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DIVISION OF HAZARDOUS
WASTE REMEDIATION

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Fulton Terminals Site, City of Fulton, Oswego County, New York.

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Fulton Terminals site. The selected remedial alternative was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Contingency Plan (NCP). This decision is based on the administrative record for this site. The attached index identifies the items that comprise the administrative record upon which the selection of the remedial action is based.

The State of New York has concurred with the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present a current or potential threat to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

The selected remedy will address residual soil contamination at the site and contaminated groundwater in the underlying aquifer. Prior cleanup actions have resulted in the removal of visibly-contaminated surface soil and all storage tanks containing hazardous substances.

The major components of the selected remedy are:

- Excavation and treatment, via on-site low temperature thermal extraction, of approximately 4,000 cubic yards of contaminated soil.

- Placement of the treated soils into the excavated areas;

- Extraction and treatment, via air-stripping and carbon adsorption, of the groundwater underlying the site, and reinjection, or another type of recharge technique, to recharge the treated water into the ground; and

- Disposal of the treatment residuals at an off-site Resource Conservation and Recovery Act (RCRA) hazardous waste facility.

The groundwater treatment will continue until federal and state standards for the organic contaminants have been achieved. Because benzene, ethylbenzene and xylene have been detected in upgradient wells at levels exceeding groundwater standards, a separate investigation will be undertaken by the New York State Department of Environmental Conservation (NYSDEC) to define and eliminate the source of the upgradient contamination if these contaminants remain elevated at the time when federal and state standards for the other organic contaminants have been achieved.

It should be noted that the groundwater quality standards for metals may not be achieved, as naturally occurring metal concentrations in the groundwater surrounding the site are higher than the metal concentrations in the groundwater underlying the site. As a result, the quality of the groundwater at the end of this remedial action may not be adequate for use as a potable water supply. Therefore, institutional controls will be established to prevent the utilization of the groundwater at the site for such purposes. Any institutional controls, including, without limitation, well construction permits and water quality certifications, shall be consistent with New York State law.

DECLARATION

Consistent with CERCLA, as amended by SARA, and the NCP, I have determined that the selected remedy is protective of human health and the environment, attains federal and state requirements that are applicable or relevant and appropriate to the remedial action, and is cost effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. Because this remedy will not result in hazardous substances remaining on-site above health based levels, the five-year review will not apply to this action.

William J. Muszynski, P.E.
Acting Regional Administrator

Date

DECISION SUMMARY

FULTON TERMINALS SITE

FULTON, NEW YORK

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION II

NEW YORK

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ATTACHMENTS

SITE NAME, LOCATION, AND DESCRIPTION

The Fulton Terminals site is located near the northern corporate limits of the City of Fulton, Oswego County, New York. It is 10 miles southeast of the City of Oswego and 22 miles north-northwest of the City of Syracuse. The site covers approximately 1.6 acres, and is bounded on the west by First Street, on the south by Shaw Street, on the east by Route 481, and on the north by a warehouse. The Oswego River lies immediately west of First Street, approximately fifty feet from the site (see Figure 1). The various waste storage tanks shown in Figure 1 were associated with former activities at the site and have since been removed.

Land use in the vicinity of the site is commercial and industrial. Immediately south of Fulton Terminals across Shaw Street is a former waste disposal site, the Fulton 6th Ward, a portion of which has been regraded and covered by a new industrial building. This one-acre site was used from 1966 to 1969. South of Shaw Street to the west is a trucking company, and to the east is the County Office Building. North of the site is a large warehouse. Across Route 481 and east of Waterhouse Creek is the former Van Buren Street Dump site, which has been converted into a park. This 17-acre site was used from the early 1950s until the late 1960s for the disposal of municipal waste and constuc- tion and demolition debris. A number of private homes and the fringe of the downtown commercial district are within one-half mile of the site.

According to the City of Fulton Chamber of Commerce, natural resources in the area consist of the Oswego River and Lake Neatahwanta. Recreational water activities on the Oswego River, which runs adjacent to the site, include boating and fishing. Lake Neatahwanta, located approximately 3 miles southwest of the site, is utilized for public swimming, fishing, boating and camping activities. Several sand and gravel pits are located within a few miles of the site.

The population of the City of Fulton was 13,312 according to the 1980 U.S. census. The population of Oswego County was 113,901 according to the 1980 census.

The Fulton Terminals site is situated on a relatively flat parcel of land created by filling of the former floodplain of the Oswego River. The Oswego River flows south to north and is located approximately 50 feet west of the site (see Figure 1). Four hundred feet to the east is the Waterhouse Creek which drains a small basin in the uplands into a swampy area before emptying into the Oswego River, approximately 1,250 feet north of the site. During normal flow periods, the river level is approxi- mately 10 feet below ground surface in the vicinity of site. The western portion of the site is sloped gently toward the Oswego River and it occurs within the 100-year floodplain of the Oswego River.

The site is underlain by a relatively thick section of unconsolidated deposits that overlie bedrock. A layer of sand and gravel appears to be laterally continuous over bedrock, and ranges in thickness from approximately 25 to 58 feet. A silt and clay unit occurs above the sand and gravel unit throughout most of the site, with thickness varying from 0 to approximately 25 feet. Artificial fill, consisting predominantly of sand and gravel, covers the surface of the site varying in thickness from approximately 4 to 12 feet.

The artificial fill is the uppermost hydrologic unit, and is mostly unsaturated. The water table generally coincides with the elevation of the bottom of the fill. The underlying silt and clay unit has very low hydraulic conductivity. The next lowest sand and gravel unit constitutes the main discharge toward the river. The bedrock unit has relatively low hydraulic conducti- vity, based on slug tests, and has a groundwater flow direction toward the Oswego River.

SITE HISTORY

From 1936 until 1960, the Fulton Terminals site was utilized by the Logan Long Shingle Company to manufacture asphalt and roofing materials. During these operations, asphalt was stored in aboveground tanks, and underground tanks were used for storing fuel oil. The underground tanks were abandoned in 1958 when the fuel source was converted from oil to gas. Logan Long discontinued its asphalt manufacturing process in 1960, and deeded the property to Cities Service Oil Company, which reportedly leased the site to other asphalt manufacturers.

In 1972, the site was purchased by Fulton Terminals, Inc., a subsidiary of Pollution Abatement Services, Inc. (PAS), a hazardous waste incineration facility in the City of Oswego, New York. The site was active from 1972 to 1977 as a staging and storage area for materials scheduled for incineration at the PAS facility in Oswego. From December 1977 to December 1978, Fulton Terminals leased Tank No. 1 to Inland Chemicals Corporation of Fort Wayne, Indiana.

In April 1981, NYSDEC was alerted to the fact that hazardous waste was present on-site. In May 1981, Fulton Terminals,Inc. was cited for not meeting federal and state standards for a hazardous waste storage facility. Subsequent to that citation, a cleanup was initiated by the principals of Fulton Terminals, which included sampling, emptying, dismantling, and removing four tanks (Nos. 2, 3, 4, and 7). The cleanup was terminated in March 1983, when the principals were fined by NYSDEC for using an unlicensed PCB handler. Tank samples affirmed the presence of hazardous waste, and PCBs were detected in surface soil samples.

The Fulton Terminals site was included on the National Priorities List in December 1982, and is currently ranked 515.

In August 1985, the US Environmental Protection Agency (EPA) and NYSDEC entered into a cooperative agreement, which provided funds for NYSDEC to perform a remedial investigation and feasibility study (RI/FS) at the site.

In September 1985, field work for the RI commenced. The work was conducted by NYSDEