amount of space available to treat the soil and to place the soil after treatment. Solidification will not be retained for further consideration as a technology for use on-site. Solidification may be applied off-site as a necessary pre-treatment prior to land disposal.

### 5.8.2.6 Isolation, Removal, and Disposal Technologies

**Capping:** Covering or capping the areas of contaminated soil with a low permeability cap would serve to limit human exposure and will also reduce the mobilization of contaminants from soil in the unsaturated zone into the groundwater. A cap may also enhance the effectiveness of vapor extraction by reducing the amount of short circuiting that may occur due the relatively permeable nature of the surficial fill. Although capping does not result in the destruction or treatment of the volatile organic contaminants, used in conjunction with vapor extraction technology it is expected to be very effective in eliminating the potential for direct human exposure to the contaminated soil and enhancing the performance of a vapor extraction system. Capping the contaminated soil in-place will be retained for further consideration.

**Off-Site Land Disposal:** If contaminated soil is to be excavated, temporary storage on-site in drums or bulk containers may be necessary pending off-site treatment and/or disposal. Given the limited amount of space available for on-site treatment and the relatively small quantity of contaminated soil, off-site disposal at a RCRA permitted landfill, which may require treatment before disposal, may be an effective means of remediating the Site. Off-site land disposal (with or without pre-treatment) will be retained for further consideration.

### 5.8.3 Screening of Remedial Technologies for Groundwater

The technologies that may have application in the remediation of contaminated groundwater at the Pelican site have been initially evaluated. The technologies that appear to be difficult to implement due site-specific constraints at the Site or that have not been demonstrated to be effective when applied to similar chemical contaminants in a similar setting have been eliminated from further consideration. The results of the initial evaluation are presented in Table 5-5, and summarized below.

### 5.8.3.1 Physical/Chemical Treatment Technologies

These technologies are commonly used in the treatment of contaminated waste waters.

**Particulate Removal:** Technologies commonly used to remove suspended and settleable solids from waste water include particulate filters and gravity clarification. These are typically pre-treatment processes that are used in conjunction with other treatment technology such as air stripping or adsorption using activated carbon. Filtration and gravity clarification (sedimentation) will likely be required to remove settleable and suspended solids before the groundwater is further treated. Solids entrained in the recovered groundwater may blind carbon adsorption units or foul air stripping equipment. In the event groundwater is treated on-site, both particulate filters and gravity clarification will be retained for further consideration.

# TABLE 5-5
# PELICAN MANUFACTURING, INC. SITE
# REMEDIAL TECHNOLOGY IDENTIFICATION AND SCREENING FOR GROUNDWATER REMEDIATION

| Technology | Description | Screening |
|---|---|---|
| Physical/ Chemical Treatment | | |
| Particulate Removal | Provides for the removal of settleable and suspended solids. Sand filters or porous media filters are used. May be used for pretreatment. Flocculating agents may be required to enhance the removal of suspended solids. | Effectiveness: Filtration is commonly used to remove suspended and settleable solids. Additional treatment may be required if concentrations are high.<br>Implementability: The particulate removal process is easy to implement since it is used regularly and equipment is readily available. Filtration equipment requires relatively little space.<br>Comments: This technology is retained for further consideration, if groundwater is treated on-site. |
| Gravity Separation | This technology would be used in those situations where distinct phases of differing density liquids are present in groundwater. It could be used to remove high concentrations of settleable solids. | Effectiveness: Phase separation is a widely used means of separating liquids of different densities. It is also an effective means of removing settleable solids.<br>Implementability: This technology is a highly implementable at this Site. The equipment required is readily available and easily installed and operated. Typically requires more space than filters.<br>Comments: This technology is retained for further consideration, if groundwater is treated on-site. |

## TABLE 5-5
## PELICAN MANUFACTURING, INC. SITE
## REMEDIAL TECHNOLOGY IDENTIFICATION AND SCREENING FOR GROUNDWATER REMEDIATION

| Technology | Description | Screening |
|---|---|---|
| Aeration/Stripping | Volatile and some semi-volatile constituents can be removed from liquid streams by creating turbulence or mixing to expedite the natural aeration process. | Effectiveness: Aeration/air stripping has proven effective many times for the removal of VOCs from groundwater under similar circumstances.<br>Implementability: This is a commonly used technology and could easily be implemented at the Site.<br>Comments: This technology is effective for the primary contaminants of concern. Since it is readily implementable, it will be considered for use as a primary groundwater treatment. |
| Adsorption and Ion Exchange | These processes are used to remove constituents from a liquid or vapor phase by passing the flow over or through a media (such as granular activated carbon-GAC) which concentrates the constituents. | Effectiveness: Adsorption by GAC is commonly applied to remove a wide range of organics and metals from aqueous and vapor streams. It would be an effective technology for the groundwater and other waste water contaminants. However, the GAC could become a hazardous waste once contaminated. The GAC would then be subject to the regulatory restrictions associated with these wastes.<br>Implementability: Adsorption technology is readily available. Equipment is compact and could be used on-site.<br>Comments: Adsorption and ion exchange technologies will be retained for consideration for remediation of groundwater, or other contaminated water sources on the |

# TABLE 5-5
# PELICAN MANUFACTURING, INC. SITE
# REMEDIAL TECHNOLOGY IDENTIFICATION AND SCREENING FOR GROUNDWATER REMEDIATION

| Technology | Description | Screening |
|---|---|---|
| Adsorption and Ion Exchange (cont'd) |  | Site. However, the spent GAC may be a regulated hazardous waste once contaminated. The GAC would then be subject to the regulatory restrictions associated with these wastes. |
| Ultraviolet (UV) Oxidation | This process destroys dissolved organic contaminants in aqueous waste streams using chemical oxidation. The UV light is absorbed by many organic contaminants causing a change in their chemical structure or making them more reactive with chemical oxidants. | Implementability: This technology may have application if groundwater is treated on-site. Equipment is compact and could be used on-site. May require more maintenance than other technologies.<br>Comments: May require more maintenance than other technologies. Other technologies with proven effectiveness available. Will not be retained for further consideration. |
| Catalytic Oxidation | This process destroys volatile organic compounds in gaseous waste streams. Typically, a precious metal catalyst, such as platinum or palladium, is used in conjunction with heat to destroy organic contaminants. May be used to treat organic vapors produced by an air stripper or soil vapor extraction equipment. | Effectiveness: Catalytic oxidation has been demonstrated to be effective in the destruction of volatile organics in gaseous waste streams.<br>Implementability: This technology is readily available Equipment is compact and could be used on-site. Use will require conformance with air pollution regulations.<br>Comments: Use requires less energy than incineration This technology will be retained for further consideration. |

## TABLE 5-5
## PELICAN MANUFACTURING, INC. SITE
## REMEDIAL TECHNOLOGY IDENTIFICATION AND SCREENING FOR GROUNDWATER REMEDIATION

| Technology | Description | Screening |
|---|---|---|
| Biological Treatment | | |
| Ex-Situ Treatment | This technology uses microorganisms to degrade organic contaminants by enhancing natural biological processes. Treatment is performed in reactor vessels in which nutrients, dissolved oxygen and temperature are carefully controlled. Treatment could be performed on-site or at publicly owned sewage treatment plant or commercially operated facilities. | Effectiveness: This technology is commonly employed in the treatment of sanitary and industrial wastewater. High concentrations of certain organic contaminants, such as polynuclear aromatic hydrocarbons, may have a detrimental effect on biological treatment. Bench scale tests may be required.<br>Implementability: Package treatment systems are widely available. Optimum performance may require a heated enclosure, and there may not be enough space on the Site.<br>Comments: Because of the proven ability of this technology in the treatment of sanitary and industrial wastewater, this technology is retained for further consideration. Concentration of organics in groundwater may be too dilute to support biological activity without supplemental carbon source. |
| Isolation/Removal/Disposal Technologies | | |
| Groundwater Interceptor Trench | This technology is used as a passive means to recover groundwater. A gravel filled trench is placed downgradient of the contaminant plume and groundwater is collected as it enters the trench and is pumped for final disposition. | Effectiveness: A trench is an effective and simple means of collecting groundwater. However, since it is only a means of collecting groundwater, it does not reduce the toxicity or volume of hazardous wastes. |

# TABLE 5-5
# PELICAN MANUFACTURING, INC. SITE
# REMEDIAL TECHNOLOGY IDENTIFICATION AND SCREENING FOR GROUNDWATER REMEDIATION

| Technology | Description | Screening |
|---|---|---|
| Groundwater Interceptor Trench (cont'd) | A trench can be used to remove soil vapors at the same time it is used to recover groundwater. | Implementability: Construction of an interceptor trench requires commonly available equipment and methods. This technology has a proven record under similar applications. Readily implemented where depth to groundwater is small.<br>Comments: This technology would provide one of the most effective and implementable means of collecting groundwater and is, therefore, retained for further consideration. |
| Gradient Control Wells (Extraction Wells) | Pumping wells are used to extract contaminated groundwater and to control groundwater movement. Can be as effective as a trench. | Effectiveness: Groundwater extraction wells have been used on many sites and are a proven, effective technology. However, complete removal of contaminants is controlled by many factors including location of source, amount of contaminant in the vadose zone created by water level drawdown near the well, and the properties of the contaminant being removed. This technology does not reduce the volume or toxicity of the contaminants.<br>Implementability: Extraction wells can be installed using readily available drilling equipment and materials. Installation is often less disruptive to a site. Can be sited to focus on areas of higher contaminant concentrations.<br>Comments: Based on the effectiveness and ease of implementation, groundwater extraction wells will be retained for further consideration. |

# TABLE 5-5
# PELICAN MANUFACTURING, INC. SITE
# REMEDIAL TECHNOLOGY IDENTIFICATION AND SCREENING FOR GROUNDWATER REMEDIATION

| Technology | Description | Screening |
|---|---|---|
| Groundwater Flow Barriers (cut-off walls, grout curtains, and sheet piling) | This technology, by creating a low permeability vertical barrier to groundwater flow, increases the effectiveness of groundwater recovery and reduces the inflow of groundwater that does not contain contaminants. | Effectiveness: Groundwater flow barriers are used frequently with gradient control technologies. If constructed properly, a cut-off wall, grout curtain or sheet pile would create an effective barrier to groundwater flow. This technology does not reduce the volume or toxicity of the contaminants.<br>Implementability: Installation of an effective cut-off wall, grout curtain or sheet pile would be difficult at the Site due the limited amount of space, adjacent buildings and roads and the building itself.<br>Comments: Although effective at other sites, the complications with implementation makes installation of a groundwater flow barrier an impractical choice at the Site. This technology will not be retained for further consideration. |
| On-Site Discharge | On-site discharge requires treatment of water to groundwater standards prior to discharge in storm sewers or onto the ground. | Effectiveness: This technology of routing water from a treatment system to a storm sewer or to a preferred surface location is proven and effective.<br>Implementability: This technology can be easily implemented. Treated groundwater can be discharged to the surface drainage immediately west of the Site or to nearby storm sewers. A monitoring program will be required to verify that the treated effluent satisfies discharge limits. |

# TABLE 5-5
# PELICAN MANUFACTURING, INC. SITE
# REMEDIAL TECHNOLOGY IDENTIFICATION AND SCREENING FOR GROUNDWATER REMEDIATION

| Technology | Description | Screening |
|---|---|---|
| On-Site Discharge (cont'd) | | Comments: This technology will be retained for further consideration with water treatment technologies. |
| Off-Site Wastewater Treatment Facility (POTW) | Off-site discharge involves discharging water to a public sewer system which drains to a publicly owned treatment works (POTW). The discharge water must either be pretreated or contain levels of contaminants which can be treated by the POTW. | Effectiveness: Off-site discharge to a POTW is a proven effective technology. The POTW would have established performance criteria and testing. This would be considered a permanent elimination of the contaminants.<br>Implementability: This technology could be easily implemented with readily available equipment. Testing may be required prior to the discharge to the POTW.<br>Comments: Since the Site is located within a city and a POTW is readily accessible, this technology will be retained for further consideration. |

**Aeration/Stripping:** The COC at the Pelican site are volatile and may be effectively removed from groundwater by aeration or air stripping. The volatiles removed from the groundwater may have to be collected or destroyed to satisfy air quality considerations. Air stripping will be retained for further consideration.

**Adsorption and Ion Exchange**: The COC at the Pelican site can be removed using activated carbon adsorption technology. Carbon adsorption has been demonstrated to be highly effective in the removal of a wide range of organic contaminants from groundwater and the technology is readily available from several qualified vendors. Carbon adsorption has also been demonstrated to be effective in controlling volatile organics present in the vapor phase. Carbon adsorption may have application in controlling air emissions if air stripping is used to treat the groundwater. Carbon adsorption technology will be retained for further consideration.

**UV Oxidation:** The COC present in groundwater at the Pelican site are amenable to destruction by means of UV/chemical oxidation. UV/chemical oxidation has been used successfully to remove and destroy volatile organics dissolved in groundwater. However, USEPA reports the efficiency in the destruction of trichloroethane is approximately 21% (USEPA, 1993). UV technology will not be retained for further consideration.

**Catalytic Oxidation:** Catalytic oxidation may also be used to control air emissions resulting from removal of volatiles from groundwater, soil, or sediment. Catalytic oxidation has been demonstrated to be effective in the destruction of the Pelican COC. Catalytic oxidation equipment is available from several reputable vendors and will be retained for further consideration.

#### 5.8.3.2 Biological Treatment Technologies

Biological treatment of contaminated groundwater recovered at the Pelican site may be effective. Ex-situ treatment is preferred over in-situ. Due to the limited amount of space available at the Site, off-site treatment appears preferable to on-site treatment. Although the dichloroethenes and trichloroethane are relatively resistant to biological degradation, treatment at a conventional sewage treatment plant using aerobic treatment may be effective. Use of a conventional sewage treatment plant for the treatment of groundwater will be retained for further consideration.

#### 5.8.3.3 Isolation, Removal, and Disposal Technologies

**Groundwater Interceptor Trenches/Gradient Control Wells:** Groundwater interceptor trenches and gradient control/extraction wells are retained as potential means of recovering groundwater from the Site. Since groundwater contamination appears limited to the shallow groundwater system, both trenches and wells appear feasible.

**Control of Groundwater Movement:** Use of low permeability materials to impede/control the flow of groundwater (grout curtains, interlocking sheet piles, slurry walls) is often used in conjunction with groundwater recovery. At the Pelican site, such controls would ideally be located upgradient of the Site and would result in a significant reduction in the amount of groundwater moving beneath the Site. Due to the limited amount of space available to install groundwater controls upgradient of the Site and the need to extend the control onto adjacent properties, these technologies do not appear to be implementable and will not be retained for further consideration.

**Discharge of Treated Groundwater:** Groundwater treated on-site must be discharged. Discharge of the treated effluent to surface drainage west of the Site is readily implementable. The treated effluent may also be discharged via existing sewers to the City of Jamestown's sewage treatment plant. Due to the limited amount of space available at the Site, the shallow depth to groundwater, and the need to control groundwater movement, discharge to groundwater at the Site does not appear implementable and will not be given further consideration.

**Alternatives Means of Transport for Off-Site Treatment:** Groundwater may require transport off-site for treatment. Placing groundwater in drums would be impractical and time-consuming. However, transport in bulk such as tank trucks or by means of existing sewer lines is feasible and practical, and both will be retained for further consideration.

## 5.9 Remedial Alternatives

### 5.9.1 Development of Remedial Alternatives

Remedial alternatives have been developed for the Pelican site. Several alternatives have been developed for each contaminated medium (soil, sediments and groundwater) and treatment by-products (organic vapors). The alternatives were developed in conformance with the National Contingency Plan (NCP), the Environmental Conservation Law (ECL) and NYSDEC program guidance (TAGM HWR-4030). The final remedial program selected for the Pelican site will be developed by selecting compatible alternatives to address contamination present in the soil, sediment and groundwater which best meet the remedial objectives for the Site.

As described in TAGM 4030 the development of alternatives consisted of the following steps:

- Remedial action objectives were developed specific to soil, sediment and groundwater based on an analysis of exposure pathways.

- General response actions were developed for each medium such that the remedial action objectives would be satisfied.

- Volumes and areas of the various media were identified to which the general response actions would be applied, taking into account protectiveness and the chemical and geological characterization of the Site.

- Technologies applicable to each medium were identified and screened to eliminate the technologies that cannot be implemented technically at the Site.

The technologies that passed the screening were assembled into remedial alternatives designed to provide a comprehensive remedial program for the Pelican site. The following sections provide a brief description of the conceptual design of each proposed remedial alternative. During the preliminary screening of these remedial alternatives (Section 5.10) additional details regarding effectiveness and implementability will be considered. Those alternatives that are retained after screening will be evaluated in even greater detail in Section 5.11, Detailed Evaluation of Remedial Alternatives.

### 5.9.2 General No Action Alternative

This alternative applies to all of the contaminated media on the Site. The no action alternative is used as a baseline for the evaluation of the other alternatives. This alternative takes no action to contain, control or otherwise remediate the contaminated soil, sediment and groundwater at the Pelican site. In the event that no remedial actions are taken, a long term monitoring program will be designed and implemented. The decision to take no action would be reexamined periodically (once every five years) based on the results of the monitoring program. Deed restrictions will be placed on the Pelican site and properties downgradient of the Site to restrict the use of the property and prevent the installation of groundwater wells that could be used as potable supply wells.

### 5.9.3 Remedial Alternatives for Contaminated Soil (Alternative Series A)

Surface and subsurface soil located north and west of the site buildings contains concentrations of 1,2-dichloroethene, trichloroethene, 1,1,1-trichloroethane, tetrachloroethene, and acetone at concentrations greater than site cleanup goals. The surface or near surface soil samples that exceeded cleanup goals were collected at locations S-8, S-12, D3-S2, PM-S2, and PM-TP-1, and at locations beneath the building floor slab as shown on Figure 5-1.

Subsurface soil samples were collected from soil borings prior to monitoring well installation. The soil boring samples that exceeded cleanup goals were collected at a depth of 7-9 feet in the vicinity of MW-2, from 2-4 feet and 10-12 feet in the vicinity of MW-3, from 2-4 feet in the vicinity of MW-4 and from 8-10 feet in the vicinity of MW-1.

Although the lateral and vertical extent of the subsurface soil contamination is not fully defined, for the purpose of this feasibility study, the volume of contaminated soil that may require remediation has been estimated based on the following assumptions. The volume of contaminated soil located above the water table is located in only a few "hot spots" west and north of the building and beneath the building floor as shown on Figure 5-2. Each of the four "hot spots" outside the building are assumed to cover an area no greater than 20 feet x 20 feet laterally and five feet deep. Based on these assumptions, the total volume of "hot spot" soil is approximately 300 cubic yards (cy).

Based on the analysis of soil and soil gas samples, the contaminated soil beneath the building floor, but above the groundwater surface, is assumed to extend to a depth five feet and amounts to approximately 650 cy of soil.

Finally, the volume of soil containing COC at concentrations greater than the cleanup goals was estimated including the "hot spots" and contaminated soil below the water table. For this calculation, the areal extent of contamination was assumed to be approximately 16,000 square feet (as outlined in Figure 5-2) and the approximate vertical extent was assumed to be 12 feet. It is assumed that the entire thickness of fill and granular morainal deposits will require remediation. Based on the results of field screening of soil samples with an HNU and laboratory analysis of soil samples, the underlying low permeability silty clay morainal deposits and till deposits do not contain significant concentrations of volatile organic compounds. Based on these assumptions, the total volume of soil to be remediated would be approximately 7,000 cubic yards. This volume does not include the contaminated soil below the building floor.

The following remedial alternatives have been developed for contaminated soil. The no action alternative for soil has been included in the General No Action Alternative (Section 5.9.2).

#### 5.9.3.1 Alternative A1: Installation of Low Permeability Cap

This alternative provides for covering the contaminated soil with a low permeability cap. Due to the limited amount of space and the existing building at the Site, a soil cap appears impractical due to the necessary thickness of the various soil layers. The most practicable cap would be an asphalt cement pavement comprised of 4 inches of subbase and 2 inches of surface course. This would prevent direct contact and contaminant transport via wind erosion and surface runoff. Land use/deed restrictions would forbid alteration of the cap. Long-term maintenance and monitoring would be required. The decision to cap the contaminated soil would be reexamined periodically (once every five years) based on the results of the monitoring program.

#### 5.9.3.2 Alternative A2: In-Situ Vapor Extraction of "Hot Spot" Soils (~300 cy) and Soil under Building Foundation

The contaminated soil would be treated in-place using vapor extraction technology. Dual phase (soil vapor and groundwater) extraction wells would be required due to the shallow depth to groundwater over much of the western portion of the Site. Extraction wells would be installed at "hot spots" north and west of, and within the building. Soil vapors would be recovered to promote the removal of volatile organic contaminants in the soil. Vapor extraction would be focused on the upper approximately five feet of soil where contamination is most concentrated and provides the greatest source for groundwater contamination. Due to the permeability of the surficial soil, a low permeability cap may be required as part of the in-situ soil vapor extraction system in order to minimize short circuiting.

The rate of groundwater removal would be no more than required to dewater the upper five feet of soil. Groundwater recovery and treatment will be discussed in Alternative Series B and C (Sections 5.9.4 and 5.9.5) and treatment of recovered organic vapors will be discussed in Alternative Series E (Section 5.9.7).

### 5.9.3.3 Alternative A3: In-Situ Vapor Extraction of Soil under Building Foundation; Consolidation of "Hot Spot" Soils (~300 cy); and Ex-Situ Vapor Extraction in Building

This alternative would be similar to Alternative A2; in-situ vapor extraction would be used to treat soil below the building. However, the "hot spot" soils outside the building (approximately 300 cy) would be excavated and treated in an ex-situ vapor extraction system constructed within the building. Potential advantages of ex-situ treatment are:

- the potential for withdrawing groundwater would be reduced because vapor extraction wells would only be installed within the building where the depth to groundwater is greater than beneath the hot spots located further west on the Site;

- the vapor permeability of the excavated soil would be increased as a result of loosening the soil during excavation and handling. Care will be necessary to prevent compaction during placement in the treatment area;

- no low permeability cover would be needed outside the building;

- the building would provide protection from the elements;

- costs would be lowered because a dual phase vapor extraction system would not be needed.

Vents would be constructed in the building and air would be allowed to flow through the soil during system operation. If the system were shut down for an extended period of time, a tarp would be placed over soil to mitigate the release of soil vapors into the ambient air in the building. Structural improvements to the building may be required for safe construction and operation of a treatment system within the building. Post excavation sampling would be performed to confirm removal of "hot spots". Excavated areas would be backfilled with clean fill. At the completion of treatment, the treated soils would be spread over the Site and revegetated or paved. Post-remediation groundwater monitoring would be required to verify the effectiveness of the treatment.

The water table is deeper under the building (7 to 8 feet) than at other locations on the Site and should be more conducive to vapor extraction without groundwater recovery. Lower vapor extraction flow rates could be maintained to minimize or eliminate removal of groundwater through the vapor extraction wells in the building. This would eliminate the need for an on-site groundwater treatment system.

Alternatives for treatment of organic vapors generated as a result of the soil treatment are discussed in Section 5.9.7, Alternative Series E.

#### 5.9.3.4 Alternative A4: In-Situ Vapor Extraction of Soil under Building Foundation; Excavation of "Hot Spot" Soils (~300 cy); and Off-Site Treatment or Disposal

This alternative includes treatment of soil below the building floor using in-situ vapor extraction as discussed in Alternative A3. The "hot spot" soils north and west of the building (approximately 300 cy) would be excavated, placed in temporary storage containers and transported off-site to a RCRA permitted treatment, storage, disposal facility (TSDF). According to Hazardous Substance Regulations that are to go into effect on January 15, 1995, the concentrations of the volatile organic compounds present in approximately on half the volume of excavated soil exceed the Land Disposal Restrictions. This means that approximately 150 cy of soil will require treatment before land disposal. The exact pre-treatment method employed will depend on the TSDF, but it is assumed to be a form of thermal treatment. The remaining 150 cy could be directly landfilled in a RCRA permitted landfill.

Post-excavation samples would be required to confirm removal of "hot spots". Excavated areas would be backfilled with clean soil from an off-site borrow source and revegetated or paved. Post-remediation groundwater monitoring would be required to verify the effectiveness of the treatment.

#### 5.9.3.5 Alternative A5: In-Situ Vapor Extraction of all Contaminated Site Soil (~7,000 cy) Including Soil under Building Foundation

This alternative would be similar to Alternative A2 except that larger amounts of groundwater would be removed in order to depress the water table and to increase the vertical influence of the vapor extraction system. The contaminants in the near-surface soil as well as residual contamination below the groundwater table would be treated in-place using vapor extraction technology. Additional vapor extraction points would be needed as compared with Alternative A2 in order to provide in-situ treatment to the larger volume of contaminated soil. Soil vapor extraction would be greatly enhanced by installation of a low permeability cap. Groundwater monitoring would be required to assess the changes (improvement) in groundwater quality resulting from operation of the system. As discussed in Alternative A3, organic vapors generated by the soil vapor extraction system may require treatment (Refer to Section 5.10.6, Alternative Series E).

#### 5.9.3.6 Alternative A6: In-Situ Vapor Extraction under Building Foundation; Excavation of all Contaminated Site Soil (~7,000 cy); and Off-Site Treatment or Disposal

This alternative is similar to Alternative A4 except that the volume of soil to be removed would include soil above and below the groundwater table (approximately 7,000 cy). Because the soil under the building foundation is not accessible to excavation, in-situ vapor extraction is proposed for remediation of this soil.

### 5.9.4 Remedial Alternatives for Groundwater (Alternative Series B)

The following remedial alternatives have been developed to address control and/or remediation of the contaminated groundwater detected in monitoring wells at the Pelican site. The no action alternative for groundwater has been included in the General No Action Alternative (Section 5.9.2).

#### 5.9.4.1 Alternative B1: Groundwater Recovery to Enhance Vapor Extraction of Shallow "Hot Spot" Soils

Under this alternative, groundwater removal would be limited to what is necessary to operate a vapor extraction system designed to provide in-situ treatment of the shallow "hot spot" soils. Contaminated groundwater would be pumped from dual extraction wells associated with the vapor extraction system. Groundwater removal would be controlled to depress the water table sufficiently to maximize the efficiency of vapor extraction in the shallow soils. Groundwater pumping would cease at the completion of "hot spot" remediation. Groundwater treatment alternatives are discussed in Alternative Series C (Section 5.9.5).

#### 5.9.4.2 Alternative B2: Groundwater Recovery to Enhance Vapor Extraction of all Contaminated Site Soils

Under this alternative, removal of significant volumes of groundwater would be necessary to depress the groundwater table to a level that would allow vapor extraction of all the contaminated soil overlying the till. Contaminated groundwater would be pumped from the dual extraction wells associated with the vapor extraction system. Groundwater treatment alternatives are discussed in Alternative Series C (Section 5.9.5).

#### 5.9.4.3 Alternative B3: Hydraulic Containment of Contaminated Groundwater

Under this alternative, groundwater removal would be limited to what is necessary to prevent contaminated groundwater from migrating off site. Contaminated groundwater would be pumped from a lateral trench or extraction wells located at the rear of the building. Hydraulic containment would continue until groundwater recovery and natural degradation lowered the contaminant concentrations to below cleanup levels. A long-term groundwater monitoring program would be required to assure effectiveness of the system. Groundwater treatment alternatives are discussed in Alternative Series C (Section 5.9.5).

#### 5.9.4.4 Alternative B4: Groundwater Pump and Treat

Under this alternative, contaminated groundwater would be pumped from a lateral recovery trench or extraction wells at a higher rate than for hydraulic containment, with the objective of enhancing the rate at which groundwater quality is restored. Pumping would continue until sufficient pore volumes were removed to lower the contaminant concentrations to below cleanup levels. A long-term groundwater monitoring program would be required to assure effectiveness of the system. Groundwater treatment alternatives are discussed in Alternative Series C (Section 5.9.5).

#### 5.9.4.5 Alternative B5: In-Situ Air Sparging

In-situ air sparging would consist of bubbling air through the upper, unconfined water bearing zone, consequently removing organic contaminants in the soil and groundwater. The air sparging technology would be combined with a low permeability cap and a vapor extraction system to capture the organic vapors released by air sparging and to prevent the vapors from discharging into the atmosphere. Treatment of organic vapors is discussed in Alternative Series E (Section 5.9.7).

### 5.9.5 Remedial Alternatives for Groundwater Treatment (Alternative Series C)

The following remedial alternatives have been developed to address treatment of recovered groundwater at the Pelican site.

#### 5.9.5.1 Alternative C1: On-Site Groundwater Treatment (Air Stripper)

This alternative provides for on-site treatment of recovered groundwater using an air stripper. If necessary, groundwater would be pretreated to remove particulates and dissolved metals (iron). Air pollution controls would be installed to limit the emissions from the air stripper (See Section 5.9.7). This alternative requires continued operation and maintenance. The water and the vapors discharged form the air stripper would be monitored to insure compliance with discharge limitations. Data obtained from the monitoring system would be evaluated continuously to optimize system performance and to determine the necessity for continued system operation.

#### 5.9.5.2 Alternative C2: On-Site Groundwater Treatment (Activated Carbon)

This alternative provides for on-site treatment of recovered groundwater using activated carbon. No air pollution controls would be needed as part of the groundwater treatment system. Operation, monitoring, and maintenance would be required as in Alternative C1.

#### 5.9.5.3 Alternative C3: Off-Site Treatment at Local Waste Water Treatment Plant

This alternative provides for discharge of recovered groundwater to the local publicly owned waste water treatment plant for off-site treatment. Use of the local waste water treatment plant is subject to the approval of local municipal officials. Monitoring of the discharge to the sanitary sewer system may be required to comply with local ordinances.

### 5.9.6 Remedial Alternatives for Contaminated Floor Drain Sediment (Alternative Series D)

The following remedial alternatives have been developed for remediation of the contaminated sediments located in floor drains and the septic tank at the Site. The no action alternative for the contaminated sediments has been included in the General No Action Alternative (Section 5.9.2).

#### 5.9.6.1 Alternative D1: On-Site Containment

This alternative provides for the in-place containment of contaminated sediments by either capping, plugging or otherwise sealing the floor drains and the septic tank. Long-term monitoring of groundwater quality would be required to determine the effectiveness of this remedy. The decision to contain the wastes in-place would be reexamined periodically (once every five years) based on the results of the monitoring program.

#### 5.9.6.2 Alternative D2: Removal and Consolidation with "Hot Spot" Soils; and Ex-Situ Vapor Extraction

This alternative provides for the removal of contaminated sediment from the floor drains and septic tank. The sediment would be consolidated with other site soils and treated by ex-situ vapor extraction in the building as discussed in Alternative A3 (Section 5.9.3.3).

#### 5.9.6.3 Alternative D3: Removal and Off-Site Disposal (TSDF)

This alternative provides for the removal and off-site disposal of contaminated sediment from the floor drains and septic tank. Due to the high concentrations of contaminants in the sediments, any actively managed sediments will be classified as an F001 waste and will be subject to land disposal restrictions. The sediment will be transported off-site for ultimate treatment and disposal at a RCRA permitted facility.

### 5.9.7 Remedial Alternatives for Control of Organic Vapors (Alternative Series E)

The following remedial alternatives have been developed for control of organic vapors that may be released as a result of on-site treatment of groundwater using an air stripper and/or in-situ remediation of the contaminated soil using soil vapor extraction.

#### 5.9.7.1 Alternative E1: Vapor Phase Activated Carbon

Organic vapors produced by the air stripper and/or the soil vapor extraction system, could be removed from the air using vapor phase activated carbon. If activated carbon is used, an in-line heater/dryer will also be required to reduce the relative humidity in the off gas from the air stripper. Monitoring of the emissions from the activated carbon units would also be necessary to verify compliance with emission limits. Once the adsorptive capacity of the carbon is reached, the spent carbon would be transported off-site for disposal or regeneration. The use of activated carbon to control air emissions will require less maintenance than catalytic oxidation.

### 5.9.7.2 Alternative E2: Catalytic Oxidation

Catalytic oxidation offers an alternative to activated carbon in the removal of organic vapors in the air streams generated by soil vapor extraction and the air stripper. As above, monitoring of the emissions from the catalytic oxidation unit would also be necessary to verify compliance with emissions limits. The catalytic oxidizing unit will require periodic inspection and maintenance. Supplemental fuel will also be required to provide for the complete combustion of the recovered volatile organics, but no waste residues (such as the spent carbon above) will be generated by the process.

## 5.10 Preliminary Screening of Remedial Alternatives

The screening process is intended to eliminate ineffective or unworkable alternatives and to focus on a range of feasible alternatives suitable for further evaluation in the detailed analysis.

New York State guidance on selection of remedial actions (NYSDEC TAGM HWR-4030, 1989 REVISED, 1990) suggests that two broad factors be used in the initial screening process: effectiveness and implementability. This guidance also emphasizes the need to consider proven technologies with demonstrated performance. Federal guidance includes cost in the initial screening process along with effectiveness and implementability. Consistent with NYS Guidance, cost has not been included in this initial screening of alternatives. In the following section, alternatives will be screened based on:

**Effectiveness:** Each alternative will be evaluated as to the extent to which it will eliminate significant threats to public health and the environment through reductions in toxicity, mobility and volume of the hazardous wastes. Short-term effectiveness refers to benefits derived during or immediately after implementation and to increased risks resulting from implementation of an alternative. Long-term effectiveness refers to performance of a remedial measure and the certainty that this performance will be maintained.

**Implementability:** Each alternative will be evaluated with respect to the technical and administrative implementability. Short-term technical implementability is concerned with the feasibility of constructing remedial measures and takes into account the availability of equipment and materials, overall difficulty of construction, and the potential that unresolvable difficulties will arise. Long-term technical implementability refers to continuing operation and maintenance components and the feasibility of any required repairs. Administrative implementability refers to compliance with applicable rules, regulations and statutes, the ability to obtain approvals from other offices and agencies and the availability of treatment, storage, and disposal services and capacity.

The effectiveness and implementability of each alternative identified in Section 5.9 were assessed and are described in the following section. The basis for rejection or acceptance of each alternative is described below. A list of the remedial alternatives is provided on Table 5.6 with an indication of whether the alternative has been retained or eliminated from further consideration.

### 5.10.1 General No Action Alternative

The General No Action Alternative includes a long-term groundwater monitoring program and restrictions on future uses of the Site.

**Effectiveness:** With the exception of long-term monitoring, this alternative will involve no other actions. Natural degradation and flushing may reduce the levels of contamination but this alternative includes no action to enhance the rate of contaminant reduction. Contaminant degradation will depend upon naturally occurring processes, and would be uncontrolled and unpredictable. Since there would be no removal of contaminated soil, sediment or groundwater, this alternative would pose no remediation-related short-term risks to site workers or local residents. Long-term risks associated with dermal contact and inhalation of volatiles would continue. The results of the RI indicated that site-related contamination is not likely to impact the Jamestown Aquifer which is used for public water supply. The contamination has not migrated vertically downward due to the upward acting gradient across the underlying till confining layer. Therefore, the no action alternative does not pose a long-term risk to human health through ingestion unless a private shallow well were installed due to some future residential use of the property. This is considered to be highly unlikely due to the commercial nature of surrounding property and the availability of a public water supply.

Shallow groundwater flow is to the west discharging into a drainageway between the Site and former Jamestown City Landfill or commingling with the groundwater beneath the landfill, eventually discharging into the Chadakoin River and associated wetlands. The areal extent of the plume is limited by topography, local streams and the Chadakoin River. The groundwater quality beneath the landfill is unlikely to be significantly affected by the organic groundwater contaminants derived from the Pelican site.

**Implementability:** This alternative would be highly implementable as it requires only the installation of a long-term monitoring system.

**Summary:** This alternative is easily implemented but will have no short-term effect on reducing the toxicity, mobility or volume of the contaminants. The No Action Alternative is used as a basis against which all other alternatives are compared, and therefore will be retained for detailed evaluation.

### 5.10.2 Contaminated Soil (Alternative Series A)

The remedial alternatives for contaminated soil at the Pelican site have been screened as follows:

# TABLE 5-6

## PELICAN MANUFACTURING, INC. SITE
## SUMMARY OF PRELIMINARY SCREENING OF REMEDIAL ALTERNATIVES

| REMEDIAL ALTERNATIVE | | RETAIN/ ELIMINATE |
|---|---|---|
| General No Action Alternative | | Retain |
| **Alternative Series A - Contaminated Soil** | | |
| A1 | Installation of Low Permeability Cap | Eliminate |
| A2 | In Situ Vapor Extraction of "Hot Spot" Soils (~300 cy) and Soil under Building Foundation | Eliminate |
| A3 | In Situ Vapor Extraction of Soil under Building Foundation; Consolidation of "Hot Spot" Soils (~300 cy); and Ex Situ Vapor Extraction in Building | Retain |
| A4 | In Situ Vapor Extraction of Soil under Building Foundation; Excavation of "Hot Spot" Soils (~300 cy); and Off-Site Treatment or Disposal | Retain |
| A5 | In Situ Vapor Extraction of all Contaminated Site Soil (~7,000 cy) Including Soil under Building Foundation. | Retain |
| A6 | In Situ Vapor Extraction under Building Foundation; Excavation of all Contaminated Site Soil (~7,000 cy); and Off-Site Treatment or Disposal | Eliminate |
| **Alternative Series B - Groundwater** | | |
| B1 | Groundwater Recovery to Enhance Vapor Extraction of Shallow "Hot Spot" Soils | Eliminate |
| B2 | Groundwater Recovery to Enhance Vapor Extraction of all Contaminated Site Soils | Retain |
| B3 | Hydraulic Containment of Contaminated Groundwater | Eliminate |
| B4 | Groundwater Pump and Treat | Retain |
| B5 | In Situ Air Sparging | Eliminate |

# TABLE 5-6(CONTINUED)

## PELICAN MANUFACTURING, INC. SITE
## SUMMARY OF PRELIMINARY SCREENING OF REMEDIAL ALTERNATIVES

| REMEDIAL ALTERNATIVE | RETAIN/ ELIMINATE |
|---|---|
| **Alternative Series C - Groundwater Treatment** | |
| C1 On-Site Groundwater Treatment (Air Stripper) | Retain |
| C2 On-Site Groundwater Treatment (Activated Carbon) | Retain |
| C3 Off-Site Treatment at Local POTW | Retain |
| **Alternative Series D - Floor Drain and Septic Tank Sediments** | |
| D1 On-Site Containment | Eliminate |
| D2 Removal and Consolidation with "Hot Spot" Soils; and Ex Situ Vapor Extraction | Retain |
| D3 Removal and Off -Site Disposal (TSDF) | Retain |
| **Alternative Series E - Control of Organic Vapors** | |
| E1 Vapor Phase Activated Carbon | Retain |
| E2 Catalytic Oxidation | Retain |

#### 5.10.2.1 Alternative A1: Installation of Low Permeability Cap

The major components of this alternative are:

- Construction of a low permeability cap; and
- Long-term monitoring and maintenance.

**Effectiveness:** This alternative would reduce the potential for dermal exposure to contaminated soil by providing a physical barrier to direct contact and suppress the release of volatiles into the air. The cap would also reduce surface infiltration and the resulting transport of surface soil contaminants into groundwater. This alternative would not reduce the potential for continued horizontal migration of contaminants within the saturated soil. The long-term risks associated with groundwater contamination are minimal as described in the General No Action Alternative. These risks would be reduced as groundwater quality is restored by natural flushing or active groundwater remediation. Short-term risks to workers or local residents during construction would be minimal since no excavation and handling of soil would be required. Long-term effectiveness would depend on long-term maintenance and restrictions on future land use. If the site buildings were subject to demolition or retrofitting, such activities would increase the potential for an uncontrolled breach of the cap.

**Implementability:** Commonly available equipment, materials and construction practices would be required to implement this alternative. Further, long-term monitoring and maintenance would be accomplished using existing monitoring wells and readily available materials and equipment.

**Summary:** This alternative is considered highly implementable and has less short-term risk than an alternative requiring excavation. Potential long-term risks are presented by the failure to reduce the volume or toxicity of the hazardous wastes and the uncertainty associated with cover maintenance and reliance on land use restrictions to prevent exposure. Based on these long-term risks, this alternative will not be retained for detailed evaluation.

#### 5.10.2.2 Alternative A2: In-Situ Vapor Extraction of "Hot Spot" Soils (~300 cy) and Soil under Building Foundation

The major components of this alternative are:

- Installation of dual vapor/groundwater extraction wells designed to treat shallow "hot spot" soils;
- Installation of a low permeability cap;
- Extraction and treatment of organic vapors according to the alternative selected for Alternative Series E;

- Treatment of groundwater according to the alternative selected for Alternative Series C; and

- Short-term performance monitoring of soil, soil vapor and groundwater treatment.

**Effectiveness:** This alternative would be effective in removing the organic soil contaminants from the areas with relatively high concentrations and would therefore be effective in eliminating the source of groundwater contamination. It would not be effective in remediating any contaminated soil below the groundwater table, but the concentration of VOCs in the soil below the water table is considerably lower and the VOCs will likely degrade over time once the shallow source contaminants are removed. Minimal short-term risks associated with the installation of the extraction wells could easily be controlled using common health and safety practices.

The relatively high permeability of the contaminated soil is also compatible with vapor extraction. The VOCs to be removed from the soil all have vapor pressures greater than 0.03 atmospheres at 20° Celsius and are considered sufficiently volatile for removal with vapor extraction. The VES pilot study performed at the Site indicated that, in conjunction with lowering the water table through groundwater pumping and construction of a low permeability cap, a vapor extraction system would effectively remove the contaminants from the shallow subsurface soils and provide a high degree of reduction to potential long-term risks from dermal contact, through the removal of organic contaminants.

**Implementability:** This alternative is considered a permanent, proven remedy and as such is favored from the standpoint of compliance with federal and NYSDEC policy and guidance. Vapor extraction requires skilled personnel to operate, maintain, and monitor the performance of the system. This alternative could be implemented in the limited space available. The vapor extraction system could be installed in one of the site buildings. The connection between the main system and the individual extraction points would require protection from the elements. Groundwater monitoring would be required to assess the changes (improvement) in groundwater quality resulting from operation of the system.

**Summary:** This alternative is expected to be highly effective in reducing the volume, toxicity and mobility of the site contamination and is considered highly implementable. However, Alternative A3 is very similar in effectiveness and has distinct advantages relative to implementability. These advantages are discussed in the following section. Therefore, Alternative A2 will not be retained for detailed evaluation.

### 5.10.2.3 Alternative A3: In-Situ Vapor Extraction of Soil under Building Foundation; Consolidation of "Hot Spot" Soils (~300 cy); and Ex-Situ Vapor Extraction in Building

The major components of this alternative are:

- Installation of vapor extraction wells within the building (assume groundwater recovery would be negligible);

- Excavation of "hot spot" soils and consolidation in one of the site buildings as part of an ex-situ vapor extraction treatment system;

- Post-excavation soil sampling;

- Treatment of organic vapors according to the alternative selected for Alternative Series E;

- Short-term performance monitoring of soil, soil vapor and groundwater treatment; and

- Placement of treated soil on-site at completion of treatment.

**Effectiveness:** The effectiveness of this alternative would be similar to Alternative A2 since vapor extraction is a proven treatment method. Excavation of the soil could potentially increase the soil permeability to vapor as a result of loosening during excavation and placement. Higher permeability to vapor should increase the rate of remediation. Short-term impacts associated with excavation and handling of the contaminated soil would be mitigated by requiring appropriate health and safety procedures during construction.

**Implementability:** Advantages of this alternative over Alternative A2 are related to implementability. Rather than requiring vapor extraction points across the Site, the "hot spot" soils (approximately 300 cy) would be excavated and placed in an ex-situ vapor extraction system constructed within the building, thus limiting the size of the vapor extraction system and eliminating the need for weatherproofing extraction points. Other potential advantages of ex-situ treatment include:

- reduced or eliminated groundwater removal;

- no low permeability cover would be needed outside the building; and

- the building would act as protection from the elements, possibly resulting in an increased rate of removal of the VOCs.

Since the building is unoccupied it would be available for constructing the ex-situ system. Structural improvements to the building may be required for safe construction and operation of a treatment system within the building. Post excavation sampling would be required to confirm removal of "hot spots". O&M would be required for the in-situ VES as described for Alternative A2. Post remediation groundwater monitoring would be required to verify the effectiveness of the treatment.

**Summary:** This alternative is considered effective and highly implementable and, due to its advantages over Alternative A2, it will be retained for detailed evaluation.

### 5.10.2.4 Alternative A4: In-Situ Vapor Extraction of Soil under Building Foundation; Excavation of "Hot Spot" Soils (~300 cy); and Off-Site Treatment or Disposal

The major components of this alternative are:

- Installation of vapor extraction wells within the building (assume groundwater recovery would be negligible);
- Excavation of approximately 300 cy of "hot spot" soils and off-site transport to a permitted TSDF;
- Off-site thermal treatment of soils exceeding the Land Disposal Restriction criteria and disposal of remaining soils at a RCRA permitted landfill;
- Post-excavation soil sampling;
- Backfilling excavated areas with clean fill;
- Treatment of organic vapors according to the alternative selected for Alternative Series E;

**Effectiveness:** This alternative would effectively remove the soil that causes a risk of human exposure through direct contact and which appears to be the primary source of groundwater contamination through infiltration of precipitation. As discussed in Alternative A2, the contaminants below the groundwater table would not be effected by this remedial alternative, but are lower in concentration and would likely degrade over time. The contaminants in the excavated soils would be destroyed or immobilized according to RCRA requirements. Short-term risks would result from excavation, but these risks could be effectively mitigated using commonly applied health and safety procedures.

**Implementability:** This alternative is highly implementable. Wastes would be transported to a commercial facility that is properly permitted and is in compliance with its operating permits. Off-site thermal treatment avoids the difficulties associated with on-site treatment including test burns, permitting and community acceptance. Post-excavation samples would be required to confirm removal of "hot spots". Excavated areas would be backfilled with clean soil from an off-site borrow source and revegetated or paved. The in-situ VES will require operation and maintenance as described for Alternative A2. Post-remediation groundwater monitoring would be required to verify the effectiveness of the treatment.

**Summary:** This alternative is considered both highly effective and highly implementable when compared with other alternatives. It will be retained for detailed evaluation.

### 5.10.2.5 Alternative A5: In-Situ Vapor Extraction of all Contaminated Site Soil (~7,000 cy) Including Soil under Building Foundation

The major components of this alternative are:

- Installation of dual vapor/groundwater extraction wells designed to treat all contaminated soil above and below the groundwater surface;

- Installation of a low permeability cap;

- Extraction and treatment of organic vapors according to the alternative selected for Alternative Series E;

- Treatment of groundwater according to the alternative selected for Alternative Series C; and

- Short-term performance monitoring of soil, vapor and groundwater treatment.

**Effectiveness:** This alternative would be similar to Alternative A2, except that larger amounts of groundwater will be removed in order to depress the water table over the entire Site. Depressing the water table will increase the vertical and lateral extent of influence of the vapor extraction system. The contaminants in the near surface soil as well as residual contamination below the present groundwater table would be treated in-place using vapor extraction technology.

**Implementability:** Additional vapor extraction points would be needed as compared with Alternative A2 in order to treat the necessary area of contaminated soil. Soil vapor extraction would be greatly enhanced by installation of a low permeability cap. The effort to operate, maintain, and monitor the performance of the vapor extraction system would be greater for this alternative than Alternative A2 because of the relative size of the system. Groundwater monitoring would also be required to assess the changes (improvement) in groundwater quality resulting from operation of the system.

**Summary:** This alternative would be more effective than other alternatives at reducing the volume of contaminants at the Site and having an overall positive effect on groundwater. However, this alternative would require a larger vapor/groundwater extraction and treatment system and would be more complicated to implement and maintain. Many of the dual extraction points would require protection from the elements. However, based on its anticipated overall effectiveness, this alternative will be retained for detailed evaluation.

#### 5.10.2.6 Alternative A6: In-Situ Vapor Extraction under Building Foundation; Excavation of all Contaminated Site Soil (~7,000 cy); and Off-Site Treatment or Disposal

The major components of this alternative are:

- Excavation of approximately 7,000 cy of "hot spot" and saturated soils and off-site transport to a permitted TSDF;

- Thermal treatment of soils exceeding the Land Disposal Restriction criteria and disposal of remaining soils at a RCRA permitted landfill;

- Post-excavation soil sampling;

- Backfilling excavated areas with clean fill;

- Installation of vapor extraction wells within the building (assume groundwater removal would be negligible);

- Treatment of organic vapors according to the alternative selected for Alternative Series E;

**Effectiveness:** This alternative would effectively remove the soil containing COC at concentrations exceeding site soil cleanup objectives. The contaminants would then be destroyed or immobilized according to RCRA requirements. Short-term risks to workers and the community would arise during excavation activities, but these could be effectively mitigated using commonly applied health and safety procedures.

**Implementability:** This alternative would not be as easily implemented as Alternative A5 because deep excavation near structures could cause settlement and may require engineering controls for stabilization. Wastes would be transported to a commercial facility that is properly permitted and in compliance with its operating permits. Off-site thermal treatment avoids the difficulties of on-site thermal treatment associated with test burns, permitting and community acceptance. Operation and maintenance of the in-situ vapor extraction system in the building would be required.

**Summary:** Due to the potential problems presented by performing deep excavation around the building, and the fact that in-situ vapor extraction would still be required to remediate the soil under the building, this alternative will not be retained for detailed evaluation because the additional effort required to implement this alternative does provide sufficient additional benefits as compared to other alternatives.

### 5.10.3 Groundwater (Alternative Series B)

The remedial alternatives developed to control and/or enhance the quality of the contaminated groundwater detected in monitoring wells at the Pelican site have been screened as follows:

#### 5.10.3.1 Alternative B1: Groundwater Recovery to Enhance Vapor Extraction of Shallow "Hot Spot" Soils

The major components of this alternative are:

- Installation of dual vapor/groundwater extraction wells designed to treat shallow "hot spot" soils;

- Treatment of groundwater according to the alternative selected for Alternative Series C; and

- Short-term performance monitoring of groundwater treatment.

**Effectiveness:** Due to the minimal volume of groundwater proposed for removal, this alternative would do little to control the flow or enhance the quality of groundwater at the Site. However, the characteristics of the upper, unconfined water-bearing zone are amenable to groundwater removal and, therefore, a dual extraction well would be effective in lowering the water table to enhance vapor extraction. Short-term risks to on-site workers and local residents associated with groundwater recovery would be minimal and could be controlled with common health and safety practices. Long-term risks associated with groundwater contamination are minimal as described in the General No Action Alternative. These risks would be reduced as groundwater quality is restored by natural flushing.

**Implementability:** Installation of dual vapor/groundwater extraction wells is readily implementable. Standard equipment and practices could be used to construct the system. Operation and maintenance of the groundwater removal system will require periodic inspection to insure the collection system operates properly, but would be relatively short term, ending at the completion of "hot spot" remediation using vapor extraction.

**Summary:** Since Alternative A3 is being retained rather than Alternative A2, this alternative only applies to the in-situ vapor extraction points proposed for inside the building. Since groundwater recovery associated with vapor extraction beneath the building is assumed to be negligible, this alternative will not be retained for detailed evaluation.

#### 5.10.3.2 Alternative B2: Groundwater Recovery to Enhance Vapor Extraction of all Contaminated Site Soils

The major components of this alternative are:

- Installation of dual vapor/groundwater extraction wells designed to treat all contaminated soil above and below the water table;

- Treatment of groundwater according to the alternative selected for Alternative Series C; and

- Short-term performance monitoring of groundwater treatment.

**Effectiveness:** This alternative would require significant depression of the groundwater table. The upper, unconfined water bearing zone that contains the contaminated groundwater is fill and mixed morainal deposits that vary in composition from coarse gravel to silty clay. The average hydraulic conductivity measured in wells screened in the shallow water bearing unit (MW-1S, MW-19 and MW-20) is 4.5E-03 cm/sec (12.9 ft/day) which should be amenable to groundwater removal through a dual vapor/groundwater extraction well. Such a system should be highly effective in controlling groundwater levels in the vicinity of the well. As described in the General No Action Alternative, long-term risks associated with the present level of groundwater contamination are minimal. These risks would be further reduced as groundwater quality is more rapidly restored by groundwater removal and by natural flushing.

**Implementability:** Installation of a dual vapor/groundwater extraction system is readily implementable. Standard equipment and practices could be used to construct the system. The dual extraction points will require protection from the elements. Operation and maintenance of the groundwater removal system requires periodic inspection to insure the collection system operates properly. O&M may be required for a longer period than Alternative B1 because of the larger volume of soil to be treated by vapor extraction.

**Summary:** This alternative would be effective in depressing the groundwater table which would enhance vapor extraction. The alternative is readily implementable but would be associated with a complicated, relatively high maintenance vapor/groundwater extraction and treatment system. This alternative will be retained for detailed evaluation.

#### 5.10.3.3 Alternative B3: Hydraulic Containment of Contaminated Groundwater

The major components of this alternative are:

- Installation of groundwater extraction wells or a lateral recovery trench at the rear of the building;
- Treatment of groundwater according to the alternative selected for Alternative Series C; and
- Long-term groundwater monitoring.

**Effectiveness:** As discussed in Alternative B2, the upper, unconfined water bearing zone would be amenable to groundwater removal through a lateral recovery trench or extraction wells. Such a system should be highly effective in controlling the movement of contaminated groundwater. Short-term risks to workers would be similar to Alternative B2. If no source removal accompanies the hydraulic containment system, the system will require an extended period of operation until the VOCs are leached out of the hot spot soils. The minor long-term risks associated with off-site migration of groundwater contaminants would be mitigated under this alternative.

**Implementability:** Installation of a hydraulic containment system is readily implementable. Standard equipment and practices could be used to construct the system. Long-term operation and maintenance of the groundwater removal system would be required consisting of periodic inspection to insure the collection system was operating properly.

**Summary:** Although hydraulic containment could be implemented at the Pelican site, this alternative will not be retained for detailed evaluation. Hydraulic containment would entail a significant long-term effort that is anticipated to result in little additional reduction in the potential for off-site migration of groundwater which under existing conditions presents little risk.

#### 5.10.3.4 Alternative B4: Groundwater Recovery to Enhance the Rate at Which Groundwater Quality is Restored

The major components of this alternative are:

- Installation of groundwater extraction wells or a lateral groundwater recovery trench at the rear of the building;
- Treatment of groundwater according to the alternative selected for Alternative Series C; and
- Long-term performance monitoring of groundwater.

**Effectiveness:** As discussed in Alternative B2, the upper, unconfined water bearing zone would be amenable to groundwater removal through a lateral recovery trench or extraction wells. Such a system should be highly effective in capturing groundwater. Short-term risks to workers would be similar to Alternative B2. Although such a recovery system is expected to be highly effective in collecting contaminated groundwater, it may not be totally effective in restoring groundwater quality. Fine-grained soil can limit the recoverability of the groundwater contaminants. Factors that could limit contaminant recovery by the groundwater pump and treat method include contaminant adsorption to soil particles; preferential flow of groundwater through higher permeability deposits (stratified drift); and residual separate phase contamination, if any, held by capillary forces.

Short-term risks to on-site workers and local residents associated with groundwater recovery would be minimal and could be controlled with common health and safety practices. Long-term risks, which under existing conditions are minimal, would be further reduced by the more rapid removal of groundwater contaminants.

**Implementability:** Installation of a groundwater recovery system is readily implementable. Standard equipment and practices could be used to construct the system. Long-term operation and maintenance of the groundwater removal system, consisting of periodic inspection to insure the collection system operates properly, will be required.

**Summary:** This alternative is readily implemented and highly effective for recovering groundwater. The rate of removal of subsurface contaminants will be increased although the time required to restore groundwater quality is difficult to predict and depends upon the hydrogeologic conditions and the nature of the contaminants. This alternative will be retained for detailed evaluation.

#### 5.10.3.5 Alternative B5: In-Situ Air Sparging

The major components of this alternative are:

- Installation of air sparging points;
- Installation of vapor extraction trenches;
- Installation of a low permeability cap;
- Extraction of soil vapors and treatment of vapors according to the alternative selected for Alternative Series E; and
- Short-term performance monitoring of soil, soil vapor and groundwater treatment.

**Effectiveness:** In-situ air sparging has been proven to be effective in removing the organic soil contaminants in subsurface soils. However, certain factors can limit the effectiveness of this technology including the hydrogeologic setting. The hydrogeologic setting at the Pelican site is not likely to be conducive to air sparging for the following reasons. According to an article by Nyer and Sutherson (GWMR Fall 1993) problems that can occur with air sparging include mounding of the water table, uncontrolled release of contaminants and potential undermining of the structural stability of foundations and utilities. Due to the depth to groundwater at the Pelican site (generally less than five feet) and the proximity of the buildings, there is a significant potential for these problems to occur.

Mounding, caused by the displacement of water with injected air, could cause flooding of the Site by the surfacing of the groundwater. Mounding would also decrease the size of the vadose zone, inhibiting the use of vapor extraction to control the soil vapors released during air sparging. The relatively shallow thickness of the contaminated water bearing zone (approximately seven feet) would reduce the potential for air bubbles to spread laterally and create a large cone of influence. If no impermeable cap were constructed, uncontrolled soil vapors could migrate to the soil surface and into the ambient air. Even with a cap, the soil vapors could potentially migrate into adjacent buildings or underground utilities.

**Implementability:** This alternative is considered a permanent, proven remedy and, as such, is favored from the standpoint of compliance with federal and NYSDEC policy and guidance. Air sparging is usually combined with vapor extraction and requires skilled personnel to operate, maintain and monitor the performance of the system. The potential for mounding of groundwater and the difficulties associated with vapor extraction limit the implementability of this alternative.

**Summary:** Due to the likelihood of potential problems related to implementing air sparging at the Pelican site, this technology will not be retained for detailed evaluation.

### 5.10.4 Groundwater Treatment (Alternative Series C)

The remedial alternatives developed to address treatment of recovered groundwater at the Pelican site have been screened as follows:

#### 5.10.4.1 Alternative C1: On-Site Groundwater Treatment (Air Stripper)

The major components of this alternative are:

- Construction of a groundwater treatment system comprised of pre-treatment components (particulate and dissolved metal removal), air stripper, and air pollution controls;
- Discharge of treated groundwater to a local surface water body or municipal sewer; and
- Operation, maintenance and monitoring.

**Effectiveness:** This alternative uses a proven treatment technology. The organic contamination would be removed from groundwater and transferred into the air through the process of air stripping. If emission rates exceed allowable emissions standards, the VOCs will be removed via the technology selected for Alternative Series E prior to air emission.

Short-term risks to on-site workers and local residents associated with groundwater treatment would be minimal and will be controlled with common health and safety practices. Long-term risks, which under existing conditions are minimal, would be further reduced by the more rapid removal of the groundwater contaminants. This alternative will require long-term operation and maintenance to keep all mechanical equipment functional, and monitoring of air emissions and water discharge.

**Implementability:** This alternative is highly implementable relative to treatment of recovered groundwater. Air stripping has the proven ability of removing organic chemicals from groundwater similar to those identified at the Site. Provisions must be made for long-term operation and maintenance of the recovery and treatment system. There is enough room on-site to install a treatment system although it would occupy a significant portion of land available at the rear of the Site. Discharge to a local surface water body would be facilitated by the presence of storm sewers. Discharge to the sanitary sewer would also be readily implementable.

**Summary:** As a groundwater treatment system, this alternative rates high from both the effectiveness and implementability standpoints and is retained for detailed evaluation.

#### 5.10.4.2 Alternative C2: On-Site Groundwater Treatment (Activated Carbon)

The major components of this alternative are:

- Construction of a groundwater treatment system comprised of pre-treatment components (particulate and dissolved metal removal) and granulated activated carbon;

- Discharge of treated groundwater to a local surface water body or POTW; and
- Operation, maintenance and monitoring.

**Effectiveness:** Activated carbon has been demonstrated to be highly effective in removing organic contaminants from groundwater. Contaminants are transferred to the carbon for ultimate destruction or disposal at a TSDF. Short-term risks to on-site workers and local residents associated with groundwater treatment would be minimal and could be controlled with common health and safety practices. This alternative would require long-term operation and maintenance to keep all mechanical equipment functional and operating at the proper efficiency, and monitoring of water discharge.

**Implementability:** This alternative is highly implementable. Activated carbon groundwater treatment systems are readily available on the market. Provisions must be made for long-term operation and maintenance of the recovery and treatment system. Discharge to a local surface water body could be facilitated by the presence of storm sewers. Discharge to the sanitary sewer would also be readily implementable. No air pollution controls would be needed as part of the groundwater treatment system.

**Summary:** As a groundwater treatment system, this alternative rates high from both the effectiveness and implementability standpoints and is retained for detailed evaluation.

#### 5.10.4.3 Alternative C3: Off-Site Treatment at Local Municipal Waste Water Treatment Plant

The major components of this alternative are:

- Discharge of recovered groundwater to a municipal treatment plant; and
- Monitoring.

**Effectiveness:** This alternative includes discharge of recovered groundwater directly to a sanitary storm sewer for treatment at the local waste water treatment plant. The effectiveness of treatment would rely on the plant's ability to treat site-specific contaminants. Some volatilization of the VOCs would occur during treatment and there would be the potential for inhalation of the VOCs at the treatment plant.

**Implementability:** The implementability of this alternative is dependant on approval of the municipality (City of Jamestown) and compliance with local ordinances. If pre-treatment is required, the relative efficiency and implementability of this alternative would be significantly reduced. Operation of the system would require periodic inspection to insure that the collection system was functioning properly. Monitoring of the discharge to the sanitary sewer system may be required to comply with local ordinances.

**Summary:** This alternative would be effective in removing the contamination from the Site and discharge of water to the local sanitary sewer would be highly implementable. The administrative limitations (local ordinances or the treatment capabilities of the local plant) are not currently defined but may reduce the implementability of this alternative. This alternative will be retained for detailed evaluation.

### 5.10.5 Contaminated Floor Drain Sediment (Alternative Series D)

The remedial alternatives developed for remediation of the contaminated sediments located in floor drains and the septic tank at the Pelican site have been screened as follows:

#### 5.10.5.1 Alternative D1: On-Site Containment

The major components of this alternative are:

- In-place containment of contaminated sediments by either capping, plugging or otherwise sealing the floor drains and septic tank; and
- Long-term monitoring

**Effectiveness:** This alternative would provide a barrier to direct human contact with the contaminated sediment and eliminate the potential for exposure. It would also limit the potential for leaching of contaminants into groundwater. Short-term risks would be minimal because the contaminated sediments would not be disturbed. However, the volume and toxicity of the contaminants would not be reduced, and long-term risks associated due to potential leaks and disturbance of the sediment due to future use of the Site would continue to be present. Long-term monitoring would be required.

**Implementability:** Commonly available equipment, materials and construction practices would be used to implement this alternative. This alternative would also be highly implementable in terms of administrative concerns because no permitting would be required.

**Summary:** This alternative is effective in the near-term in reducing the potential for direct contact and is readily implementable. However, it does not reduce the toxicity of the COC and may not be as reliable as other alternatives in the long-term. It will not be retained for detailed evaluation.

#### 5.10.5.2 Alternative D2: Removal and Consolidation with "Hot Spot" Soils; and Ex-Situ Vapor Extraction

The major components of this alternative are:

- Vacuuming, excavating or otherwise removing the contaminated sediments;

- Consolidation with the excavated hot spot soils; and
- Treatment of sediment with other site soils in an ex-situ vapor extraction system proposed under Alternative A3.

**Effectiveness:** This alternative would be effective in reducing the volume, toxicity and mobility of the contaminants located in the floor drain and septic tank sediments thus mitigating long-term risk of exposure. Short-term risks to workers and the community during sediment removal could be controlled by common health and safety practices. Ex-situ vapor extraction should be effective at removing the organic contaminants from the sediments.

**Implementability:** Common equipment is available for removing floor drain and septic tank sediments. Construction of an ex-situ vapor extraction system in the building should be feasible as described for Alternative A3.

**Summary:** This alternative is considered to be highly effective and highly implementable and will be retained for detailed evaluation.

### 5.10.5.3 Alternative D3: Removal and Off-Site Disposal at a Permitted TSDF

The major components of this alternative are:

- Vacuuming, excavating or otherwise removing the contaminated sediments; and
- Treatment or disposal of sediments at a RCRA permitted TSDF facility.

**Effectiveness:** This alternative would eliminate the potential for exposure to contaminated sediment by removing the sediment from the site and treating it at a permitted TSDF facility. The sediment, characterized as an F001 waste, would be subject to land disposal restrictions. Short-term risks could be created by volatile emissions during removal and handling of the contaminated sediments. Air monitoring and common health and safety practices would be used to reduce the short-term risks. Long-term risks would be eliminated.

**Implementability:** Commonly available equipment, materials and construction practices will be used to implement this alternative. This alternative would also be highly implementable in terms of administrative concerns because no permitting would be required.

**Summary:** This alternative is considered highly implementable and will provide a high degree of effectiveness in that it removes the contaminated sediments and eliminates long-term risks. This alternative will be retained for detailed evaluation.

### 5.10.6 Control of Organic Vapors (Alternative Series E)

The remedial alternatives developed for control of organic vapors that may be released as a result of on-site treatment of groundwater using an air stripper and/or in-situ remediation of the contaminated soil using soil vapor extraction have been screened as follows:

#### 5.10.6.1 Alternative E1: Vapor Phase Activated Carbon

The major components of this alternative are:

- Construction of a vapor phase carbon treatment system comprised of a heater/dryer and activated carbon;
- Emissions monitoring; and
- Disposal or regeneration of spent carbon.

**Effectiveness:** This alternative would be effective in removing the organic contaminants from the air. The contaminants would be transferred to another media for ultimate destruction or disposal at a permitted TSDF. Short-term, risks would be minimal and long-term risks would be essentially eliminated.

**Implementability:** This alterative is highly implementable both technically and administratively. The equipment required to perform this remedy is commonly available and the permitting/approvals necessary are readily obtainable. There is enough room on site to install a recovery system and treatment systems although treatment systems would occupy a significant portion of land available at the rear of the Site. The use of activated carbon to control air emissions will require less maintenance than catalytic oxidation.

**Summary:** This alternative will be retained for detailed evaluation as it would be effective in removing contaminants from the Site and could be readily implemented.

#### 5.10.6.2 Alternative E2: Catalytic Oxidation

The major components of this alternative are:

- Construction of a catalytic oxidation vapor treatment system;
- Emissions monitoring; and
- Periodic inspection and maintenance.

**Effectiveness:** This alternative would effectively destroy organic vapors thereby reducing the toxicity, volume and mobility. The effectiveness of the destruction process would require verification through emissions monitoring.

**Implementability:** This alternative would be implementable both technically and administratively. The catalytic oxidizing unit will require periodic inspection and maintenance. The equipment required to perform this remedy is commonly available and the permitting/approvals necessary are readily obtainable.

**Summary:** This alternative would be highly effective and is implementable. It will be retained for detailed evaluation.

### 5.10.7 Summary of Preliminary Screening

The remedial alternatives identified in Section 5.9 were screened against the criteria of implementability and effectiveness. A summary of the results of the screening of remedial alternatives is presented above in Table 5-6.

## 6.0 DETAILED ANALYSIS OF ALTERNATIVES (THIRD PHASE FS)

This section describes the evaluation criteria for the detailed analysis of alternatives developed in Section 5.10. The remedial alternatives are summarized and then systematically evaluated on an individual and comparative basis.

### 6.1 Evaluation Criteria

NYSDEC TAGM HWR-90-4030 on selection of remedial actions (NYSDEC, 1989; REVISED, May 1990) presents seven criteria to be used for evaluating remedial alternatives that have passed the preliminary screening process. These criteria are as follows:

- Compliance with New York State Standards, Criteria and Guidelines (SCGs);
- Overall protection of human health and the environment;
- Short-term effectiveness;
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility or volume of waste;
- Implementability; and
- Costs (Capital, Annual Operation and Maintenance, Present Worth).

Descriptions of the criteria are given below.

#### 6.1.1 Compliance with New York State SCGs

SCGs are those requirements found in laws, regulations, and state guidance which help to define remedial actions as cited in 6 NYCRR Part 375. SCGs specific to the Pelican site are discussed in Section 2.13. Proposed remedial alternatives will be analyzed to establish whether they comply with SCGs under State environmental laws, public health laws, and State facility siting laws. A remedial program is expected to comply with applicable or relevant and appropriate SCGs unless "good cause exists" as defined in 6 NYCRR, Part 375.

#### 6.1.2 Overall Protection of Human Health and the Environment

This evaluation criterion provides a check to determine whether a proposed remedial alternative is adequate with respect to the protection of human health and the environment. Long-term effectiveness and permanence, short-term effectiveness, and compliance with SCGs are the primary factors on which the determination of overall protection of human health and the environment is based. The evaluation will focus on how each proposed alternative achieves protection over time, how site risks are reduced, as well as how each contaminated source is to be eliminated, reduced, or controlled.

### 6.1.3 Short-Term Effectiveness

Remedial alternatives must consider short-term impacts associated with the construction and implementation phase of remediation. Alternatives will be evaluated according to their effects on human health and the environment. These considerations include:

- Protection of the community during implementation of the proposed remedial action (i.e., inhalation of volatile gases);
- Protection of workers during implementation;
- Environmental impacts that may result from the implementation of the remedial alternative and the reliability of mitigative measures to prevent or reduce these impacts; and
- Time until remedial response objectives are met including the estimated time required to achieve protection.

### 6.1.4 Long-Term Effectiveness and Permanence

This criterion addresses the long-term effectiveness and permanence of the remedial alternative with respect to the quantity of residual chemicals remaining at the Site after response goals have been met. The principal focus of this analysis is the adequacy and reliability of controls necessary to manage the untreated waste and treatment residuals. Characteristics of the residual chemicals such as volume, toxicity, mobility, degree to which they remain hazardous, and tendency to bioaccumulate must also be examined. Specifically, these considerations are:

- Residual risk;
- Adequacy of controls; and
- Reliability of controls.

### 6.1.5 Reduction of Toxicity, Mobility, or Volume of Waste

This criterion assesses the degree to which the remedial alternative utilizes recycling and/or treatment technologies that permanently decrease toxicity, mobility, or volume of the chemicals as its primary element. It also assesses the effectiveness of the treatment in addressing the predominant health and environmental threats presented by the Site. There are several specific factors that will be considered under this evaluation criterion including:

- Treatment process included in the alternative and the contaminants it will treat;

- Amount of contaminant that will be treated or destroyed;

- Degree of expected reduction in toxicity, mobility, or volume;

- Degree to which the treatment will be permanent (i.e., irreversible);

- Type and quantity of treatment residuals that will remain following treatment accounting for persistence, toxicity, mobility and the tendency to bioaccumulate; and,

- Whether the alternative will satisfy the regulatory preference for treatment as a primary element.

### 6.1.6 Implementability

This criterion assesses the technical and administrative feasibility of implementing a remedial alternative according to the following criteria.

- Technical feasibility: includes difficulties and unknowns relating to the construction and operation of a technology, the reliability of the technology including problems resulting in schedule delays, ease of performing additional remedial actions, and the ability to monitor the effectiveness of the remedy.

- Administrative feasibility: involves coordinating with governmental agencies to obtain necessary permits or approvals.

- Availability of services and materials: includes sufficiency of off-site treatment, storage and disposal capacity; access to necessary equipment, specialists and additional resources; potential for obtaining competitive bids especially for new and innovative technologies; and availability of state-of-the-art technologies.

### 6.1.7 Costs

This criterion can be divided into capital costs, annual operation and maintenance (O&M) costs, and net present worth costs. Capital costs consist of direct (construction) and indirect (engineering, etc.) costs.

Direct capital costs include:

- Construction and equipment costs: materials, labor, equipment required to install/perform a remedial action.
- Land and site-development costs: land purchase and associated expenses, site preparation of existing property.
- Building and service costs: process and non-process buildings, utility connections, and purchased services.
- Disposal costs: transporting and disposing of materials.

Indirect capital costs include:

- Engineering expenses: administration, design, construction, supervision, drafting, and treatability testing.
- Legal fees and license or permit costs: administrative and technical costs expended to obtain licenses and permits for installation and operation.
- Start up costs incurred during initiation of remedial action.
- Contingency allowances: costs resulting from unpredicted circumstances (i.e., adverse weather, strikes, inadequate site characterization).

Annual O&M costs are post-construction costs expended to maintain and ensure the effectiveness of a remedial action. The following are annual O&M costs to be evaluated:

- Labor costs: wages, salaries, training, overhead, and fringe benefits for operational labor.
- Maintenance materials and maintenance labor costs: labor and parts, etc. necessary for routine maintenance of facilities and equipment.
- Auxiliary materials and utilities: chemicals and electricity needed for treatment plant operations, water and sewer services.
- Disposal of residue: disposal or treatment and disposal of residues such as sludges from treatment processes.
- Purchased services: sampling costs, laboratory fees, and professional fees as necessary.
- Administrative costs: costs associated with the administration of O&M that have not already been accounted for elsewhere.

- Insurance, taxes, and licensing costs: liability and sudden accidental insurance, real estate taxes on purchased land or rights-of-way, licensing fees for certain technologies, permit renewal and reporting costs.

- Replacement costs: maintenance of equipment or structures that wear out over time.

- Cost of periodic Site reviews if a remedial action leaves residual contamination.

Net present worth consists of capital and O&M costs calculated over the lifetime of the remedial action and expressed in present day value. The lifetime of the remedial action is considered to be a maximum of 30 years for costing purposes.

Any remedial action that leaves hazardous waste at a site may affect future land use, resulting in a loss of business activities, residential development, and taxes. This unquantified cost will be considered for those alternatives that would leave hazardous wastes on site.

## 6.2 General No Action Alternative

This alternative involves no actions other than imposing deed restrictions and performing long-term monitoring of groundwater quality. Monitoring data would be reviewed to ensure adequate protection of human health and the environment and to provide adequate warning of any future need to implement remedial measures. The evaluation of the need for, and approach to, the remediation of the contaminated soil and sediment at the Pelican site may be determined independent from such evaluation of the contaminated groundwater. Therefore, the no action alternative will be discussed separately for soil/sediment and groundwater.

### Compliance with NYS SCGs

Soil: Chemical-specific SCGs for soil (TAGM HWR-94-4046) and groundwater quality standards (6 NYCRR Parts 373 and 703) would not be met under the no-action alternative as no removal/treatment of soil or sediment is proposed under this alternative. Natural attenuation resulting from degradation will decrease levels of contamination over time.

Groundwater: Chemical-specific SCGs for groundwater quality standards (Parts 373 and 703) would not be attained as no removal/treatment of groundwater is proposed under this alternative. Natural attenuation resulting from dilution and degradation will decrease levels of contamination over time.

### Overall Protection of Human Health and the Environment

Soil: This alternative would provide no additional environmental protection. Potential human exposure to contaminated soil would be reduced by restricting site usage to minimize human contact with the contaminated soil.

Groundwater: Given the current uses of the site, the groundwater is not considered a health risk. As discussed in the preliminary screening, the RI indicated that site-related contamination has not impacted the Jamestown Aquifer which is the nearest water bearing unit used for public water supply. This alternative does not pose a long-term risk to human health through ingestion unless a private shallow well were installed on site at some time in the future to provide a potable water supply in connection with some future use of the site. This would be unlikely because deed restrictions would be instituted and a public water supply is readily available. The shallow groundwater flow is discharging into a drainageway between the Site and the former Jamestown City Landfill or commingling with the groundwater beneath the landfill. The off-site migration of contaminants in the shallow groundwater do not appear to be having a significant impact on human health or the environment. These contaminants will degrade over time due to natural processes.

### Short-Term Effectiveness

Soil: Since no action would be taken that would disturb the contaminated soil under this alternative, implementation would not pose any additional short-term risks to workers, the community or the environment as a result of construction activities.

Groundwater: Since no action would be taken to remove contaminated groundwater under this alternative, implementation would not pose any additional short-term risks to on-site workers, the community or the environment. A groundwater monitoring program would take only a short time to develop and implement.

### Long-Term Effectiveness and Permanence

Soil: The long-term risk of exposure to the contaminated soil/sediment is not reduced unless adequate site security is maintained and trespassers or future site occupants are prevented from direct contact with contaminated soil or sediment.

### Groundwater

Residual risk: The existing site conditions do not appear to pose long-term health risks given current uses of the Site, since the drinking water in the area is not being impacted by the Site. However, a health risk would be posed if the Site were converted to residential use and an on-site drinking water well installed.

Adequacy of controls: The risk of exposure to contaminated groundwater is minimal due to the current site use and the ready availability of a public water supply. However, even with deed restrictions, long-term use of the groundwater would be difficult to control.

Reliability of Controls: No groundwater controls would be implemented under this alternative.

### Reduction of Toxicity, Mobility or Volume of Waste

Soil: The no action alternative would not reduce the toxicity or volume of the COC in soil or sediment other than through natural degradation over the long-term. Since treatment is not part of this alternative, irreversibility does not apply.

Groundwater: The no action alternative would not significantly reduce the toxicity or volume of COC in groundwater at the Site other than allowing them to dissipate naturally over a long period of time. The mobility of the groundwater is also not reduced. Since active treatment is not part of the no action alternative, irreversibility does not apply.

### Implementability

Soil: Since no action is proposed relative to soil and sediment, implementability does not apply.

Groundwater: Site conditions could be monitored. Groundwater monitoring would be carried out to determine the need for any future remedial actions. Services to perform groundwater monitoring are readily available.

### Cost

If any aspect of the no action alternative is selected as part of the Site remedy, deed restriction and long-term monitoring would be required. The cost associated with implementing a deed restriction (surveying, etc) is estimated to be $5,000. The costs associated with annual groundwater monitoring include sample collection from each of the eight Site wells plus three quality control samples (11 samples total) to be analyzed for volatile organic compounds (EPA Method 8240). Costs also include preparation of work plan, field activities and final report preparation. The estimated capital costs for the General No Action Alternative is estimated to be $23,500. Annual O&M costs are estimated to be $10,840. Over a 30 year monitoring period, and assuming a five percent discount rate, the total present worth cost of the General No Action Alternative is estimated to be $195,130. A breakdown of these costs is presented in Table 6-1 with backup information provided in Appendix P.

In addition, there would be costs associated with the loss of future use of the property or a reduced value of the property due to the presence of hazardous waste and the continued listing of the property on the New York State Registry of Inactive Hazardous Waste Sites. These costs have not been estimated.

## Table 6-1
## Cost Estimate
## General No Action Alternative

| ITEM | QUANTITY | UNIT COST | UNIT | COST | BASIS |
|---|---|---|---|---|---|
| **CAPITAL COSTS** | | | | | |
| A. Direct Capital Costs | | | | | |
| B. Site Control (Deed Restrictions) | 1 | $5,000 | LS | $5,000 | 3 |
| C. Establish Baseline Groundwater Quality | 1 | $9,200 | LS | $9,200 | |
| **Total Direct Costs:** | | | | $14,200 | |
| **Indirect Capital Costs:** | | | | | |
| 1. Document/Plan Preparation | 1 | $7,200 | LS | $7,200 | 2 |
| 2. Engineering and Permitting (30% of Total Direct Costs) | | | | $4,260 | |
| 3. Contingency (20% of Total Direct Costs) | | | | $2,840 | |
| **Total Indirect Costs:** | | | | $14,300 | |
| **TOTAL CAPITAL COSTS:** | | | | $28,500 | |
| **ANNUAL O&M COSTS** | | | | | |
| 1. Annual Groundwater Monitoring (8 samples + 3QC) | 1 | $7,400 | LS | $7,400 | 2 |
| 2. Monitoring Well Replacement/Repair | 1 | $2,000 | LS | $2,000 | 2 |
| 3. Five Year Review | 1 | $1,440 | LS | $1,440 | 2 |
| **TOTAL ANNUAL O&M COSTS:** | | | | $10,840 | |
| **PRESENT WORTH OF COSTS:** | | | | | |
| 1. Present Worth of Annual O&M Costs (5% Discount Rate, 30 Years) | | | | $166,630 | |
| 2. Total Capital Costs | | | | $28,500 | |
| **TOTAL PRESENT WORTH:** | | | | $195,130 | |

**BASIS:**

1. Means Site Work and Landscape Cost Data, 1994
2. TAMS Professional Experience
3. Dunn Engineering Company Professional Experience

## 6.3 Alternative Series A - Alternatives for Remediation of the Contaminated Soil

As discussed in Section 5.9.3, the quantity of soil to be remediated has been estimated in two ways. The first considers only the soil containing COC at concentrations above cleanup goals that is located above the water table. The soil in this category generally extends less than five feet in depth and is discontinuous across the Site. It is referred to as "hot spot" soil and allegedly resulted from spills (poor housekeeping), infiltration of contaminated surface runoff from the building and grounds, and/or contaminated subsurface discharge from building floor drains. This soil is considered a source of groundwater contamination. Based on soil sampling results, the quantity of the "hot spot" soil is estimated to be approximately 300 cubic yards (cy).

The second way contaminated soil quantities were calculated was to include soil located below the water table that contains COC at concentrations above cleanup goals. These saturated soils are within the groundwater contamination plume. Although the number of soil samples collected at depth was limited compared to surface soil samples, it is assumed that the saturated soil contamination is more extensive areally than the "hot spot" soil, but COC are present at considerably lower concentrations. The combination of "hot spot" and contaminated saturated soil is considered to be all the contaminated soil on the Site and is estimated to be approximately 7,000 cy.

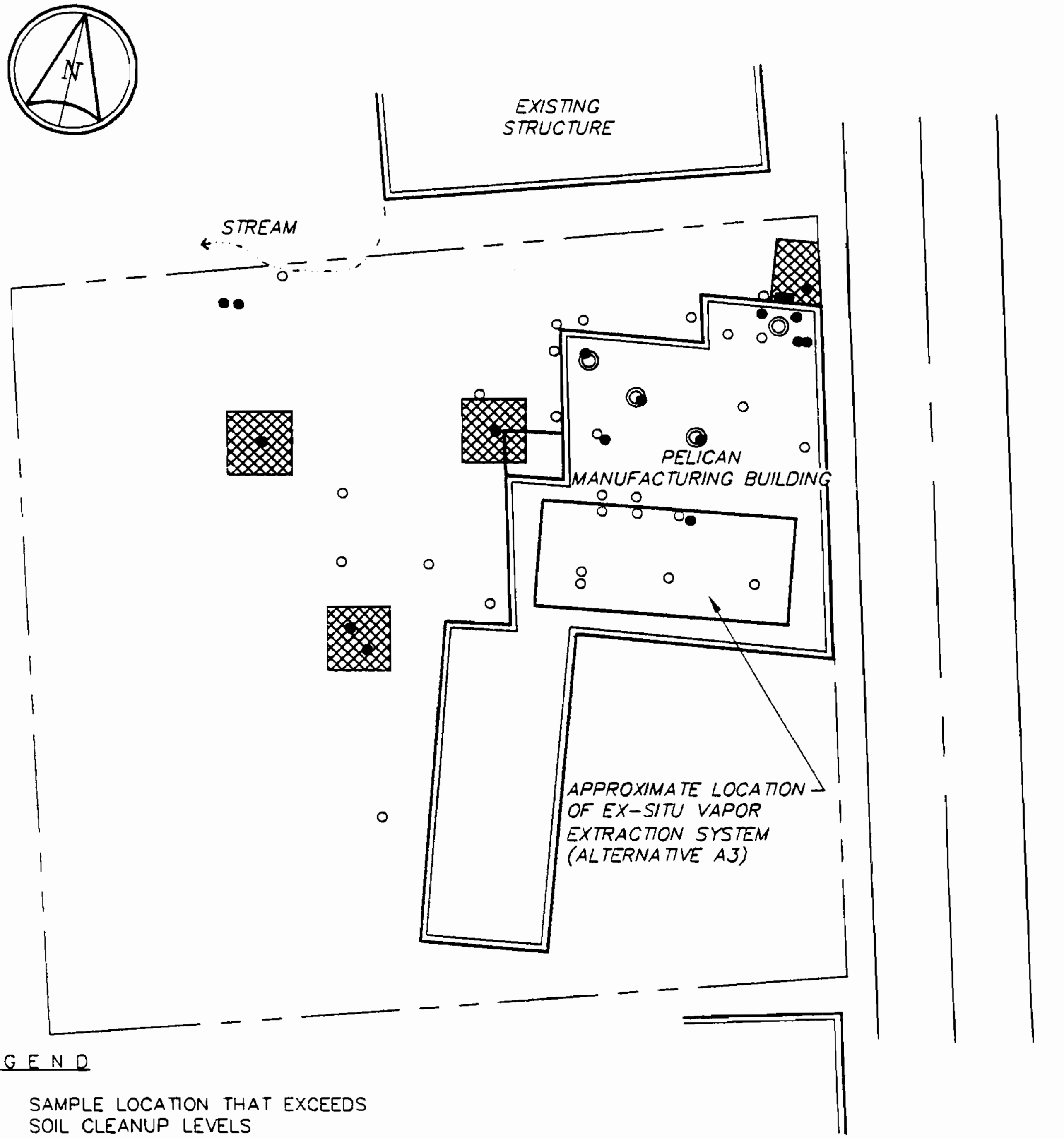
Of the remedial alternatives that were retained after the completion of preliminary screening, Alternatives A3 and A4 were developed to address only the "hot spot" soil and Alternative A5 was developed to address all contaminated soil.

### 6.3.1 Alternative A3: In-Situ Vapor Extraction of Soil under Floor of Building; Consolidation of "Hot Spot" Soils (~300 cy); and Ex-Situ Vapor Extraction in Building

The conceptual design for the in-situ system is as follows:

- The results of the pilot study indicate the radial influence of one vapor extraction point extends approximately 15 feet. Due to the building floor acting as an impermeable barrier to air flow, it is assumed that the influence of an extraction point within the building would be at least 20 or 25 feet. Based on the results of subfloor soil sampling in the building, it appears that four vapor extraction points (8 to 10 feet in depth) would be adequate for in-situ remediation of the subfloor soils. The locations of the vapor extraction wells are shown on Figure 6-1.

- Approximately 650 cy of subfloor soil is to be remediated using in-situ vapor extraction. The estimated flow rate for the in-situ system is estimated to be 40 cfm per well (or 160 cfm total). The pressure drop at each well is expected to range between 20 and 66 inches of water. The vacuum and flow rate would be adjusted so that a minimum of groundwater is drawn into the system.



LEGEND

- ● SAMPLE LOCATION THAT EXCEEDS SOIL CLEANUP LEVELS
- ○ SAMPLE LOCATION THAT DOES NOT EXCEED SOIL CLEANUP LEVELS
- ◎ VAPOR EXTRACTION POINTS
- ▨ APPROXIMATE AREAL EXTENT OF SURFACE SOIL "HOT SPOTS" TO BE REMEDIATED (Alternatives A3 & A4)

**DUNN ENGINEERING COMPANY**
DIVISION OF RUST ENVIRONMENT & INFRASTRUCTURE

**REMEDIAL ALTERNATIVE FEATURES**
**ALTERNATIVES A3 & A4**
PELICAN MANUFACTURING, INC. SITE
City of Jamestown
Chautauqua Co., NY

| | | | | |
|---|---|---|---|---|
| PROJECT No. 35120.700 | DATE 7/94 | DWG. No. 35120-07 | SCALE 1"=50' | FIGURE No. 6-1 |

- Initial vapor monitoring would be used to evaluate system performance and to determine whether emissions controls are required. Regular monitoring of vapor emissions would be used as a guide to determine when soil sampling should be performed. Three vertical samples at two locations near each extraction point (24 samples total) are estimated to be adequate for determining whether cleanup goals have been achieved. Soil samples would be analyzed for volatile organic compounds.

The conceptual design for the ex-situ system is as follows:

- Approximately 300 cy of "hot spot" soil is to be excavated and placed in an ex-situ system. The approximate location for the ex-situ system would be an 80 x 40 foot space within building No. 2221. A structural inspection of the building would be conducted, and any necessary repairs completed to ensure a safe working area within the building. The approximate location for the ex-situ system and the location of "hot spot" soil to be excavated are shown on Figure 6-1.

- The area to be used for the ex-situ system would be covered with plastic sheeting. Berms would be constructed around the system to capture any water draining from the excavated soil. A thin layer (~six-inches) of sand would be placed on the sheeting. The vapor extraction piping would be laid on the sand, spaced approximately every three feet. The piping would be covered with enough sand to protect it from small earth moving equipment. The sand will be at least as coarse as the excavated soil. The overhead door at the rear of the building would be used to transport the soil into the building. The 300 cy would be spread in this area to approximately 2.5 to 3 feet thick.

- The vapor flow rate from the ex-situ system is expected to be high (300 to 500 cfm) and the pressure drop negligible due to the likely increase in soil permeability during excavation and the short distance the air would have to flow through the soil.

- A tarp would be used to cover the soil only when the system is not in operation. Fans to vent the building and proper respiratory protection would be available if air monitoring indicated that organic vapors inside the building were above health and safety action levels.

- Initial monitoring would consist of weekly air sampling. When vapor concentrations indicate that soil cleanup goals may have been achieved, soil samples will be collected approximately every 10 cy (30 samples total). Samples would be analyzed for volatile organic compounds.

- Post-excavation samples would be collected to confirm that all "hot spot" soil had been removed. Approximately four samples per "hot spot" (one from each excavation side wall) would be collected. No soil samples from the floor of the excavation would be collected because excavation will stop when the groundwater table is reached and existing data show contaminated soil occurs below the water table. Excavated areas will be backfilled with clean soil and the treated soil will also be used as fill. At the completion of the work, the area will be revegetated or paved.

Loadings to air from the soil as a result of vapor extraction were estimated in three ways. TCE is the most frequently occurring contaminant and at the highest concentrations. TCE was used to represent all other soil contaminants. The methods used to calculated loadings were as follows:

- The results of the pilot study indicated that a vapor extraction well pumped at a rate of approximately 40 cfm yields an estimated TCE loading of 0.0024 lbs/hour to the air. Assuming the concentrations of the soil under the building are similar to the soil in the vicinity of the pilot study, four wells pumped at 25 cfm should yield a total TCE loading of 0.006 lbs/hour to the air.

- The average concentrations of TCE in the subfloor soils (21.6 ppm-weight) and the "hot spot" soils (76.3 ppm-weight) were also used to calculate potential loadings to air. Details of the calculations are provided in Appendix O. For these calculations it is assumed that each system will operate for six months and all of the TCE will partition into the soil vapor. The in-situ system designed to treat approximately 650 cy of soil by means of four wells with a total vapor extraction rate of 100 cfm, would have an estimated TCE loading of 0.0078 lbs/hour to air The ex-situ system, designed to treat approximately 300 cy of soil and having an approximate vapor extraction rate of 300 cfm, would have an estimated TCE loading of 0.0128 lb/hour to air. Collectively (both systems operating), the TCE loading to air would be 0.021 lb/hour.

- Finally, the average concentration of TCE measured during the soil gas survey was used to estimate loadings to air. The concentrations of TCE in soil gas would probably represent the levels that would be emitted during the start up of a vapor extraction program but would not likely represent long-term loadings. The average TCE soil gas concentration in the vicinity of the "hot spot" soil was 73 ppm-volume. Assuming this is the average concentration in the subfloor soils as well, the initial loading to air from the in-situ system would be 0.16 lb/hour and from the ex-situ system (excavated "hot spot" soil) would be 0.48 lb/hour. This indicates that the total initial loading to air could be near 0.64 lb/hour. See Appendix O for details of these calculations.

The NYSDEC Air Guide 1 limit of TCE is 0.1 lb/hour. It is assumed, based on the estimations discussed above, that except for a short period at the very beginning of the vapor extraction process, emissions will be well below the regulatory limit and will not require any type of control.

## Compliance with NYS SCGs

SCGs for this alternative are those that relate to excavation of contaminated soil and operation of on-site treatment systems. This would include guidance on determining cleanup goals including the October 1991 NYSDEC draft document entitled "Cleanup Policy and Guidelines - Volume 1" and TAGM HWR-94-4046 entitled, "Determination of Soil Cleanup Objectives and Cleanup Levels" REVISED, January 1994. Requirements for excavation and treatment activities include OSHA health and safety standards and RCRA standards. Recently promulgated EPA Corrective Action Management Unit (CAMU) regulations (40 CFR 268, and 40 CFR 264 Subpart S, February 16, 1993) are considered relevant, providing a regulatory basis for excavation, on-site treatment, and on-site disposal of treated soil. The results of a vapor extraction pilot study indicate that this technology would decrease the concentrations of site contaminants to the site cleanup goals. The on-site treatment system is subject to applicable New York State air and hazardous waste regulations.

## Overall Protection of Human Health and the Environment

The combined components of this alternative will provide a high level of protection to human health and the environment at and in the vicinity of the Site. The organic solvents in the soil will be removed and potentially destroyed (see Alternative Series E). Residual concentrations of COC in soil are expected to be reduced to levels at or below the target cleanup goals.

Soil contamination below the groundwater table would not be addressed in this alternative but, as discussed in the General No Action Alternative, long term risks to human heath and the environment associated with groundwater contamination are minimal and will decrease over time with the natural attenuation and degradation of the contamination.

## Short-Term Effectiveness

Community protection: Since this alternative would involve the excavation and handling of hazardous wastes, it has the potential to cause short-term effects within the community associated with volatile emissions, noise and dust. The implementation of a comprehensive safety and monitoring program during the remedial action would mitigate these potentially adverse effects and provide a high degree of community protection. A Health and Safety Plan, including a description of the control measures would be developed for the Site, with review by the State. Confirmatory samples would be collected following remediation to confirm that the remedy is effective.

Worker protection: Workers involved with the soil excavation and backfilling activities could be exposed direct contact with contaminated soils. Risks will be mitigated by properly outfitting workers with appropriate personnel protection equipment, including proper breathing apparatus, continuous air monitoring, industrial hygiene procedures and the use of controlled excavations. Additionally, due to the age and current condition of the building proposed to house the ex-situ system, structural repairs may be required for worker protection during implementation of this alternative.

Environmental impacts: Short-term adverse environmental impacts due to excavation activities may occur. They can be mitigated by the proper use of erosion and dust control measures.

Time to implement: It is estimated that this alternative could be set up and implemented within six months and the soil treatment completed within approximately two years after mobilization to the Site.

### Long-Term Effectiveness and Permanence

Residual risk: The contaminated "hot spot" soil will be excavated or treated in-situ (under the building) until the soil concentrations are at or below the target clean-up goals. The risks to potential future residents due to direct contact or incidental ingestion of contaminated soil are mitigated effectively by removal and treatment of the contaminated soil. Any minimal long-term risk associated with contaminants present below the water table would persist until natural degradation reduces levels to below cleanup goals. The removal of "hot spot" soil eliminates the potential for continued leaching of contaminants into the groundwater system.

Adequacy of controls: The on-site, in-situ and ex-situ vapor extraction system should achieve its performance requirement of preventing direct contact to any receptors and removing a source of groundwater contamination. Short-term soil and groundwater testing will be performed to confirm the effectiveness of treatment. There will be no long-term management at the Site except groundwater monitoring, since the source of contamination will have been treated.

Reliability of controls: The removal of the volatile organics from the soil, the source of contamination, should eliminate the source of contamination found in the shallow groundwater at the Site.

### Reduction of Toxicity, Mobility or Volume of Waste

This alternative would remove from the soil the majority of the contaminants at the Site. The contaminants would either be transferred at acceptable levels to air or would be captured and destroyed. This alternative would not reduce the toxicity, mobility or volume of the contaminants in the saturated soil but these concentrations are relatively low, do not currently pose a risk of exposure to humans or the environment, and will degrade naturally over time.

### Implementability

Ability to construct and operate: Excavation of the contaminated soil and any structural reinforcement of the building would utilize common construction equipment and materials. In-situ and ex-situ vapor extraction systems are available that could be operated in the small space available at the Site.

Reliability: The results of a VES pilot study indicate that this technology can meet the remedial action objectives for the COC related to soil.

Ease of undertaking additional actions: This alternative could complicate or hinder other remedial actions during operation of the system because the system would require a considerable amount of the open space at the Site. Proper scheduling during the remedial design phase should allow completion of all remedial actions at the Site.

Ability to monitor: Soil, groundwater and air quality monitoring could be readily performed to ensure the effectiveness of this remedy.

Availability of services: Services to excavate the contaminated soil and treat using in-situ and ex-situ vapor extraction are readily available.

**Cost**

The capital costs to implement Alternative A3 are estimated to be $327,762 for the estimated volume of contaminated soil. The time to complete this alternative is assumed to be two years during which time O&M will be required for the in-situ and ex-situ vapor extraction systems. System performance monitoring and confirmation sampling will be conducted to determine whether the remedial objectives for soil have been achieved. The estimated annual O&M cost is $66,400. Long-term groundwater monitoring may be considered for evaluating the effect of this remedial alternative but the cost are not included with this alternative but rather with the General No Action Alternative or Alternative Series B. Based on a two year operating period, the present worth cost for Alternative A3 is estimated to be $451,200. A detailed breakdown of these costs is provided on Table 6-2 with backup provided in Appendix P.

### 6.3.2 Alternative A4: In-Situ Vapor Extraction of Soil under Floor of Building; Excavation of "Hot Spot" Soils (~300 cy); and Off-Site Treatment or Disposal

The conceptual design for the in-situ portion of this alternative is the same as for Alternative A3. The conceptual design for performing excavation of the "hot spots" and off-site disposal is as follows:

- Soil would be excavated and stored temporarily on site in a containment area or "roll off" containers. The portion of the soil that is considered a regulated hazardous waste (F001) would be transported off site for treatment at a permitted RCRA treatment, storage and disposal facility (TSDF). Any soil not considered a regulated hazardous waste would be transported off site to a RCRA permitted landfill.

- Post-excavation samples would be collected as described for Alternative A3.

- Clean fill would be brought to the Site to fill excavations. The Site would be revegetated or paved.

## Table 6-2
## Cost Estimate
## Alternative A3
## In-Situ Vapor Extraction of Soil Under Floor of Building Consolidation of "Hot Spot" Soils (300 CY); and Ex-Situ Vapor Extraction in Building

| ITEM | QUANTITY | UNIT COST | UNIT | COST | BASIS |
|---|---|---|---|---|---|
| **CAPITAL COSTS:** | | | | | |
| **Direct Capital Costs:** | | | | | |
| A. Mobilization/Demobilization | 1 | $50,000 | LS | $50,000 | 2 |
| B. Health and Safety Measures | 1 | $20,000 | Month | $20,000 | 2 |
| C. Construction Management | 2 | $12,000 | Month | $24,000 | 2 |
| D. Building Repairs/Modification | 1 | $15,000 | LS | $15,000 | 2 |
| E. In-Situ System | | | | | |
| 1. Vapor Extraction Well Installation (2"Ø, 10' Deep with 10' Screen, PVC) | 4 | $2,050 | Each | $8,200 | 1,2 |
| 2. Vacuum Blower (125 CFM, Including Knockout Tank and Filter) | 1 | $5,700 | Each | $5,700 | 6 |
| 3. Associated Piping (2"Ø, PVC) | 300 | $9.59 | LF | $2,877 | 1,2 |
| 4. Instrumentation and Control System | 1 | $5,000 | LS | $5,000 | 2 |
| F. Ex-Situ System | | | | | |
| 1. Excavation of "Hot Spot" Soils and Transportation and Spreading of Soil in Building, and Backfilling with Clean Fill | 1 | $11,400 | LS | $11,400 | 2 |
| 2. Plastic Floor Cover, (30 mil HDPE) | 3825 | $0.31 | SF | $1,186 | 3 |
| 3. Installation of Berm (Lumber Berm) | 1200 | $0.91 | LF | $1,092 | 1,2 |
| 4. Placement of Sand Layer (12" Thick) | 120 | $28.74 | CY | $3,449 | 1 |
| 5. Vapor Extraction Piping System (3' Apart, 2"Ø, PVC ) | 1400 | $7.20 | LF | $10,080 | 1,2 |
| 6. Soil Cover (Reinforced Plastic) | 3350 | $0.27 | SF | $905 | 3 |
| 7. Installation of Building Ventilation Fans | 1 | $4,240 | LS | $4,240 | 1,2,7 |
| 8. Vacuum Blower (500 CFM) | 1 | $7,500 | Each | $7,500 | 2,6 |
| 9. Post Excavation Sampling | 1 | $7,260 | LS | $7,260 | 2 |
| 10. On-Site Disposal of Treated Soils | 300 | $5 | CY | $1,500 | 2 |
| 11. Instrumentation and Control System | 1 | $5,000 | LS | $5,000 | 2 |
| G. System Start-Up | | | | | |
| 1. Labor | 1 | $22,900 | LS | $22,900 | 2 |
| 2. Monitoring | 1 | $11,220 | LS | $11,220 | 2 |
| **Total Direct Costs:** | | | | $218,508 | |
| **Indirect Capital Costs:** | | | | | |
| 1. Engineering and Permitting (30% of Total Direct Costs) | | | | $65,552 | |
| 2. Contingency (20% of Total Direct Costs) | | | | $43,702 | |
| **Total Indirect Costs:** | | | | $109,254 | |
| **TOTAL CAPITAL COSTS:** | | | | $327,762 | |

# Table 6-2
# Cost Estimate
# Alternative A3
# In-Situ Vapor Extraction of Soil Under Floor of Building Consolidation of "Hot Spot" Soils (300 CY); and Ex-Situ Vapor Extraction in Building

| ITEM | QUANTITY | UNIT COST | UNIT | COST | BASIS |
|---|---|---|---|---|---|
| **ANNUAL O&M COSTS:** | | | | | |
| 1. Annual System Inspection/Monitoring Cost | | | | | |
| a. Labor | 1 | $22,400 | LS | $22,400 | |
| b. Total Monitoring | 1 | $26,000 | LS | $26,000 | |
| c. Reporting | 1 | $8,000 | LS | $8,000 | |
| 2. Standard Repair and Maintenance | 1 | $10,000 | LS | $10,000 | 2 |
| **TOTAL O&M COSTS:** | | | | $66,400 | |
| **PRESENT WORTH OF COSTS:** | | | | | |
| 1. Present Worth of Annual O&M Costs (5% Discount Rate, 2 Years) | | | | $123,438 | |
| 2. Total Capital Costs | | | | $327,762 | |
| **Total Present Worth Cost:** | | | | $451,200 | |

**BASIS:**

1. Means Site Work and Landscape Cost Data, 1994
2. TAMS Professional Experience
3. AIN Plastics
4. VWM Scientific Catalog
5. Terra Vac In-Situ Vacuum Extraction System Application Analysis Report (EPA/540/45-89/003)
6. Wintek Corporation
7. 1994 McMaster-Carr Supply Company Catalog

The loadings of volatile organic compounds from soil to air would be the same as discussed for the in-situ system in Alternative A3. Therefore, it is assumed, except for a short period at the very beginning of the vapor extraction process, emissions will be well below New York State guidelines and will not require any type of control.

### Compliance with NYS SCGs

SCGs for this alternative are those that relate to in-situ treatment of contaminated soil under the building and excavation, transport and manifesting of the contaminated soil outside the building. Requirements for these activities include OSHA health and safety standards and RCRA standards for transport and manifesting.

The TSDF is subject to RCRA regulations relating to several aspects of the treatment and disposal for the contaminated soil. These include facility operation standards, recordkeeping and groundwater protection, as well as, land disposal restrictions.

### Overall Protection of Human Health and the Environment

The combined components of this alternative will provide a high level of protection to human health and the environment, not only in the vicinity of the Site but also in general. Any excavated F001 contamination will be permanently removed from the Site to levels at or below the established cleanup goals. After removal from the Site, the F001 waste will undergo thermal treatment eliminating it from the environment. Other non-F001 contaminated soil will be disposed in a RCRA permitted landfill that is subject to regular monitoring and maintenance requirements. The excavation of contaminated soil and in-situ treatment of the soil under the building will remove the potential source of shallow groundwater contamination.

As in Alternative A3, soil contamination below the groundwater table would not be addressed in this alternative but as discussed in the General No Action Alternative, long term risks to human heath and the environment associated with groundwater contamination are minimal and will decrease over time with the natural attenuation and degradation of the contamination.

### Short-Term Effectiveness

Short term effects on the community, on-site workers and the environment related to the excavation and handling of hazardous wastes would be controlled as described for Alternative A3. Confirmatory samples would be collected to ensure the adequacy of cleanup. Structural reinforcement of the building may also be required to protect workers who would be installing vapor extraction point within the building.

Time to implement: Soil excavation and transportation should be completed within three to six months after the remedial contractor has mobilized at the Site. It is anticipated that the in-situ extraction system installed to treat soil beneath the building will be operated for one to two years.

### Long-Term Effectiveness and Permanence

Residual risk: The contaminated soil will be treated in-situ or excavated until the concentrations of COC in the soil are at or below the target clean-up goals. The risks to potential future residents due to direct contact or incidental ingestion of contaminated soil are mitigated effectively by removal or treatment of the contaminated soil. Treatment by off-site incineration of excavated soils regulated as F001 wastes effectively destroys the contaminants.

Adequacy of controls: The in-situ vapor extraction system and incineration of contaminated soil at an off-site TSDF will be monitored and controlled to prevent any adverse effects on public health and the environment. There will be no long-term management at the Site except long-term groundwater monitoring.

Reliability of controls: No on-site controls, other than deed restriction, would be required because contaminated soil above the water table would be removed. It is anticipated that the off-site disposal facility will function properly for an indefinite period, assuming proper maintenance.

### Reduction of Toxicity, Mobility or Volume of Waste

This alternative would not only remove a significant portion of the contaminated soil from the Site, but would also result in the permanent destruction of any soil regulated as F001 wastes through incineration, thereby effectively removing them from the environment. However, the toxicity, mobility and volume of any residual contamination below the water table would not be reduced except through natural degradation.

### Implementability

Ability to construct and operate: Excavation of the contaminated soil would utilize common construction equipment and materials. In-situ vapor extraction uses specialized equipment but contractors experienced in using this equipment are readily available. Thermal treatment of the soil can be performed at facilities which are properly permitted to handle F001 wastes.

Reliability: All aspects of this alternative would be highly reliable in achieving the remedial action objectives as it involves proven technologies.

Ease of undertaking additional actions: This alternative would not complicate or hinder other remedial actions.

Ability to monitor: Soil, groundwater and air quality monitoring would be readily performed to ensure the effectiveness of this remedy.

Availability of services: Services to treat, excavate and transport the contaminated soil are readily available.

### Cost

The capital costs to implement Alternative A4 are estimated to be $658,916 for the estimated volume of contaminated soil. The time to complete this alternative is assumed to be two years during which time O&M will be required for the in-situ vapor extraction system. System performance monitoring and confirmation sampling will be conducted to determine whether the remedial objectives for soil have been achieved. The estimated annual O&M cost is $54,100. Long-term groundwater monitoring may be considered for evaluating the effect of this remedial alternative but the cost are not included with this alternative but rather with the General No Action Alternative or Alternative Series B. Based on a two year operating period, the present worth cost for Alternative A4 is $759,488. A detailed breakdown of these costs is provided on Table 6-3 with backup provided in Appendix P.

### 6.3.3 Alternative A5: In-Situ Vapor Extraction of All Contaminated Site Soil (~7,000 cy) Including Soil under Floor of Building

The conceptual design for the in-situ system inside the building is the same as for Alternative A3. The design of the in-situ system outside the building is as follows:

- A low permeability cover would be constructed in the area known to contain contamination. The area to be covered would require clearing and grubbing. The cover could consist of a layer of sand covered by 20 mil polyethylene sheeting and another layer of sand or gravel. The low permeability cover should increase the radius of influence of the in-situ vapor extraction points from 15 feet to a least 20 to 25 feet.

- Based on the extent of contamination in the saturated soil and the assumption that each vapor extraction point would have a 20 to 25 foot radius of influence, approximately 17 vapor extraction points (configured as shown on Figure 6-2) would be required for in-situ treatment of soils outside the building. Each vapor extraction point would be constructed to remove both groundwater and soil vapor. Each point would consist of a six-inch diameter well installed to a depth of approximately 20 to 25 feet (to the top of till) and fully screened. The groundwater table would be depressed using a system of pumps as described in Alternative B2. The recovered water would be handled according to the remedial alternative selected for Alternative Series C.

- Based on an assumed average vapor removal rate of 40 cfm from each well, the total removal rate of the system would be 680 cfm.

- Performance monitoring would consist initially of weekly air sampling. When vapor concentrations indicate that soil cleanup goals may have been achieved, three vertical soil samples will be collected over the vapor extraction interval near each vapor extraction point (51 samples total). Samples would be analyzed for volatile organic compounds.

# Table 6-3
# Cost Estimate
# Alternative A4
# In-Situ Vapor Extraction of Soil Under Floor of Building; Excavation of "Hot Spots" Soils (~300 CY); and Off-Site Treatment or Disposal

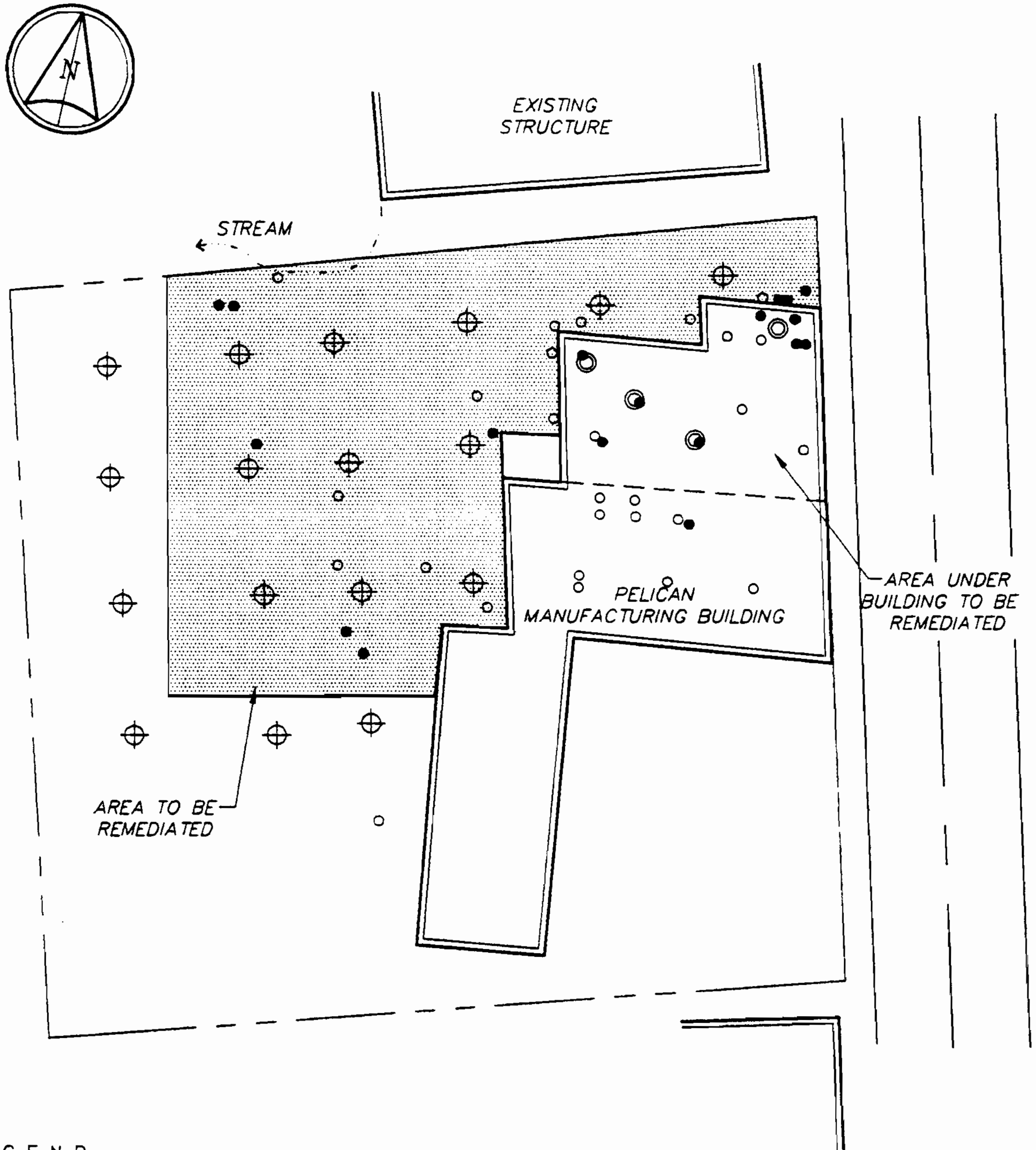
| ITEM | QUANTITY | UNIT COST | UNIT | COST | BASIS |
|---|---|---|---|---|---|
| **CAPITAL COSTS:** | | | | | |
| **Direct Capital Costs:** | | | | | |
| A. Mobilization/Demobilization | 1 | $50,000 | LS | $50,000 | 2 |
| B. Health and Safety Measures | 1 | $20,000 | Month | $20,000 | 2 |
| C. Construction Management | 2 | $12,000 | Month | $24,000 | 2 |
| D. In-Situ System | | | | | |
| 1. Extraction Well Installation (2"Ø, 10' Deep with 10' Screen, PVC) | 4 | $2,050 | Each | $8,200 | 1,2 |
| 2. Vacuum Blower (125 CFM), Including Knockout Tank and Filter | 1 | $5,700 | Each | $5,700 | 4 |
| 3. Associated Piping System (2"Ø, PVC) | 300 | $9.59 | LF | $2,877 | 1 |
| 4. Instrumentation and Control System | 1 | $5,000 | LS | $5,000 | 2 |
| E. Excavation of "Hot Spot" Soils and Off-Site Treatment or Disposal | | | | | |
| 1. Excavation and On-Site Storage of Hot Spot" Soils and Backfilling with Clean Fill | 1 | $11,400 | LS | $11,400 | 2 |
| 2. Disposal of F001 Waste | 1 | $235,800 | LS | $235,800 | 2 |
| 3. Disposal of Non-F001 Waste | 1 | $50,200 | LS | $50,200 | 2 |
| 4. Post Excavation Sampling | 1 | $7,260 | LS | $7,260 | 2 |
| F. System Start-Up | | | | | |
| 1. Labor | 1 | $11,700 | LS | $11,700 | 2 |
| 2. Monitoring | 1 | $7,140 | LS | $7,140 | 2 |
| **Total Direct Costs:** | | | | $439,277 | |
| **Indirect Capital Costs:** | | | | | |
| 1. Engineering and Permitting (30% of Total Direct Costs) | | | | $131,783 | |
| 2. Contingency (20% of Total Direct Costs) | | | | $87,855 | |
| **Total Indirect Costs:** | | | | $219,639 | |
| **TOTAL CAPITAL COSTS:** | | | | $658,916 | |

# Table 6-3
# Cost Estimate
# Alternative A4
# In-Situ Vapor Extraction of Soil Under Floor of Building; Excavation of "Hot Spots" Soils (~300 CY); and Off-Site Treatment or Disposal

| ITEM | QUANTITY | UNIT COST | UNIT | COST | BASIS |
|---|---|---|---|---|---|
| **ANNUAL O&M COSTS:** | | | | | |
| 1. Annual System Inspection/Monitoring Cost | | | | | |
| a. Labor | 1 | $22,400 | LS | $22,400 | 2 |
| b. Total Monitoring | 1 | $18,700 | LS | $18,700 | 2 |
| c. Reporting | 1 | $8,000 | LS | $8,000 | 2 |
| 2. Standard Repair and Maintenance | 1 | $5,000 | LS | $5,000 | 2 |
| **TOTAL O&M COSTS:** | | | | $54,100 | |
| **PRESENT WORTH OF COSTS:** | | | | | |
| 1. Present Worth of Annual O&M Costs (5% Discount Rate, 2 years) | | | | $100,572 | |
| 2. Total Capital Costs | | | | $658,916 | |
| **TOTAL PRESENT WORTH:** | | | | $759,488 | |

**BASIS:**

1. Means Heavy Construction Cost Data, 1994
2. TAMS Professional Experience
3. VWM Scientific Catalog
4. Wintek Corporation



LEGEND

● SAMPLE LOCATION THAT EXCEEDS SOIL CLEANUP LEVELS

○ SAMPLE LOCATION THAT DOES NOT EXCEED SOIL CLEANUP LEVELS

▨ APPROXIMATE AREAL EXTENT OF SURFACE AND SUBSURFACE SOIL TO BE REMEDIATED (Alternative A5)

⊕ *DUAL VAPOR/GROUNDWATER EXTRACTION POINT*

◎ *VAPOR EXTRACTION POINT*

**DUNN ENGINEERING COMPANY**
DIVISION OF **RUST** ENVIRONMENT & INFRASTRUCTURE

**REMEDIAL ALTERNATIVE FEATURES**
**ALTERNATIVES A5 AND B2**
PELICAN MANUFACTURING, INC. SITE
City of Jamestown
Chautauqua Co., NY

| PROJECT No. 35120.700 | DATE 7/94 | DWG. No. 35120-08 | SCALE 1"=50' | FIGURE No. 6-2 |
|---|---|---|---|---|

It is assumed that the loading of contaminants from soil to air would be the same for soil outside and under the building. Therefore, it is assumed that, except for a short period at the very beginning of the vapor extraction process, emissions will be well below the limit and will not require any type of control.

**Compliance with NYS SCGs**

SCGs for this alternative are those that relate to on-site treatment systems. Requirements for these activities include OSHA health and safety standards. The results of a vapor extraction pilot study indicate that this technology would decrease the concentrations of site contaminants to site cleanup goals. The on-site treatment system is subject to applicable New York State hazardous waste treatment and air pollution regulations.

**Overall Protection of Human Health and the Environment**

This alternative will provide a high level of protection to human health and the environment in the vicinity of the Site. The volatile organic contaminants present in the soil near the ground surface and below the groundwater table will be removed and treated (see Alternative Series E) to levels at or below the established cleanup goals.

**Short-Term Effectiveness**

Community protection: The only short-term effects on the community potentially created by implementation of this alternative are associated with the installation of vapor extraction points and operation of the vapor extraction system. These risks can be controlled with common health and safety practices. Based on the calculations discussed with Alternative A3, volatile emissions associated with the VES should be less than the 0.1 lb/hr limit set forth in the NYSDEC air protection guidelines. If volatile emissions do require treatment, this would be accomplished according to Alternative Series E.

Worker protection: Workers involved with installing the vapor extraction system could be exposed to small risks associated with dermal contact with contaminated soils or inhalation of volatile emissions. Risks will be mitigated by properly outfitting workers with appropriate personnel protection equipment, including proper respiratory protection, air monitoring, industrial hygiene procedures, and the use of controlled excavations.

Environmental impacts: There should be no short-term adverse environmental impacts associated with this alternative.

Time to implement: This remedial alternative can be installed within six months of contractor mobilization to the Site. It is assumed that this alternative will remove 80% of the contamination within six to 12 months and the cleanup objectives will be met within 12 to 24 months.

### Long-Term Effectiveness and Permanence

Residual risk: The contaminated soil will be treated in-situ by vapor extraction and the vapor will be treated according to the alternative selected for Alternative Series E, if required by New York State air pollution control regulations. The long-term risks due to direct contact or incidental ingestion of contaminated soil are mitigated effectively by removal of the contaminated soil and the replacement of treated soil. Groundwater quality should be restored more quickly than with other alternatives since the source of contamination is being treated.

Adequacy of controls: The on-site in-situ and ex-situ vapor extraction system should achieve its performance requirement of preventing direct contact to any receptors and removing the source of groundwater contamination. Short-term soil, groundwater and air testing will be performed to confirm the effectiveness of treatment. There will be no long-term management of soils required at the Site, since contaminated soil will have been treated.

Reliability of controls: Given the short duration required for in-situ treatment of the soil (one to two years), the remedial system is expected to operate reliably requiring only routine maintenance. The removal of the source of contamination should prevent the potential for additional risks to shallow groundwater at the Site.

### Reduction of Toxicity, Mobility or Volume of Waste

This alternative would reduce the toxicity, mobility or volume of site contaminants by removing them from the soil. The contaminants would either be transferred at acceptable levels to air or would be captured and destroyed.

### Implementability

Ability to construct and operate: In-situ and vapor extraction systems are available that can be operated in the small space available at the Site.

Reliability: The results of a VES pilot study indicate that this technology can meet the remedial action objectives for the COC related to soil. Vapor extraction is also a proven technology.

Ease of undertaking additional actions: This alternative could complicate or hinder other remedial actions during operation of the system because the vapor extraction points would be distributed across the Site and connected to the main system a network of pipes. Proper scheduling during the remedial design phase should allow completion of all remedial actions at the Site.

Ability to monitor: Soil, groundwater and air quality monitoring could be readily performed to ensure the effectiveness of this remedy.

Availability of services: Services treat soils using in-situ vapor extraction are readily available.

Cost

The capital costs to implement Alternative A5 are estimated to be $507,110. The time to implement this alternative is assumed to be two years during which time O&M will be required for the in-situ vapor extraction system. System performance monitoring and confirmation sampling will be conducted to determine whether the remedial objectives for soil have been achieved. The estimated annual O&M cost is $74,400. Long-term groundwater monitoring may be considered for evaluating the effect of this remedial alternative but the cost are not included with this alternative but rather with the General No Action Alternative or Alternative Series B. Based on a two year operating period, the present worth cost for Alternative A5 is $645,420. A detailed breakdown of these costs is provided on Table 6-4 with backup provided in Appendix P.

## 6.4 Alternative Series B - Alternatives for the Recovery of Groundwater

The effect of taking no action to control or enhance groundwater quality is discussed under the General No Action Alternative.

In order to perform the detailed evaluation of the two alternatives retained after the preliminary screening (B2 and B4) the two-dimensional analytical groundwater flow model TWODAN was employed. Existing hydrogeologic conditions were used to calibrate the input parameters for the model, then the effects of each groundwater remedial alternative were simulated. The model was used to predict the effect of the remedial alternatives on groundwater flow direction and to estimate pumping rates. Additional information regarding the TWODAN analytical model and its use for this evaluation is provided in Appendix Q.

### 6.4.1 Alternative B2: Groundwater Recovery to Enhance Vapor Extraction of all Contaminated Site Soils

As discussed for Alternative A5, 17 dual vapor/groundwater extraction points would be installed outside the building (see Figure 6-2). The four vapor extraction points inside the building would not be designed to pump groundwater. Modeling of the 17 groundwater pumping wells indicated that a total of approximately 23 gallons/minute (gpm) would be withdrawn from the wells collectively (see Appendix Q). Groundwater recovery would cease once the soil cleanup objectives have been met. The small size of the Site limits the effect a low permeability cap would have on the groundwater flow regime and a cap is not likely to have a significant effect on the pumping rate. Recovered groundwater would be handled according to the alternative selected for Alternative Series C.

# Table 6-4
## Alternative A5
## In-Situ Vapor Extraction of All Contaminated Site Soil (~7,000 CY) Including Soil Under Floor of Building

| ITEM | QUANTITY | UNIT COST | UNIT | COST | BASIS |
|---|---|---|---|---|---|
| **CAPITAL COSTS:** | | | | | |
| **Direct Capital Costs:** | | | | | |
| A. Mobilization/Demobilization | 1 | $75,000 | LS | $75,000 | 2 |
| B. Health and Safety Measures | 2 | $20,000 | | $40,000 | 2 |
| C. Construction Management | 3 | $12,000 | Month | $36,000 | |
| D. Installation of 4 Vapor Extraction Wells (2"Ø, 10' Deep with 10' Screen, PVC) & 17 Dual Vapor/Groundwater Extraction Wells (6"Ø, 25' Deep with 25 Screen, PVC) | 1 | $64,600 | LS | $64,600 | 2 |
| E. Vacuum Blowers (Including Knockout Tank and Filter) | | | | | |
| 1. For Vapor Extraction Wells (125 CFM) | 1 | $5,700 | Each | $5,700 | 3 |
| 2. For Dual Vapor/Groundwater Extraction Wells (1000 CFM) | 1 | $20,065 | Each | $20,065 | 3 |
| F. Associated Piping (for Vapor) | | | | | |
| 1. 2"Ø, PVC, Vapor Wells | 300 | $9.59 | LF | $2,877 | |
| 2. 2"Ø, PVC in Trenches | 3910 | $9.65 | LF | $37,732 | |
| G. Low Permeability Cover | | | | | |
| 1. Clearing and Grubbing | 22500 | $0.05 | SF | $1,125 | 1 |
| 2. Plastic sheeting (20 mil, HDPE) | 22500 | $0.27 | SF | $6,075 | 4 |
| 3. Gravel (6" Thick) | 420 | $16 | CY | $6,720 | 1 |
| H. Instrumentation and Control System | 1 | $5,000 | LS | $5,000 | 2 |
| I. System Start-Up | | | | | |
| 1. Labor | 1 | $22,900 | LS | $22,900 | 2 |
| 2. Monitoring | 1 | $14,280 | LS | $14,280 | 2 |
| **Total Direct Costs:** | | | | $338,074 | |
| **Indirect Capital Costs:** | | | | | |
| 1. Engineering and Permitting (30% of Total Direct Cost) | | | | $101,422 | |
| 2. Contingency (20% of Total Direct Cost) | | | | $67,615 | |
| **Total Indirect Costs:** | | | | $169,037 | |
| **TOTAL CAPITAL COSTS:** | | | | $507,110 | |

## Table 6-4
## Alternative A5
## In-Situ Vapor Extraction of All Contaminated Site Soil (~7,000 CY) Including Soil Under Floor of Building

| ITEM | QUANTITY | UNIT COST | UNIT | COST | BASIS |
|---|---|---|---|---|---|
| **ANNUAL O&M COSTS:** | | | | | |
| 1. Annual System Inspection and Monitoring Cost | | | | | |
| a. Labor | 1 | $22,400 | LS | $22,400 | |
| b. Monitoring | 1 | $34,000 | LS | $34,000 | |
| c. Reporting | 1 | $8,000 | LS | $8,000 | |
| 2. Standard Repair and Maintenance | 1 | $10,000 | LS | $10,000 | |
| **TOTAL O&M COSTS:** | | | | $74,400 | |
| **PRESENT WORTH OF COSTS:** | | | | | |
| 1. Present Worth of Annual O&M Costs (5% Discount Rate, 2 years) | | | | $138,310 | |
| 2. Total Capital Costs | | | | $507,110 | |
| **TOTAL PRESENT WORTH:** | | | | $645,420 | |

**BASIS:**

1. Means Site Work and Landscape Cost Data, 1994
2. TAMS Professional Experience
3. Wintek Corporation

### Compliance with NYS SCGs

Chemical-specific SCGs for groundwater quality standards (Parts 373 and 703) may be attained under this alternative. OSHA health and safety standards would be satisfied. The on-site treatment system is subject to applicable New York State hazardous waste treatment and air pollution regulations.

### Overall Protection of Human Health and the Environment

Currently there appears to be no pathway for human exposure and no significant risk to the environment associated with contaminated groundwater at the Pelican Site. This alternative would enhance soil remediation and would promote restoration of groundwater quality more quickly than Alternatives A3 and A4 since contaminants below the water table will also be removed. Groundwater monitoring would be performed to evaluate the results of remedy with respect to the protection of human health and the environment.

### Short-Term Effectiveness

Community protection: There would be no significant risks or adverse impacts to the community during implementation of this alternative other than with potential volatile emissions associated with groundwater removal. If necessary, the air pollution controls will be used to control such emissions to protect human health and the environment.

Worker protection: This alternative would not pose a substantial risk to the workers as they would be wearing PPE (personal protective equipment) as necessary, during the implementation of this alternative.

Environmental impacts: Implementation of this alternative would pose little or no adverse impacts to the environment. It is anticipated, the rate of organic emissions into the air resulting from the groundwater recovery process (prior to groundwater treatment addressed in Alternative Series C) would be below NYSDEC levels of concern.

Time to implement: The time required to install and test dual vapor/groundwater extraction wells would be four to eight weeks after contractor mobilization to the Site. Once the system is operational groundwater recovery would continue until the objectives of the vapor extraction system have been achieved which is anticipated to take one to two years (see Alternative A5).

### Long-Term Effectiveness and Permanence

Residual risk: This alternative would reduce only partially any minor residual risk associated contaminated groundwater since groundwater will be removed only during operation of the soil vapor extraction system. Long-term groundwater monitoring would be performed to evaluate risk associated with residual groundwater contamination.

Adequacy of controls: Residual groundwater contamination remaining after implementation of this alternative would not be controlled. There appears to be no significant risk to human health or the environment associated with groundwater contamination. Long-term monitoring would be performed to evaluate any future need to implement remedial measures with respect to groundwater.

Reliability of controls: Groundwater monitoring should provide a highly reliable means of evaluating the effects of residual contamination on human health and the environment.

### Reduction of Toxicity, Mobility or Volume of Waste

This alternative would remove contaminated groundwater from the shallow water bearing unit but would do nothing to reduce the toxicity, mobility or volume of the hazardous organic constituents. Treatment and/or destruction of the hazardous constituents depends upon the alternative selected for Alternative Series C. Some residual groundwater contamination is likely to remain within the formation. These residuals would degrade over time, but this time period is difficult to predict.

### Implementability

Ability to construct and operate: The groundwater recovery system could be constructed with little or no difficulty. The operation of the dual vapor and groundwater extraction system would require periodic inspection and monitoring, (e.g. weekly) to ensure the system is operating properly. Hydrogeologic testing indicates that the extraction wells would be screened in a formation amenable to groundwater recovery.

Reliability: Groundwater recovery via dual vapor/groundwater extraction wells is a proven reliable technology. The major difficulty anticipated with this remedial system is fouling of the wells due to the apparent high concentrations of iron in the groundwater.

Ease of undertaking additional actions: This alternative would complicate or prevent additional action on-site as it would occupy the majority of the space on the Site.

Ability to monitor: Groundwater level monitoring would readily be performed to ensure adequate dewatering of the Site.

Availability of services: There are no aspects of this alternative that would require specialty services. Therefore, it is very unlikely that the project would be delayed by the unavailability of services or materials.

### Cost

The capital costs to implement Alternative B2 are estimated to be $199,997. The capital costs include a pre-remedial design pump test and installation of pumps, manifolds, underground piping, and instrumentation and controls. The time to implement this alternative is assumed to be two years during which time O&M will be required for the dual vapor/groundwater extraction system. Inspection of the system is included under Alternative A5. Groundwater monitoring along with groundwater recovery system maintenance and repair are included in the annual O&M costs for this alternative which have been estimated to be $12,400. This alternative would not provide for the remediation of groundwater therefore, long-term groundwater monitoring would be required if this alternative is selected for the recommended Site remedy. The costs for long-term monitoring are included in the General No Action Alternative. Based on a two year operating period, the present worth cost for Alternative B2 is estimated to be $223,047. A detailed breakdown of these costs is provided on Table 6-5 with backup provided in Appendix P.

### 6.4.2 Alternative B4: Groundwater Recovery Trench

This alternative uses a trench at the rear of the building to remove groundwater to control contaminant migration and to actively enhance the rate of restoration of groundwater quality in the vicinity of the Site. The proposed location of the groundwater recovery trench is shown on Figure 6-3. A recovery trench was modeled and the results showed the pumping rate from the trench to be approximately 20 gpm if the depth of the trench extended to the top of till (elevation 1306 feet amsl). Such a trench would adequately capture site groundwater (see Appendix Q). Recovered groundwater would be handled (treated) according to the alternative selected for Alternative Series C.

#### Compliance with NYS SCGs

Chemical-specific SCGs for groundwater quality standards (Parts 373 and 703) will eventually be attained under this alternative, however the time required to achieve these objectives is undetermined and could be very long-term. OSHA health and safety standards would be satisfied. The groundwater recovery system is subject to applicable New York State hazardous waste regulations.

#### Overall Protection of Human Health and the Environment

Currently there is no risk to human health and no apparent human exposure to, nor significant risk to the environment associated with, contaminated site groundwater. However, this alternative would enhance the rate of restoration of groundwater quality and the removal of volatile organics sorbed in the saturated soil which would further reduce the minor potential for long-term risk to human health or the environment. Groundwater monitoring would be performed to evaluate the results of remedy as related to the protection of human health and the environment.

#### Short-Term Effectiveness

Community protection: There would be no significant risks or adverse impacts to the community during implementation of this alternative other than the potential volatile emissions associated with groundwater removal. If necessary, air pollution controls will be used to control such emissions to protect human health and the environment.

Worker protection: This alternative would not pose a substantial risk to the workers as they would be wearing PPE as necessary, during the implementation of this alternative.

# Table 6-5
# Cost Estimate
# Alternative B2
# Groundwater Recovery to Enhance Vapor Extraction of All Contaminated Site Soil

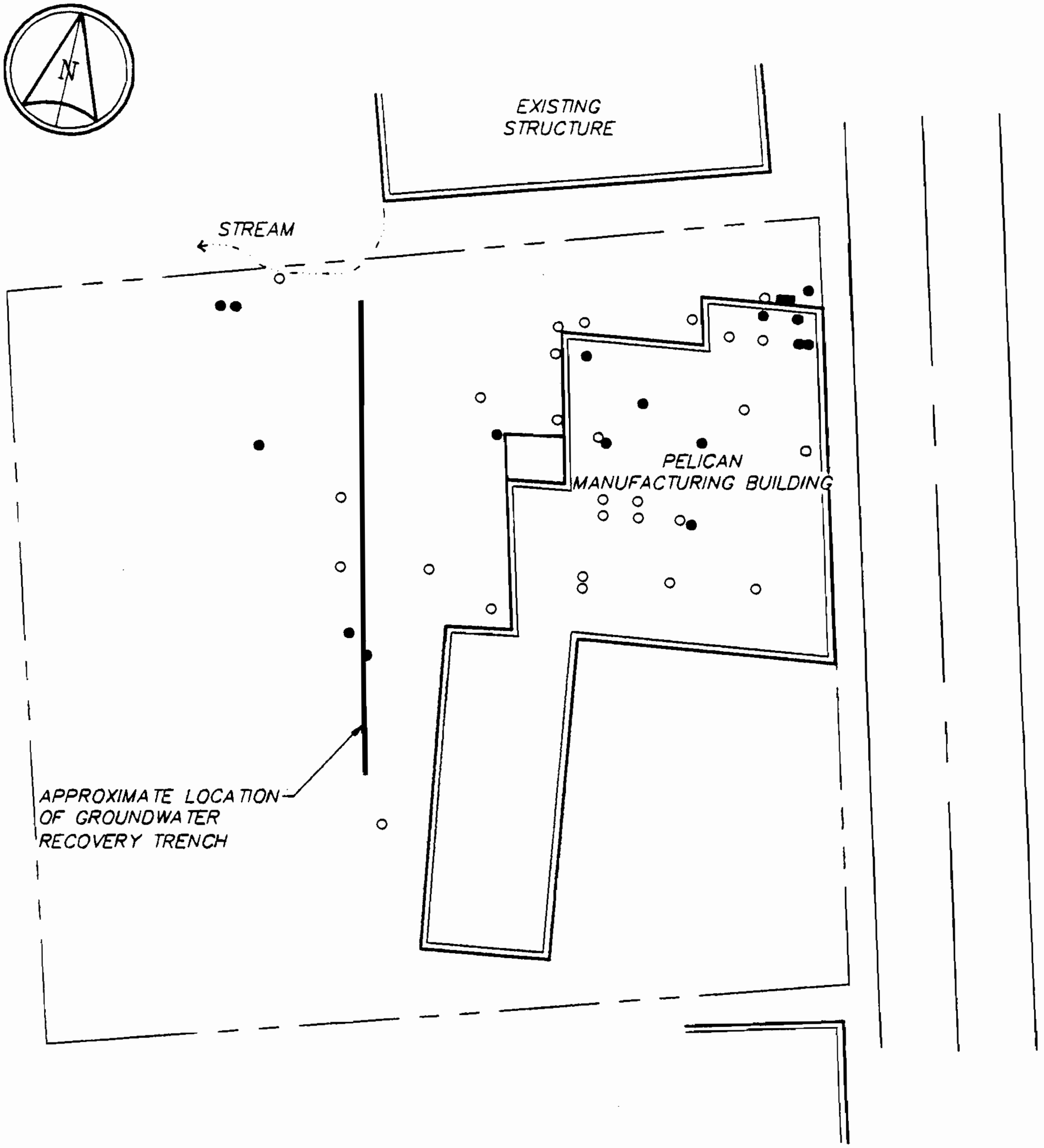
| ITEM | QUANTITY | UNIT COST | UNIT | COST | BASIS |
|---|---|---|---|---|---|
| **CAPITAL COSTS:** | | | | | |
| **Direct Capital Costs:** | | | | | |
| A. Pumping Tests | 1 | $63,000 | LS | $63,000 | 3 |
| B. Installation of Piping System | | | | | |
| 1. Piping Installation (4'Ø, PVC) | 3910 | $9.65 | LF | $37,732 | 1,2 |
| 2. Trench Excavation (700'Lx3'Wx5'D) | 1 | $12,700 | LS | $12,700 | 1,2 |
| C. Installation of Pumps and Manifold | 1 | $14,900 | LS | $14,900 | 1,2 |
| D. Instrumentation and Controls | 1 | $5,000 | LS | $5,000 | 1 |
| **Total Direct Costs:** | | | | $133,332 | |
| **Indirect Capital Costs:** | | | | | |
| 1. Engineering (30% of total direct costs) | | | | $39,999 | |
| 2. Contingency (20% of total direct costs) | | | | $26,666 | |
| **Total Indirect Costs:** | | | | $66,666 | |
| **TOTAL CAPITAL COSTS:** | | | | $199,997 | |
| **ANNUAL O&M COSTS:** | | | | | |
| 1. Baseline Groundwater Monitoring | 1 | $6,800 | LS | $7,400 | |
| 2. Standard Repair and Maintenance | 1 | $5,000 | LS | $5,000 | |
| **TOTAL O&M COST:** | | | | $12,400 | |
| **PRESENT WORTH OF COSTS:** | | | | | |
| 1. Present Worth of Annual O&M Costs (5% Discount Rate, 2 Years) | | | | $23,050 | |
| 2. Total Capital Costs | | | | $199,997 | |
| **TOTAL PRESENT WORTH:** | | | | $223,047 | |

**Notes:**

Sampling and System Inspection Cost for this alternative is included in A Series Alternatives.

**BASIS:**

1. TAMS Professional Experience
2. Means Site Work and Landscape Cost Data, 1994
3. Dunn Engineering Company Professional Experience.



LEGEND

● SAMPLE LOCATION THAT EXCEEDS SOIL CLEANUP LEVELS

○ SAMPLE LOCATION THAT DOES NOT EXCEED SOIL CLEANUP LEVELS

**DUNN ENGINEERING COMPANY**
DIVISION OF RUST ENVIRONMENT & INFRASTRUCTURE

**REMEDIAL ALTERNATIVE FEATURES**
**ALTERNATIVE B4**
PELICAN MANUFACTURING, INC. SITE
City of Jamestown
Chautauqua Co., NY

| PROJECT No. 35120.700 | DATE 7/94 | DWG. No. 35120-13 | SCALE 1" =50' | FIGURE No. 6-3 |
|---|---|---|---|---|

Environmental impacts: Implementation of this alternative would pose little or no adverse impact on the environment.

Time to implement: The time required to install and test groundwater recovery trench would be approximately four to eight weeks after contractor mobilization to the Site. Once the system is operational groundwater recovery would continue until groundwater objectives have been achieved. The time to restore groundwater quality to NYSDEC standards depends on chemical and geological factors which control the rate of contamination removal.

### Long-Term Effectiveness and Permanence

Residual risk: Residual risk would be significantly reduced as the contaminated groundwater is being removed and treated. Long-term groundwater monitoring would be performed to ensure the effectiveness of the remedy.

Adequacy of controls: The components of this alternative are commonly used to treat groundwater under similar circumstances.

Reliability of controls: With proper operation and maintenance, this alternative would be highly reliable.

### Reduction of Toxicity, Mobility or Volume of Waste

This alternative includes only groundwater recovery and not treatment (see Alternative Series C) and, therefore, will not reduce the toxicity or volume of the groundwater contaminants. This alternative would reduce the mobility of groundwater contamination by preventing off-site migration. Some residual contamination is likely to remain in an immobile form within the formation. These residuals would degrade over time, but this time period is difficult to predict.

### Implementability

Ability to construct and operate: The groundwater recovery system could be constructed with little or no difficulty. The operation of a groundwater recovery trench would require periodic monitoring, (e.g. monthly) to ensure the system is operating properly. Hydrogeologic testing indicates the contaminated formation is amenable to groundwater recovery by means of a groundwater recovery trench.

Reliability: Groundwater recovery via a trench is proven to be a reliable technology.

Ease of undertaking additional actions: This alternative could complicate additional action on-site during construction because the trench would occupy a significant portion of the area the rear of the building. Once the trench is in place and backfilled, the area may be available for other remedial activities.

Ability to monitor: Groundwater level and quality monitoring would readily be performed to ensure the effectiveness of the remedy.

Availability of services: There are no aspects of this alternative that would require specialty services. Therefore, it is very unlikely that the project would be delayed by the unavailability of services or materials.

**Cost**

The capital costs to implement Alternative B4 are estimated to be $420,302. The capital costs include a pre-remedial design pump test and installation of a recovery trench, pumps, manifolds, underground piping, and instrumentation and controls. The time to implement this alternative is assumed to be at least 30 years during which time O&M will be required. Groundwater level monitoring along with groundwater recovery system inspection, maintenance and repair are included in the annual O&M costs for this alternative which have been estimated to be $47,800. Long-term groundwater monitoring would be required if this alternative is selected for the recommended site remedy. The costs for long-term monitoring are included in the General No Action Alternative. Based on a two year operating period, the present worth cost for Alternative B4 is estimated to be $1,155,082. A detailed breakdown of these costs is provided on Table 6-6 with backup provided in Appendix P.

## 6.5 Alternative Series C - Alternatives for the Treatment of Contaminated Groundwater

### 6.5.1 Alternative C1 - On-Site Groundwater Treatment (Air Stripper)

Loadings from groundwater to air have been calculated based on groundwater concentration data and a pumping rate of 23 gpm, loading to the air would be as follow:

- TCE = 0.03 lb/hr
- Vinyl Chloride = 0.04 lb/hr
- 1,2-DCE (total) = 0.22 lb/hr
- Toluene =0.02 lb/hr

The loading calculations are provided in Appendix R. Based on a NYSDEC Air Guide 1 limit of 0.1 lb/hr, it is likely that an air stripper system would require emissions control.

**Compliance with NYS SCGs**

Chemical-specific SCGs for groundwater quality standards (Parts 373 and 703) and air quality standards (NYSDEC Air Guide 1) would be attained under this alternative. OSHA

## Table 6-6
## Cost Estimate
## Alternative B4
## Groundwater Recovery Trench

| ITEM | QUANTITY | UNIT COST | UNIT | COST | BASIS |
|---|---|---|---|---|---|
| **CAPITAL COSTS:** | | | | | |
| **Direct Capital Costs:** | | | | | |
| A. Mobilization/Demobilization | 1 | $75,000 | LS | $75,000 | 2 |
| B. Health and Safety Measures | 2 | $20,000 | Month | $40,000 | 2 |
| C. Construction Management | 3 | $12,000 | Month | $36,000 | 2 |
| D. Pumping Tests | 1 | $63,000 | LS | $63,000 | 2 |
| E. Installation and Groundwater Recovery Trench and Transfers Trench | | | | | |
| 1. Excavation and Backfill | 1 | $31,910 | LS | $31,910 | 1,2 |
| 2. Piping Installation | 1 | $9,391 | LS | $9,391 | 1,2 |
| 3. Pump and Controls | 1 | $2,000 | LS | $2,000 | 1,2 |
| F. System Start-Up | 1 | $22,900 | LS | $22,900 | 2 |
| **Total Direct Costs:** | | | | $280,201 | |
| **Indirect Capital Costs:** | | | | | |
| 1. Engineering (30% of Total Direct Costs) | | | | $84,060 | |
| 2. Contingency (20% of Total Direct Cost) | | | | $56,040 | |
| **Total Indirect Costs:** | | | | $140,101 | |
| **TOTAL CAPITAL COSTS:** | | | | $420,302 | |
| **ANNUAL O&M COSTS:** | | | | | |
| 1. Baseline Groundwater Level Monitoring | 1 | $6,800 | LS | $7,400 | 2 |
| 2. Annual System Inspection and Monitoring Costs | | | | | 2 |
| a. Labor | 1 | $22,400 | LS | $22,400 | |
| b. Reporting | | $8,000 | LS | $8,000 | |
| 3. Standard Repair and Maintenance | 1 | $10,000 | LS | $10,000 | 2 |
| **TOTAL O&M COSTS:** | | | | $47,800 | |
| **PRESENT WORTH OF COSTS:** | | | | | |
| 1. Present Worth of Annual O&M Costs (5% Discount Rate, 30 Years) | | | | $734,782 | |
| 2. Total Capital Costs | | | | $420,302 | |
| **TOTAL PRESENT WORTH:** | | | | $1,155,083 | |

**Notes:**

1. These alternatives will not be combined with the others except for a disposal alternative. Therefore, costs for mobilization/demobilization and health and safety measures are included.

BASIS:

1. Means Site Work and Landscape Cost Data, 1994.
2. TAMS Professional Experience.
3. Dunn Engineering Company Professional Experience.

health and safety standards would be satisfied. The on-site treatment system is subject to applicable New York State hazardous waste treatment, air pollution, and water quality (SPDES) regulations.

**Overall Protection of Human Health and the Environment**

Alternative C1 would be protective of human health and the environment. Treatment system performance monitoring would be conducted to ensure the effectiveness of the treatment prior to discharge to a surface water body or the local POTW.

**Short-Term Effectiveness**

Community protection: There would be no significant risks or adverse impacts to the community during implementation of this alternative. The levels of volatile organic contaminants in water indicate that air pollution controls may be required on the atmosphere emissions from the air stripper. Monitoring would be performed to ensure that no unacceptable concentrations are released to the atmosphere. If air emissions required treatment, this would be provided as discussed in the Alternative Series E.

Worker protection: This alternative would not pose a substantial risk to workers as they would be wearing PPE, as necessary, during the implementation. In addition, as described above, no unacceptable short-term risks are posed to human health under any of the current significant exposure pathways.

Environmental impacts: Implementation of this alternative would pose little or no adverse impacts to the environment. Treated water would be discharged to the drainage ditch at the west side of the Site or to the local POTW, but only after it is in compliance with standards set forth in 6 NYCRR Part 700-703 and/or the local sewer use ordinance.

Time to implement: The time required to mobilize a treatment system and prepare the system for operation would be approximately four to six months after contractor mobilization to the Site.

**Long-Term Effectiveness and Permanence**

Residual risk: Any residual risk associated with exposure to the recovered contaminated groundwater would be significantly reduced as the recovered contaminated groundwater is being treated. Contaminants would be transferred from groundwater to air at acceptable concentrations or controlled by air pollution controls, such as carbon emission control systems.

Adequacy of controls: No significant quantity of residual contaminants would remain after groundwater treatment, therefore, no controls would be necessary.

### Reduction of Toxicity, Mobility or Volume of Waste

Alternative C1 would not reduce the toxicity, mobility and volume of contamination in the recovered groundwater at the Site unless emission controls were implemented which captured the volatile organics stripped from groundwater and which ultimately leads to the destruction of the contaminants. Otherwise the contaminants would not be destroyed but would be transferred into the air at acceptable levels.

### Implementability

Ability to construct and operate: Alternative C1 could be constructed with little or no difficulty. The operation of the air stripper system would require periodic monitoring, (e.g. weekly) to ensure the system is operating properly.

Reliability: Treatment via air stripping is a proven, reliable means of treating groundwater with volatile organic contaminants. Performance monitoring of the treated water will be conducted to ensure the effectiveness and reliability of the treatment system.

Ease of undertaking additional actions: This alternative could complicate additional action on-site because an air stripper would occupy a significant portion of the area at the rear of the building.

Ability to monitor: Groundwater quality and atmospheric emissions monitoring could readily be performed to ensure the effectiveness of the remedy.

Availability of services: There are no aspects of this alternative that would require specialty services. There are numerous vendors that can supply air stripping equipment. Therefore, it is very unlikely that the project would be delayed by the unavailability of services or materials.

### Cost

The cost for implementation of Alternative C1 has been evaluated in two ways as follows:

- costs were estimated for treating water from a groundwater recovery system pumped at 20 gpm for two years as part of the dual vapor/groundwater extraction system proposed for Alternatives A5 and B2; and
- costs were estimated for treating water from a groundwater recovery system pumped at 20 gpm for at least 30 years as part of the groundwater recovery trench system proposed for Alternative B4.

Cost estimates are presented in Table 6-7A for treatment of groundwater for a period of two years in conjunction with the soil vapor extraction system and in Table 6-7B for 30 years in conjunction with a long-term groundwater recovery system. The total present worth cost for two years and 30 years of operation are estimated to be $71,991 and $503,370, respectively.

# Table 6-7A
# Cost Estimate
# Alternative C1A (20 GPM for 2 Years)
# On-Site Groundwater Treatment (Air Stripper)

| ITEM | QUANTITY | UNIT COST | UNIT | COST | BASIS |
|---|---|---|---|---|---|
| **CAPITAL COSTS:** | | | | | |
| **Direct Capital Costs:** | | | | | |
| A. Iron Removal System | 1 | $5,000 | LS | $5,000 | 2 |
| B. Air Stripper | | | | | |
| 1. Equipment and Freight | 1 | $15,300 | LS | $15,300 | 1,3 |
| 2. Piping and Installation | 1 | $3,500 | LS | $3,500 | 1,3 |
| C. System Start-Up Monitoring | 1 | $4,340 | LS | $4,340 | 1 |
| **Total Direct Costs:** | | | | $28,140 | |
| **Indirect Capital Costs:** | | | | | |
| 1. Engineering (30% of Total Direct Cost) | | | | $8,442 | |
| 2. Contingency (20% of Total Direct Cost) | | | | $5,628 | |
| **Total Indirect Costs:** | | | | $14,070 | |
| **TOTAL CAPITAL COSTS:** | | | | $42,210 | |
| **ANNUAL O&M COSTS:** | | | | | |
| 1. Annual System Inspection and Monitoring Cost | | | | | |
| a. Labor (included A3, A4 or A5) | | | | | |
| b. Monitoring | 1 | $6,100 | LS | $13,020 | 1 |
| 2. Standard Repair and Maintenance | 1 | $3,000 | LS | $3,000 | 1 |
| **TOTAL O&M COSTS:** | | | | $16,020 | |
| **PRESENT WORTH OF COSTS:** | | | | | |
| 1. Present Worth of O&M Costs (5% Discount Rate, 2 Years) | | | | $29,781 | |
| 2. Total Capital Costs | | | | $42,210 | |
| **TOTAL PRESENT WORTH:** | | | | $71,991 | |

**BASIS:**

1. TAMS Professional Experience
2. Dunn Engineering Company Professional Experience
3. Northeast Equipment Inc.

# Table 6-7B
## Cost Estimate
## Alternative C1B (20 GPM for 30 Years)
## On-Site Groundwater Treatment (Air Stripper)

| ITEM | QUANTITY | UNIT COST | UNIT | COST | BASIS |
|---|---|---|---|---|---|
| **CAPITAL COSTS:** | | | | | |
| **Direct Capital Costs:** | | | | | |
| A. Iron Removal System | 1 | $5,000 | LS | $5,000 | 2 |
| B. Air Stripper | | | | | |
| 1. Equipment | 1 | $15,300 | LS | $15,300 | 1,3 |
| 2. Piping and Installation | 1 | $3,500 | LS | $3,500 | 1,3 |
| C. System Start Up | | | | | |
| 1. Monitoring | 1 | $4,340 | LS | $4,340 | 1 |
| **Total Direct Costs:** | | | | $28,140 | |
| **Indirect Capital Costs:** | | | | | |
| 1. Engineering (30% of Total Direct Cost) | | | | $8,442 | |
| 2. Contingency (20% of Total Direct Cost) | | | | $5,628 | |
| **Total Indirect Costs:** | | | | $14,070 | |
| **TOTAL CAPITAL COSTS:** | | | | $42,210 | |
| **ANNUAL O&M COSTS:** | | | | | |
| 1. Annual System Inspection and Monitoring Cost | | | | | |
| a. Labor | 1 | $20,900 | LS | $20,900 | 1 |
| b. Monitoring | 1 | $6,100 | LS | $6,100 | 1 |
| 2. Standard Repair and Maintenance | 1 | $3,000 | LS | $3,000 | 1 |
| **TOTAL O&M COSTS:** | | | | $30,000 | |
| **PRESENT WORTH OF COSTS:** | | | | | |
| 1. Present Worth of O&M Costs (5% Discount Rate, 30 Years) | | | | $461,160 | |
| 2. Total Capital Costs | | | | $42,210 | |
| **TOTAL PRESENT WORTH:** | | | | $503,370 | |

**BASIS:**

1. TAMS Professional Experience
2. Dunn Engineering Company Professional Experience
3. Northeast Equipment Inc.

### 6.5.2 Alternative C2 - On-Site Groundwater Treatment (Activated Carbon)

This alternative involves passing the recovered groundwater through activated carbon to remove organic contaminants.

**Compliance with NYS SCGs**

Chemical-specific SCGs for groundwater quality (Parts 373 and 703) may be attained under this alternative. OSHA health and safety standards would be satisfied. The on-site treatment system is subject to applicable New York State hazardous waste treatment and water quality (SPDES) regulations.

**Overall Protection of Human Health and the Environment**

Alternative C2 is protective of human health and the environment. Treatment system performance monitoring would be conducted to ensure the effectiveness of the treatment prior to discharge to a surface water body or the local POTW.

**Short-Term Effectiveness**

Community protection: There would be no significant risks or adverse impacts to the community during implementation of this alternative. An activated carbon system would not release any unacceptable air emissions nor would it involve the use of hazardous materials. The spent carbon, though contaminated, would be securely contained within a steel canister, minimizing potential harm to anyone coming in contact with the canisters.

Worker protection: This alternative would not pose a substantial risk to the workers as they would be wearing PPE, as necessary, during the implementation of this alternative.

Environmental impacts: Implementation of this alternative would pose little or no adverse impacts to the environment. Treated water would be discharged to the drainage ditch to the rear of the building or to the local POTW, but only after it is in compliance with standards set forth in 6 NYCRR Part 700 and 701 and/or the local sewer use ordinance.

Time to implement: The time required to mobilize a treatment system and prepare the system for operation would be approximately four to six months after contractor mobilization to the Site.

**Long-Term Effectiveness and Permanence**

Residual risk: Residual risk would be significantly reduced as the recovered contaminated groundwater is being treated.

Adequacy of controls: No significant quantity of residual contaminants would remain after groundwater treatment, therefore, no controls would be necessary.

### Reduction of Toxicity, Mobility or Volume of Waste

Alternative C2 would significantly reduce the toxicity, mobility and volume of contamination in the recovered groundwater at the Site, as the recovered groundwater would be treated, permanently and irreversibly removing the contaminants. Contaminants would be transferred from groundwater to carbon and the contaminants sorbed on the carbon will be destroyed by thermal treatment during regeneration at a RCRA permitted treatment facility.

### Implementability

Ability to construct and operate: Alternative C2 could be constructed with little or no difficulty. The operation of the activated carbon system would require periodic monitoring, (e.g. weekly) to ensure the system is operating properly. Approximately every ten months, based on the October 1992 and February 1994 groundwater concentrations, the GAC system will need to be replaced with new carbon.

Reliability: Groundwater treatment via activated carbon is a proven, reliable means of treating groundwater contaminants with organic contaminants. Long-term groundwater monitoring will be performed to ensure the effectiveness and reliability of the remedy.

Ease of undertaking additional actions: This alternative would not complicate or prevent additional action on-site as the Site is not undergoing any major changes.

Ability to monitor: Groundwater quality monitoring could readily be performed to ensure the effectiveness of the remedy.

Availability of services: There are no aspects of this alternative that would require specialty services. There are numerous vendors that can supply activated carbon. Therefore, it is very unlikely that the project would be delayed by the unavailability of services or materials.

### Cost

The costs for implementation of Alternative C2A and C2B were estimated in the same manner as C1 and summarized in Table 6-8A and Table 6-8B. Cost estimates are presented for treatment of groundwater for a period of two years in conjunction with the soil vapor extraction system and for 30 years in conjunction with a long-term groundwater recovery system. The total present worth cost for two years and 30 years of operation are estimated to be $161,282 and $1,469,160, respectively.

## 6.5.3 Alternative C3 - Off-Site Groundwater Treatment at Local POTW

This alternative involves discharging recovered groundwater directly to a sanitary sewer managed by the local Publicly Owned Treatment Works (POTW).

# Total 6-8A
# Cost Estimate
# Alternative C2A (20 GPM for 2 Years)
# On-Site Groundwater Treatment (Activated Carbon)

| ITEM | QUANTITY | UNIT COST | UNIT | COST | BASIS |
|---|---|---|---|---|---|
| **CAPITAL COSTS:** | | | | | |
| **Direct Capital Costs:** | | | | | |
| A. Iron Removal System | 1 | $5,000 | LS | $5,000 | 2 |
| B. Activated Carbon System | | | | | |
| 1. Equipment, Installation, and Freight | 1 | $11,050 | LS | $11,050 | 1 |
| 2. Piping Installation | 1 | $1,000 | LS | $1,000 | 1 |
| **Total Direct Costs:** | | | | $17,050 | |
| **Indirect Capital Costs:** | | | | | |
| 1. Engineering (30% of Total Direct Costs) | | | | $5,115 | |
| 2. Contingency (20% of Total Direct Cost) | | | | $3,410 | |
| **Total Indirect Costs:** | | | | $8,525 | |
| **TOTAL CAPITAL COSTS:** | | | | $25,575 | |
| **ANNUAL O&M COSTS:** | | | | | |
| 1. Annual System Inspection and Monitoring Costs | | | | | |
| a. Labor (Included in A3, A4 or A5) | | | | | |
| b. Monitoring | 1 | $10,000 | LS | $10,000 | 1 |
| 2. Standard Repair and Maintenance | 1 | $3,000 | LS | $3,000 | 1 |
| 3. Activated Carbon Service | 1 | $60,000 | LS | $60,000 | |
| **TOTAL O&M COSTS:** | | | | $73,000 | |
| **PRESENT WORTH OF COSTS:** | | | | | |
| 1. Present Worth of O&M Costs (5% Discount Rate, 2 Years) | | | | $135,707 | |
| 2. Total Capital Costs | | | | $25,575 | |
| **TOTAL PRESENT WORTH:** | | | | $161,282 | |

**BASIS:**

1. TAMS Professional Experience
2. Dunn Engineering Company Professional Experience

# Table 6-8B
# Cost Estimate
# Alternative C2B (20 GPM for 30 Years)
# On-Site Groundwater Treatment (Activated Carbon)

| ITEM | QUANTITY | UNIT COST | UNIT | COST | BASIS |
|---|---|---|---|---|---|
| **CAPITAL COSTS:** | | | | | |
| **Direct Capital Costs:** | | | | | |
| A. Iron Removal System | 1 | $5,000 | LS | $5,000 | |
| B. Activated Carbon System | | | | | |
| 1. Equipment, Installation, Freight and Disposal | 1 | $11,050 | LS | $11,050 | 1 |
| 2. Piping Installation | 1 | $1,000 | LS | $1,000 | 1 |
| **Total Direct Costs:** | | | | $17,050 | |
| **Indirect Capital Costs:** | | | | | |
| 1. Engineering (30% of Total Direct Costs) | | | | $5,115 | |
| 2. Contingency (20% of Total Direct Cost) | | | | $3,410 | |
| **Total Indirect Costs:** | | | | $8,525 | |
| **TOTAL CAPITAL COSTS:** | | | | $25,575 | |
| **ANNUAL O&M COSTS:** | | | | | |
| 1. Annual System Inspection and Monitoring Costs | | | | | |
| a. Labor | 1 | $20,910 | LS | $20,910 | 1 |
| b. Monitoring | 1 | $10,000 | LS | $10,000 | 1 |
| 2. Standard Repair and Maintenance | 1 | $3,000 | LS | $3,000 | 1 |
| 3. Activated Carbon Service | 1 | $60,000 | LS | $60,000 | |
| **TOTAL O&M COSTS:** | | | | $93,910 | |
| **PRESENT WORTH OF COSTS:** | | | | | |
| 1. Present Worth of O&M Costs (5% Discount Rate, 30 Years) | | | | $1,443,585 | |
| 2. Total Capital Costs | | | | $25,575 | |
| **TOTAL PRESENT WORTH:** | | | | $1,469,160 | |

**BASIS:**

1. TAMS Professional Experience
2. Dunn Engineering Company Professional Experience

### Compliance with NYS SCGs

Chemical-specific SCGs for groundwater quality standards (Parts 373 and 703) may be attained under this alternative. OSHA health and safety standards would be satisfied. Off-site discharge is subject to New York State hazardous waste regulations, local (City of Jamestown) sewer use ordinances, and/or water quality (SPDES) regulations.

### Overall Protection of Human Health and the Environment

If the recovered groundwater meets discharge limits set by the local municipality, then it is assumed that this alternative would be protective of human health and the environment.

### Short-Term Effectiveness

Community protection: There would be no significant risks or adverse impacts to the community during implementation of this alternative.

Worker protection: This alternative would not pose a substantial risk to the workers as they would be wearing PPE, as necessary, during the implementation of this alternative.

Environmental impacts: Implementation of this alternative would pose little or no adverse impacts to the environment. Treated water would be discharged to the POTW, but only after it is in compliance with local sewer use ordinances.

Time to implement: The components of this alternative should be operational within two to four weeks of contractor mobilization to the Site.

### Long-Term Effectiveness and Permanence

Residual risk: Residual risk would be significantly reduced because the recovered contaminated groundwater would be removed from the Site.

Adequacy and reliability of controls: Control of the groundwater once it has entered the POTW sewer line would be up to the municipality.

### Reduction of Toxicity, Mobility or Volume of Waste

This alternative does provide for some reduction in the toxicity and mobility of the contaminants in the recovered groundwater. The groundwater and associated contaminants would be transferred from the Site to the local POTW where some destruction of contaminants would occur as a result of the treatment system used by the POTW.

### Implementability

Ability to construct and operate: This alternative would be simple to construct and operate. The POTW sewer line is located adjacent to the Site and could be readily accessed.

Reliability: Monitoring the discharge to the municipal sewer system would be performed to ensure that discharge limits are not being exceeded. Any further treatment of the groundwater would be the responsibility of the local POTW.

Ease of undertaking additional actions: This alternative would not complicate or hinder the implementation of other remedial actions on the Site.

Ability to monitor: Monitoring system performance would be easily performed.

**Cost**

Cost estimates are presented for treatment of groundwater for a period of two years in conjunction with the soil vapor extraction system and for 30 years in conjunction with a long-term groundwater recovery system. The total present worth cost for two years of operation and 30 years of operation are estimated to be $72,643 and $788,931, respectively. The costs for implementation of Alternative C3 were estimated in the same manner as C1 and are summarized in Table 6-9A and Table 6-9B.

## 6.6 Alternative Series D - Recovery and Treatment/Disposal of Contaminated Floor Drain Sediments

### 6.6.1 Alternative D2 - Removal and Consolidation with "Hot Spot" Soils; and Ex-Situ Vapor Extraction

This alternative involves flushing the floor drains with water and extracting water and sediments with a vacuum truck. The sediments would be drained and placed with the soil in the ex-situ vapor extraction system. Water would be treated according to the alternative selected for Alternative Series C. After flushing the drains would be backfilled with grout.

**Compliance with NYS SCGs**

This alternative would allow removal of contaminated sediment or debris to levels at or below the remedial action objectives which were developed in accordances with NYS SCGs. The solid material would be treated using the ex-situ vapor extraction system and must meet all SCGs associated with ex-situ treatment as discussed in Alternative A3.

**Overall Protection of Human health and the Environment**

Alternative D2 would be highly protective of human health and the environment since the contaminated sediment would be removed. Backfilling floor drains with grout would further ensure that exposure pathways have been eliminated.

## Table 6-9A
## Cost Estimate
## Alternative C3A (for 2 Years)
## Off-Site Treatment at Local POTW

| ITEM | QUANTITY | UNIT COST | UNIT | COST | BASIS |
|---|---|---|---|---|---|
| **CAPITAL COSTS:** | | | | | |
| **Direct Capital Costs:** | | | | | |
| A. Installation of Piping to Sanitary Sewer Lateral (Including Excavation and Backfilling, 6"Ø, PVC, ~150' L x 3' W x 5' D) | 1 | $10,000 | LS | $10,000 | 2 |
| B. System Start Up | 1 | $2,200 | LS | $2,200 | |
| **Total Direct Costs:** | | | | $12,200 | |
| **Indirect Capital Costs:** | | | | | |
| 1. Engineering (30% of Total Direct Costs) | | | | $3,660 | |
| 2. Contingency (20% of Total Direct Cost) | | | | $2,440 | |
| **Total Indirect Costs:** | | | | $6,100 | |
| **TOTAL CAPITAL COSTS:** | | | | $18,300 | |
| **ANNUAL O&M COSTS:** | | | | | |
| 1. Annual System Inspection and Monitoring Cost | | | | | |
| a. Discharge Monitoring | 1 | $6,580 | LS | $6,580 | 1 |
| b. Disposal of Groundwater at Local POTW (Pumping at 20 gpm for 1 Year) | 10.51 | $1,965 | Mgal | $20,652 | 1,2 |
| 2. Standard Repair and Maintenance | 1 | $2,000 | LS | $2,000 | 1 |
| **TOTAL O&M COSTS:** | | | | $29,232 | |
| **PRESENT WORTH OF COSTS:** | | | | | |
| 1. Present Worth of O&M Costs (5% Discount Rate, 2 Years) | | | | $54,343 | |
| 2. Total Capital Costs | | | | $18,300 | |
| **TOTAL PRESENT WORTH:** | | | | $72,643 | |

**BASIS:**

1. TAMS Professional Experience
2. Dunn Engineering Company Professional Experience

## Table 6-9B
## Cost Estimate
## Alternative C3B (for 30 Years)
## Off-Site Treatment at Local POTW

| ITEM | QUANTITY | UNIT COST | UNIT | COST | BASIS |
|---|---|---|---|---|---|
| **CAPITAL COSTS:** | | | | | |
| **Direct Capital Costs:** | | | | | |
| A. Installation of Piping to Sanitary Sewer Lateral (Including Excavation and Backfilling, 6"Ø, PVC, ~150' L x 3' W x 5' D) | 1 | $10,000 | LS | $10,000 | 2 |
| B. System Start Up | 1 | $2,200 | LS | $2,200 | |
| **Total Direct Costs:** | | | | $12,200 | |
| **Indirect Capital Costs:** | | | | | |
| 1. Engineering (30% of Total Direct Costs) | | | | $3,660 | |
| 2. Contingency (20% of Total Direct Cost) | | | | $2,440 | |
| **Total Indirect Costs:** | | | | $6,100 | |
| **TOTAL CAPITAL COSTS:** | | | | $18,300 | |
| **ANNUAL O&M COSTS:** | | | | | |
| 1. Annual System Inspection and Monitoring Cost | | | | | |
| a. Labor | 1 | $20,900 | LS | $20,900 | 1 |
| b. Discharge Monitoring | 1 | $6,580 | LS | $6,580 | 1 |
| c. Disposal of Groundwater at Local POTW (Pumping at 20 gpm for 1 Year) | 10.51 | $1,965 | Mgal | $20,652 | 1,2 |
| 2. Standard Repair and Maintenance | 1 | $2,000 | LS | $2,000 | |
| **TOTAL O&M COSTS:** | | | | $50,132 | |
| **PRESENT WORTH OF COSTS:** | | | | | |
| 1. Present Worth of O&M Costs (5% Discount Rate, 30 Years) | | | | $770,631 | |
| 2. Total Capital Costs | | | | $18,300 | |
| **TOTAL PRESENT WORTH:** | | | | $788,931 | |

**BASIS:**

1. TAMS Professional Experience
2. Dunn Engineering Company Professional Experience

### Short-Term Effectiveness

Community protection: Since this alternative would involve handling hazardous wastes, it has some inherent risks associated with volatile emissions and direct contact with sediment or wash water. The implementation of a comprehensive safety and monitoring program during the remedial action would mitigate these risks.

Worker protection: Workers involved in implementing this alternative may be exposed to contaminated sediment or water. Risks will be mitigated by ensuring that workers have proper personnel protective equipment. Air monitoring would be performed during construction.

Environmental impacts: Implementation of this alternative poses no additional risk to the environment.

Time to implement: It is anticipated that implementation of this alternative would take approximately one month to complete. Additional time would be required for the volatile organics to be removed from the sediment by the vapor extraction system.

### Long-Term Effectiveness and Permanence

Residual risk: Any future risks to human health resulting from direct contact with contaminated sediments, or to the shallow groundwater as a result of the sediments acting as a source would be eliminated by removing and treating the sediments.

Adequacy of controls: Since the contamination will be removed, no long-term controls are required.

### Reduction of Toxicity, Mobility or Volume of Waste

The contamination associated with sediment would be moved to the ex-situ treatment system. The contaminants would then be transferred to air at acceptable levels or captured by an air pollution control system for ultimate destruction. If no emission controls are used then no reduction of toxicity, mobility or volume will occur.

### Implementability

Ability to construct and operate: Alternative D2 could be implemented with little or no difficulty. The necessary equipment is commonly available.

Reliability: This alternative would be highly reliable and no long-term monitoring would be required.

Ease of undertaking additional actions: This alternative would generally not complicate or hinder other remedial actions. It would add to the total volume of soil to be treated as part of the A-series alternatives.

Availability of services: There are no aspects of this alternative that would require specialty services. The project is not likely to be delayed by unavailability of material or services.

**Cost**

The capital cost for implementation of Alternative D2 is estimated to be $2,900 as presented in Table 6-10. No maintenance costs are associated with this alternative. Treatment or disposal costs are covered in Alternative Series A.

### 6.6.2 Alternative D3 - Removal and Off-Site Disposal

This alternative is similar to Alternative D2 except that the floor drain sediments would be disposed off-site rather than treated on-site using the ex-situ vapor extraction system.

**Compliance with NYS SCGs**

This alternative provides for the removal and proper disposal of contaminated sediment or debris that contains volatile organics at levels at or below the remedial action objectives which were developed in accordance with NYS SCGs. The solid material would be treated or disposed of off-site as described for the soil in Alternative A4.

**Overall Protection of Human health and the Environment**

Alternative D2 would be highly protective of human health and the environment since the contaminated sediment would be removed. Backfilling floor drains with grout would further ensure that exposure pathways have been eliminated.

**Short-Term Effectiveness**

Community protection: Since this alternative would involve the handling hazardous wastes, it has some inherent risks associated with volatile emissions and direct contact with sediment or wash water. The implementation of a comprehensive safety and monitoring program during the remedial action would mitigate these risks.

Worker protection: Workers involved in implementing this alternative may be exposed to contaminated sediment or water. Risks will be mitigated by ensuring that workers have proper personnel protective equipment. Air monitoring would be performed during construction.

Environmental impacts: Implementation of this alternative poses no additional risk to the environment.

Time to implement: It is anticipated that implementation of this alternative would take approximately one month to complete.

## Table 6-10
## Cost Estimate
## Alternative D2
## Removal and Consolidation with "Hot Spot" Soils and Ex-Situ Vapor Extraction

| ITEM | QUANTITY | UNIT COST | UNIT | COST | BASIS |
|---|---|---|---|---|---|
| **CAPITAL COSTS:** | | | | | |
| **Direct Capital Costs:** | | | | | |
| A. Removal of Floor Drain Sediments with Vacuum Truck and Backfilling with Grout | | | | | |
| 1. Equipment Rental | 10 | $65 | Hour | $650 | 1 |
| | 200 | $0.45 | Mile | $90 | 1 |
| 2. Labor (1 Labor and 1 Equipment Operator) | 8 | $70 | Hour | $560 | 1 |
| 3. Tool and Material Allowance | 1 | $100 | LS | $100 | 2 |
| 4. Grouting | 1 | $1,500 | LS | $1,500 | 3 |
| **CAPITAL COSTS:** | | | | $2,900 | |

**Notes:**

* Estimates for Indirect Cost, O&M Cost and Present Worth Cost are not calculated, because it is a relatively small task and not necessary to have these costs included.

**BASIS:**

1. American Industrial Marine Services, Inc. Price List.
2. TAMS Professional Experience
3. Dunn Engineering Company Professional Experience.

### Long-Term Effectiveness and Permanence

Residual risk: Any future risks to human health resulting from direct contact with contaminated sediments, or to the shallow groundwater as a result of the sediments acting as a source, would be mitigated by removing and treating the sediments.

Adequacy of controls: Since the contamination will be removed, no long-term controls are required.

### Reduction of Toxicity, Mobility or Volume of Waste

The toxicity, volume and mobility of waste would be reduced by removing all of the sediment with contamination levels exceeding the remedial action objectives. The sediment would be destroyed through off-site treatment at a RCRA permitted facility.

### Implementability

Ability to construct and operate: Alternative D2 could be implemented with little or no difficulty. The necessary equipment is commonly available.

Reliability: This alternative would be highly reliable and no long-term monitoring would be required.

Ease of undertaking additional actions: This alternative would generally not complicate or hinder other remedial actions.

Availability of services: There are no aspects of this alternative that would require specialty services. The project is not likely to be delayed by unavailability of material or services.

### Cost

The capital cost for implementation of Alternative D3 is estimated to be $7,130 as presented in Table 6-11. No maintenance costs are associated with this alternative. Treatment or disposal costs are covered in Alternative Series A.

## 6.7 Control of Organic Vapors

The need for organic vapor control is highly dependent on the remedial alternative. Emission rates from the vapor extraction system scenarios included in Alternative Series A have been estimated (see Section 6.3.1 and Appendix O). The results indicate that organic vapor emissions control will not be necessary except possibly at start up of the system. Emission rates from treatment of contaminated groundwater by means of an air stripper have also been calculated (see Section 6.5.1 and Appendix P). These calculations indicate emission control for an air stripper may be required especially if the groundwater pumping rates are high. However, emission rates would probably diminish over a relatively short period of time and long-term emissions control are not likely to be necessary.

## Table 6-11
## Cost Estimate
## Alternative D3
## Removal and Off-Site Disposal (TSDF)

| ITEM | QUANTITY | UNIT COST | UNIT | COST | BASIS |
|---|---|---|---|---|---|
| **CAPITAL COSTS:** | | | | | |
| **Direct Capital Costs:** | | | | | |
| A. Removal of Floor Drain Sediments, with Vacuum Truck and Backfilling with Grout | | | | | |
| 1. Equipment Rental | 10 | $65 | Hour | $650 | 1 |
| | 200 | $0.45 | Mile | $90 | 1 |
| 2. Labor (1 Labor and 1 Equipment Operator) | 8 | $70 | Hour | $560 | 1 |
| 3. Tool and Material Allowance | 1 | $100 | LS | $100 | 2 |
| 4. Grouting | 1 | $1,500 | LS | $1,500 | 3 |
| B. Off-Site Disposal of Sediment (as F001 Waste) | 1 | $4,230 | LS | $4,230 | 2 |
| **CAPITAL COSTS:** | | | | $7,130 | |

**Notes:**

* Estimates for Indirect Cost, O&M Cost and Present Worth Cost are not calculated, because it is a relatively small task and not necessary to have these costs included.

** If these 3 CY of waste are the only F001 waste to be disposed of off-site, the unit price for disposal will be higher.

**BASIS:**

1. American Industrial Marine Services, Inc. Price List
2. TAMS Professional Experience
3. Dunn Engineering Company Professional Experience

### 6.7.1 Alternative E1 - Vapor Phase Activated Carbon

This alternative involves control of volatile organic emissions from an air stripper or vapor extraction system by means of activated carbon.

**Compliance with NYS SCGs**

Chemical-specific SCGs for air quality standards (NYSDEC Air Guide 1) would be attained under this alternative. OSHA health and safety standards would also be satisfied.

**Overall Protection of Human Health and the Environment**

Alternative E1 is protective of human health and the environment. Periodic air discharge monitoring would be conducted to ensure the effectiveness of the treatment system.

**Short-Term Effectiveness**

Community protection: There would be no significant risks or adverse impacts to the community during implementation of this alternative. The activated carbon system would not release any unacceptable air emissions nor would it involve the use of hazardous materials. The spent carbon, though contaminated would be securely contained within a steel canister, minimizing potential harm to anyone coming in contact with the canisters.

Worker protection: This alternative would not pose a substantial risk to the workers as they would be wearing PPE, as necessary, during the implementation of this alternative. In addition, as described above, no unacceptable short-term risks are posed to human health under any of the current significant exposure pathways.

Environmental impacts: Implementation of this alternative would pose little or no adverse impacts to the environment.

Time to implement: The time required to mobilize a treatment system and prepare the system for operation would be approximately one to three months after contractor mobilization to the Site.

**Long-Term Effectiveness and Permanence**

Residual risk: Residual risk associated with air emissions would be eliminated as air is being treated.

Adequacy of controls: Contaminants are being transferred from air to carbon for ultimate destruction. Since the contamination will be removed, no long-term management is required.

### Reduction of Toxicity, Mobility or Volume of Waste

Alternative E1 would significantly reduce the toxicity, mobility and volume of the volatile organic vapors in air. Treatment would be permanent and irreversible. Contaminants would be transferred from air to carbon and the contaminants sorbed on the carbon would be destroyed by thermal treatment during regeneration at a RCRA permitted treatment facility.

### Implementability

Ability to construct and operate: Alternative E1 could be constructed with little or no difficulty. The operation of the activated system would require periodic monitoring, (e.g. monthly) to ensure the system is operating properly.

Reliability: Activated carbon is a proven reliable means of treating organic vapor emissions. Short-term monitoring will be performed to ensure the effectiveness and reliability of the remedy.

Ease of undertaking additional actions: This alternative would not complicate or prevent additional action on-site, but would be readily combined with other remedial alternatives.

Ability to monitor: Air monitoring could readily be performed to ensure the effectiveness of the remedy.

Availability of services: There are no aspects of this alternative that would require specialty services. There are numerous vendors that can supply activated carbon. Therefore, it is very unlikely that the project would be delayed by the unavailability of services or materials.

### Cost

The costs associated with the use of activated carbon to control the emissions of VOCs removed from the soil (Alternative (E1A) and groundwater (Alternatives E1B and E1C) have been estimated and are presented in Table 6-12A, 6-12B and 6-12C, respectively. For the purpose of the cost estimate, it was assumed that it would be necessary to treat the VOCs from the soil vapor extraction system for a period of 1-2 months. For the purpose of the cost estimate, it was assumed the VOCs from the air stripper would be treated for a period of two years (Alternative B2). Groundwater treatment would terminate when the soil vapor extraction system had treated the soils to meet the cleanup objectives (estimated to take two years). In addition, the costs associated with the use of activated carbon to control VOC emissions in conjunction with a long-term (30 year) groundwater recovery system (Alternative B4) were also estimated and are presented in Table 6-12C. The costs associated with each of the three alternatives using activated carbon are summarized below.

The total capital cost for E1A is estimated to be $26,274. Capitol costs include characterizing the spent carbon and providing for disposal/regeneration. It is assumed activated carbon would be necessary for a period of not more than two months after start-up of the soil vapor extraction system and no long-term, annual operation and maintenance costs have been included. The total present worth cost is estimated to be $26,274 for Alternative E1A. The cost estimate is summarized in Tables 6-12A with backup provided in Appendix P.

The total capital cost for E1B is estimated to be $39,750. The annual O&M costs are estimated to be $119,700. The total present worth cost is estimated to be $262,272 for Alternative E1B. The cost estimate is summarized in Tables 6-12B with backup provided in Appendix P.

The total capital cost for E1C is estimated to be $39,750. The annual O&M costs are estimated to be $115,180. The total present worth cost is estimated to be $1,725,750 for Alternative E1C. The cost estimate is summarized in Tables 6-12C with backup provided in Appendix P.

### 6.7.2 Alternative E2 - Catalytic Oxidation

Due to the relatively low emission rates resulting from the treatment of soil and groundwater associated with the remedial alternatives being evaluated for the Pelican site, it appears that a sophisticated treatment option such as catalytic oxidation would not be warranted for such low levels of volatile organic vapors. This alternative will not be considered for further evaluation.

## Table 6-12A
## Cost Estimate
## Alternative E1A (for Soil Vapor Extraction System - System Start-Up Only) Vapor Phase Activated Carbon

| ITEM | QUANTITY | UNIT COST | UNIT | COST | BASIS |
|---|---|---|---|---|---|
| **CAPITAL COSTS:** | | | | | |
| **Direct Capital Costs:** | | | | | |
| A. Activated Carbon Treatment System | | | | | |
| 1. For Soil Vapor Extraction System (Including Equipment, Freight, and Disposal of Spent Carbon, for 1 Month) | 1 | $13,716 | Each | $13,716 | 2 |
| B. Associated Piping (2"Ø, PVC) | 1 | $1,460 | LS | $1,460 | 1,2 |
| C. System Start Up | | | | | |
| 1. Monitoring | 1 | $2,340 | LS | $2,340 | 2 |
| **Total Direct Costs:** | | | | $17,516 | |
| **Indirect Capital Costs:** | | | | | |
| 1. Engineering and Permitting (30% of Total Direct Costs) | | | | $5,255 | |
| 2. Contingency (20% of Total Direct Costs) | | | | $3,503 | |
| **Total Indirect Costs:** | | | | $8,758 | |
| **TOTAL CAPITAL COSTS:** | | | | $26,274 | |
| **ANNUAL O&M COSTS:** | | | | | |
| 1. Standard Repair and Maintenance | | | | N/A | |
| **TOTAL ANNUAL O&M COST:** | | | | $0 | |
| **PRESENT WORTH OF COSTS:** | | | | | |
| 1. Present Worth of Annual O&M Costs (System Required for 2 months Only) | | | | N/A | |
| 2. Total Capital Costs | | | | $26,274 | |
| **TOTAL PRESENT WORTH:** | | | | $26,274 | |

**BASIS:**

1. Means Site Work and Landscape Cost Data, 1994.
2. TAMS Professional Experience.

## Table 6-12B
## Cost Estimate
## Alternative E1B (for Air Stripper, 2 Year Operation)
## Vapor Phase Activated Carbon

| ITEM | QUANTITY | UNIT COST | UNIT | COST | BASIS |
|---|---|---|---|---|---|
| **CAPITAL COSTS:** | | | | | |
| **Direct Capital Costs:** | | | | | |
| A. Activated Carbon Treatment System | | | | | |
| 1. For Air Stripper (Including Equipment, Freight) | 1 | $22,700 | Each | $22,700 | 2 |
| 2. Associated Piping | 1 | $1,460 | LS | $1,460 | 1,2 |
| B. System Start Up | | | | | |
| 1. Monitoring | 1 | $2,340 | LS | $2,340 | |
| **Total Direct Costs:** | | | | $26,500 | |
| **Indirect Capital Costs:** | | | | | |
| 1. Engineering and Permitting (30% of Total Direct Costs) | | | | $7,950 | |
| 2. Contingency (20% of Total Direct Costs) | | | | $5,300 | |
| **Total Indirect Costs:** | | | | $13,250 | |
| **TOTAL CAPITAL COSTS:** | | | | $39,750 | |
| **ANNUAL O&M COSTS:** | | | | | |
| 1. Annual System Inspection and Monitoring Costs | | | | | |
| a. Monitoring | 1 | $7,020 | LS | $7,020 | |
| 2. Standard Repair and Maintenance | 1 | $3,000 | LS | $3,000 | |
| 3. Activated Carbon Service | 1 | | LS | $109,680 | |
| **TOTAL ANNUAL O&M COST:** | | | | $119,700 | |
| **PRESENT WORTH OF COSTS:** | | | | | |
| 1. Present Worth of Annual O&M Costs (5% Discount Rate, 2 Years) | | | | $222,522 | |
| 2. Total Capital Costs | | | | $39,750 | |
| **TOTAL PRESENT WORTH:** | | | | $262,272 | |

**BASIS:**

1. Means Site Work and Landscape Cost Data, 1994.
2. TAMS Professional Experience

# Table 6-12C
## Alternative E1C (for Air Stripper, 30 Year Operation)
## Vapor Phase Activated Carbon

| ITEM | QUANTITY | UNIT COST | UNIT | COST | BASIS |
|---|---|---|---|---|---|
| **CAPITAL COSTS:** | | | | | |
| **Direct Capital Costs:** | | | | | |
| A. Activated Carbon Treatment System | | | | | |
| 1. For Air Stripper (Including Equipment, Freight) | 1 | $22,700 | Each | $22,700 | 2 |
| 2. Associated Piping | 1 | $1,460 | LS | $1,460 | 1,2 |
| B. System Start Up | | | | | |
| 1. Monitoring | 1 | $2,340 | LS | $2,340 | 2 |
| **Total Direct Costs:** | | | | $26,500 | |
| **Indirect Capital Costs:** | | | | | |
| 1. Engineering and Permitting (30% of Total Direct Costs) | | | | $7,950 | |
| 2. Contingency (20% of Total Direct Costs) | | | | $5,300 | |
| **Total Indirect Costs:** | | | | $13,250 | |
| **TOTAL CAPITAL COSTS:** | | | | $39,750 | |
| **ANNUAL O&M COSTS:** | | | | | |
| 1. Annual System Inspection and Monitoring Costs | | | | | |
| a. Monitoring | 1 | $2,500 | LS | $2,500 | |
| 2. Standard Repair and Maintenance | 1 | $3,000 | LS | $3,000 | |
| 3. Activated Carbon Service | 1 | | LS | $109,680 | |
| **TOTAL ANNUAL O&M COST:** | | | | $115,180 | |
| **PRESENT WORTH OF COSTS:** | | | | | |
| 1. Present Worth of Annual O&M Costs (5% Discount Rate, 30 Years) | | | | $1,686,000 | |
| 2. Total Capital Costs | | | | $39,750 | |
| **TOTAL PRESENT WORTH:** | | | | $1,725,750 | |

**BASIS:**

1. Means Site Work and Landscape Cost Data, 1994.
2. TAMS Professional Experience.

## 7.0 SELECTION OF REMEDY

The remedial program recommended for the Pelican site is based on the evaluation of alternatives designed to address volatile organic contaminants present in:

- groundwater;
- soil outside (west of) the Pelican buildings;
- soil beneath the buildings; and,
- sediment in floor drains within and beneath the buildings and a septic tank located to the rear (west) of the building.

In addition, alternatives were evaluated for the treatment of the organic vapors that may be generated as a result of the treatment of contaminated soil and groundwater. Each element of the proposed remedial program and the basis for its selection is discussed below. The complete remedial program recommended for the Pelican site is described in more detail in Section 7.8.

### 7.1 Selection of Alternative to Remediate Contaminated Groundwater

The remedial program recommended for the Pelican site will result in the removal of the primary source of groundwater contamination - the contaminated soil above the water table. Removal of the contaminated soil will eliminate the potential leaching of volatile organic contaminants from the soil, and will result in the gradual improvement of groundwater quality and the eventual restoration of groundwater quality to New York State groundwater quality standards. Based on the analysis of Site conditions and the remedial alternatives considered in this feasibility study, it is recommended that no further remedial action be taken to recover contaminated groundwater for treatment. Although the concentrations of volatile organics in the groundwater underlying the Pelican site exceed New York State groundwater quality standards, the contaminated groundwater does not currently have a significant impact on human health or the environment. Contaminated groundwater originating at the Pelican site does not affect a potable water supply and it is unlikely that the contaminated groundwater will affect a potable water supply in the future. The contaminated groundwater either discharges into the surface water drainage immediately west of the Site or commingles with groundwater underlying the Jamestown Landfill located immediately downgradient (west) of the Site. In either case, there is little potential for significant human exposure or adverse environmental impact.

### 7.2 Discussion of Alternative to Remediate Contaminated Groundwater

Removing the primary source of groundwater contamination, the contaminated soil above the water table, will result in the long-term restoration of groundwater quality and is also considered necessary to provide protection against direct contact with contaminated soil. Additional remedial actions, such as groundwater recovery and treatment, appear to be unnecessary to protect public health and the environment. There is little potential for human exposure to the contaminated groundwater. Contaminated groundwater originating at the Pelican site does not affect a potable water supply. The City of Jamestown provides water to the Site, and it is unlikely that a potable water supply well will ever be constructed at the Site. Moving downgradient, groundwater will either commingle with the groundwater beneath the former Jamestown City Landfill or discharge to the intermittent surface drainage west of the Site. The volatile organics in the groundwater migrating from the Pelican site are not expected to have any significant adverse affect on the groundwater quality beneath the landfill. The assessment of potential human health affects indicates that any volatile organics that discharge with groundwater into the surface drainage west of the Site will either volatilize or degrade without adversely affecting surface water quality or ambient air quality.

Given the insignificant risk to public health and the environment associated with the groundwater, a pump and treat option for groundwater is not recommended at the Pelican site. The detailed evaluation criteria for the No Action Alternative versus the Groundwater Recovery and Treatment Alternative compare as follows:

- Each alternative will comply with SCGs. The No Action Alternative will rely on natural attenuation and degradation of the volatile organics to restore groundwater quality to New York State groundwater quality standards.

- Both alternatives will be protective of human health and the environment - there is no significant risk posed by the presence of contaminated groundwater under the current Site conditions and groundwater quality will improve once the source of contamination (contaminated soil) is removed.

- The No Action Alternative will be more protective in the short-term because no contaminated groundwater will be recovered for treatment, where the potential for direct human exposure is increased. Increased exposure may result from treatment operations and the atmospheric emissions of the volatile organics removed from the groundwater during treatment.

- The Pump and Treat Alternative will result in the attainment of the remedial goals more quickly because contaminants will be removed from the groundwater system more quickly than from natural attenuation and degradation. However, the No Action Alternative will include a long-term monitoring program which will provide adequate warning of any future need to implement remedial measures to ensure adequate protection of human health and the environment.

- The No Action Alternative will provide no reduction of toxicity, volume, or mobility of the groundwater contaminants except through natural degradation. Recovering groundwater will remove contaminants from the formation and the reduction of toxicity and volume of contaminants will depend on the selected treatment alternative. Some residual contamination will likely remain in the formation even after many years of pumping.

- The No Action Alternative will be far easier to implement than the Pump and Treat Alternative.

- The present worth cost of the No Action Alternative, based on a 30 year operating period and a 5% discount rate is estimated to be $181,330 (see Table 6-1). This cost includes development of deed restrictions and long-term groundwater monitoring. The present worth cost for a Pump and Treat system over the same time period is estimated to be $1,658,452 (Alternative B4 plus Alternative C1B). This includes a groundwater recovery trench and treatment using an air stripper (the more cost effective treatment alternative for a 30 year treatment scenario).

Based on this comparison and the relatively low risk, the No Action Alternative for groundwater is recommended as part of the overall Pelican site remedy.

## 7.3 Selection of Alternative to Address Contaminated Soil West of the Buildings

The alternative recommended to address the contaminated soil located to the west of buildings is the excavation of the soil and treatment of the soil by means of vapor extraction in a treatment cell located within building No. 2223 (Alternative A3). The recommended alternative provides for the removal and treatment of the contaminated soil that currently is most likely to result in direct human exposure and that appears to be a significant source of continuing groundwater contamination. After treatment of the soil is completed, it will be returned to the Site.

## 7.4 Selection of Alternative to Address Contaminated Soil Beneath the Buildings

The alternative recommended to address the contaminated soil located beneath the buildings is vapor extraction using extraction wells installed through the floor of the building (Alternative A3). The recommended alternative provides for the removal of the volatile organic contaminants present in the soils that may be a source of continuing groundwater contamination. In-situ treatment of the soil beneath the floor slab appears to be feasible given the properties of the contaminants of concern (volatile organics) and the properties of the soil (sufficient permeability). Due to the greater thickness of the unsaturated zone (vadose zone) beneath the buildings, it is expected that vapor extraction technology can be used without entraining significant amounts of groundwater in the vapor extraction system. In-situ treatment of the volatile organic compounds present at the Pelican site is expected to be highly effective and eliminates the need to demolish any of the existing buildings.

## 7.5 Selection of Alternative to Remediate Contaminated Sediments in the Floor Drains Beneath the Buildings and in the Septic Tank

The alternative recommended to address the contaminated sediment in the floor drains located within and beneath the buildings is to flush the drain lines clean with water and to recover the water and sediments using a vacuum truck. The septic tank will also be pumped and flushed with water. The sediment will be allowed to settle and the water will

## Table 7-1
## Summary of Costs
## Recommended Remedial Program

| Item of Work | Capital Costs | Annual Costs | Total Present Worth |
|---|---|---|---|
| I. Deed Restriction | $5,000.00 | | $5,000.00 |
| II. Develop & Implement Long-Term Groundwater Monitoring Program | $23,500.00 | $10,840.00 | $195,130.00 |
| III. In-Situ Vapor Extraction of Soil Beneath Floor. Excavation of "Hot Spot" Soil, and Ex-Situ Treatment On-Site. | $327,762.00 | $66,400.00 | $451,200.00 |
| IV. Clean Out Floor Drains and Septic Tank. Combine Sediment With "Hot Spot" Soil and Treat On-Site. | $2,900.00 | | $2,900.00 |
| V. Provide Activated Carbon System to Remove Organic Vapors From Exhaust of the Soil Vapor Extraction Systems. (1) | $26,274.00 | | $26,274.00 |
| **Total:** | **$385,436.00** | **$77,240.00** | **$680,504.00** |

(1) Controls of organic emissions may be unnecessary. Final decision may be deferred until the vapor extraction systems are operational.

be recovered for treatment on-site using activated carbon. The recovered sediment will be added to the soil excavated from the "hot spots" and will be treated using vapor extraction technology in the ex-situ treatment cell located within building No. 2223 (Alternative D2).

## 7.6 Discussion of the Alternative Recommended for the Remediation of Contaminated Soil and Sediment

Three alternatives for remediating contaminated soil and sediment have been developed and evaluated. Each of the alternatives includes in-situ vapor extraction of the soil below the building foundation slab. The three alternatives that were evaluated in detail are:

**Alternative A3** - Excavation of "hot spot" soil and removal of contaminated sediments from the floor drains and septic tank. Treatment of soil and sediment in an ex-situ vapor extraction system constructed in building No. 2223. At the completion of treatment, the soil and sediment will be used as fill on the Site.

**Alternative A4** - Excavation of "hot spot" soil and removal of contaminated sediments from the floor drains and septic tank. Contaminated soil and sediment will be transported off-site to a fully permitted facility for proper treatment and disposal.

**Alternative A5** - In-situ vapor extraction of all contaminated soil, including the near surface "hot spot" soil and the contaminated soil below the water table. This alternative requires groundwater extraction to lower the water table in order to allow vapor extraction of volatile organics sorbed onto the soil currently below the water table. This alternative also requires a system to treat the extracted groundwater. Contaminated sediments would be removed from the floor drains and septic tank and treated in the ex-situ vapor extraction system described above.

The detailed evaluation criteria for these remedial alternatives compare as follows:

- Each alternative will reduce the concentration of volatile organics in the near surface soil to levels that satisfy the soil cleanup objectives. Alternatives 1 and 2 rely on natural processes of degradation to remove the VOCs from the soil below the water table. The soil cleanup objectives for soil below the groundwater table may be achieved at some time in the future.

- All alternatives will be protective of human health and the environment. Although Alternatives A3 and A4 will leave contamination below the groundwater table, there is no significant pathway for human exposure to this contamination.

- Alternative A4 provides the greatest short-term reduction in the potential for exposure to contaminated soil and sediment. Once the soil and sediment are excavated, they will be promptly removed from the Site for treatment and disposal. In-situ and ex-situ treatment are expected to require 18 - 24 months of treatment before the soil cleanup objectives are met.

- During implementation of all three alternatives, worker and community exposure will be minimized by implementing commonly used health and safety procedures.

- The long-term effectiveness of Alternative A5 is greater than the other two alternatives. Alternatives A3 and A4 will result in soil contamination remaining below the water table at levels greater than the soil cleanup objectives. However, it is anticipated that the volatile organics will degrade over time as a result of natural processes.

- Alternative A3 and A5 will provide no reduction of toxicity, volume or mobility of the soil contaminants unless air pollution control systems are used in conjunction with the vapor extraction system. Alternative A4 will provide for the destruction of the organic contaminants because the soil with the highest concentrations of organic contaminants will be treated off-site by thermal destruction.

- Each of the alternatives is implementable.

- The present worth costs for Alternatives A3, A4 and A5 are estimated to be $451,200, $759,500 and $645,400, respectively (see Tables 6-2, 6-3 and 6-4). Alternative A3 includes treatment of recovered groundwater using activated carbon (the more cost effective treatment alternative for a two year groundwater treatment alternative).

Based on this comparison and the relatively low risk involved with leaving contaminated soil below the groundwater table, Alternative A3 is recommended as part of the overall Pelican site remedy.

## 7.7 Selection of Alternative to Address Volatile Organic Vapors as a Result of Treatment of Contaminated Soil

The recommended remedial program includes the use of vapor extraction technology to remove volatile organic contaminants from soil beneath the buildings, sediment removed from the floor drains and septic tank, and approximately 300 cubic yards of soil excavated from "hot spots" located west of the buildings. Based on the calculations presented in this report, it appears the rate at which volatile organic compounds will be removed from the soil will result in atmospheric emissions that will require no air pollution controls under current NYSDEC regulations and guidance. It is possible that, when the vapor extraction systems are first started, the emission rate will exceed the emission limits. However, it is anticipated the concentration of volatile organics in the exhaust from the vapor extraction systems will decrease rapidly, and the emission rate will quickly drop below the level requiring any air pollution controls. The use of air pollution controls on the vapor extraction system appears unnecessary and, therefore, such controls are not recommended. If during system start-up, the emission rates are higher than anticipated, carbon adsorption units can easily be added to the vapor extraction system to control emissions to meet New York State air quality regulations.

## 7.8 Description of the Recommended Remedy for the Pelican Site

The conceptual design of the recommended remedy for the Pelican site is shown in Figure 7-1 and described below:

### 7.8.1 Remediation of Contaminated Soil West of the Buildings

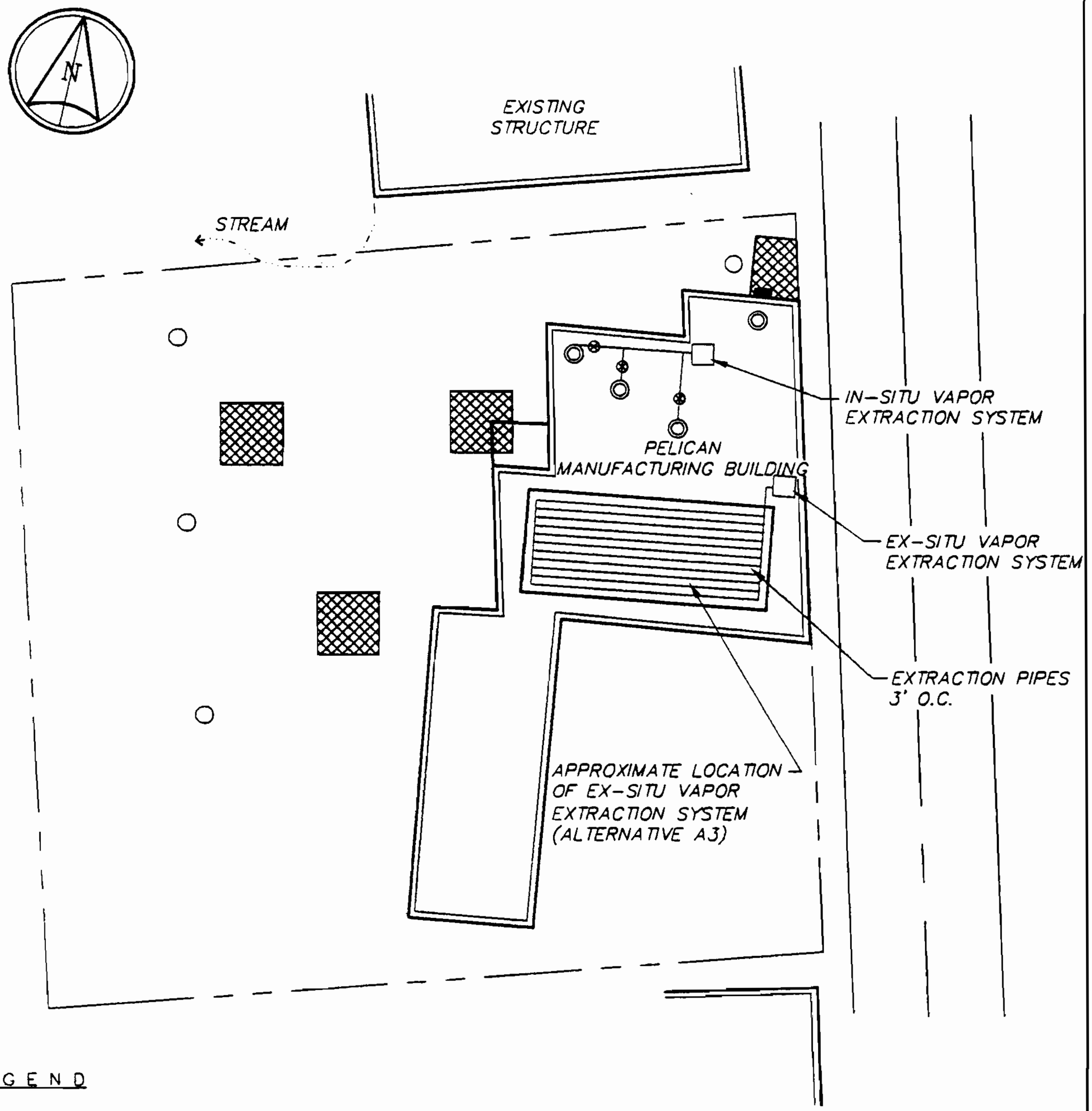
Initially, the area to the west (rear) of the buildings will be cleared and grubbed in preparation for excavation of "hot spots". Approximately 300 cy of "hot spot" soil will be excavated. Post-excavation samples will be collected to confirm that all "hot spot" soil has been removed. Approximately four samples per "hot spot" (one from each excavation side wall) will be collected. No soil samples will be collected from the floor of the excavation because excavation will stop when the groundwater table is reached, and existing data show that contaminated soil exists below the water table.

Concurrently, building No. 2223 will be inspected and repaired to provide a secure, dry, and heated enclosure in which the ex-situ and in-situ vapor extraction systems will be constructed. The excavated soil will be placed in an 80 x 40 foot space (ex-situ treatment area) prepared within building No. 2223, as shown in Figure 6-1. Ex-situ treatment within the buildings provides for secure storage of the soil until remediation is complete and allows the temperature of the soil to be controlled, thereby resulting in more rapid removal of the volatile contaminants.

The area to be used for the ex-situ system will be covered with plastic sheeting. Berms will be constructed around the system to capture any water draining from the excavated soil. A thin layer (~six inches) of sand will be placed on the sheeting. The vapor extraction piping will be laid on the sand, spaced approximately every three feet. The piping will be covered with enough sand to protect it from small earth moving equipment. The sand will be at least as permeable to air as the excavated soil. Contaminated soil will be placed in the building using the door at the loading dock at the rear of building No. 2223. The 300 cy of contaminated soil will be spread over the ex-situ treatment area to a depth of approximately two and one-half to three feet.

A separate blower will be required to treat the ex-situ soil. The vapor flow rate from the ex-situ system is expected to be high (300 to 500 cfm) and the pressure drop negligible due to the likely increase in soil permeability during excavation and the short distance the air will have to flow through the soil. A tarp will be used to cover the soil only when the system is not in operation. Fans to vent the building and proper respiratory protection will be available, if air monitoring indicates that organic vapors inside the building are above health and safety action levels.

The exhausted vapors will be monitored during system start-up to evaluate system performance and to determine whether air pollution controls are required. Regular monitoring of vapor emissions will be used as a guide to determine when soil remediation appears complete and confirmatory soil sampling should be performed.



LEGEND

- ○ LONG-TERM GROUNDWATER MONITORING WELLS
- ◎ VAPOR EXTRACTION POINTS
- ⊗ ADJUSTABLE VALVES
- ▩ APPROXIMATE AREAL EXTENT OF SURFACE SOIL "HOT SPOTS" TO BE REMEDIATED (Alternatives A3 & A4)

**DUNN ENGINEERING COMPANY**
DIVISION OF **RUST** ENVIRONMENT & INFRASTRUCTURE

**CONCEPTUAL LAYOUT OF RECOMMENDED REMEDY**

PELICAN MANUFACTURING, INC. SITE

City of Jamestown
Chautauqua Co., NY

| | | | | |
|---|---|---|---|---|
| PROJECT No. 35120.700 | DATE 7/94 | DWG. No. 35120-26 | SCALE 1"=50' | FIGURE No. 7-1 |

When vapor concentrations indicate that soil cleanup goals may have been achieved, confirmatory soil samples will be collected. It is anticipated that one sample will be taken for each 10 cy (30 samples total). Samples will be analyzed for volatile organic compounds. Soil that has been treated to meet the soil cleanup objectives will be used to backfill the excavated areas at the rear of the buildings. Upon completion of the soil remediation, the ground surface will be revegetated or paved.

### 7.8.2 Remediation of Contaminated Soil Beneath the Buildings

Approximately four vapor extraction points (8 to 10 feet in depth) will be installed in the buildings at points where the highest levels of volatile organic contamination was detected in the soil below the slab foundation. The location of the vapor extraction points are shown on Figure 6-1. The vacuum and air flow rate will be controlled such that entrainment of groundwater will be minimized. Approximately 650 cy of soil beneath the floor slab is to be remediated using in-situ vapor extraction. The estimated flow rate for the in-situ system is estimated to be 25 cfm per well (or 100 cfm total). The pressure drop at each well is expected to range between 20 and 66 inches of water.

As above, monitoring of the exhausted vapors will be performed at system start-up to evaluate system performance and to determine whether air pollution controls are required. The rate of organic emissions resulting from the vapor extraction system have been calculated, and it is anticipated that air pollution controls will not be required. Initial monitoring will consist of ~~weekly~~ air sampling.

Daily

When vapor concentrations indicate that soil cleanup objectives may have been achieved, confirmatory soil samples will be collected by again drilling through the floor slab.

### 7.8.3 Remediation of Contaminated Sediment in Floor Drains Beneath the Buildings and in the Septic Tank

The building floor drains and the septic tank will be flushed with water and the water and sediments will be removed from the drains with a vacuum truck. The sediments will be drained and placed with the excavated soil in the ex-situ vapor extraction system for treatment. Water will be treated with activated carbon. After flushing, the drains will be backfilled with grout.

### 7.8.4 Long-Term Monitoring Program

A deed restriction for the property will be instituted, and a long-term groundwater monitoring plan will be developed to ensure adequate protection of human health and the environment and to provide adequate warning of any future need to implement remedial measures. The groundwater monitoring plan will consist of annual sampling of the eight on-site wells for volatile organic analysis, data validation and report preparation.

### 7.8.5 Estimated Cost of Recommended Remedial Program

The costs associated with the recommended remedial program are:

- Long-term groundwater monitoring/deed restriction (based on 30 years of monitoring) - $181,330.
- In-situ and ex-situ vapor extraction of soil/sediment (based on two years of operation) - $451,200.
- Removal of sediments from the floor drains and septic tank, and treatment of sediment on-site - $2,900.
- Provide activated carbon service for a period of 2 months after start-up of the soil vapor extraction system - $26,274.00.
- Total present worth cost of the recommended remedial plan - $680,504.

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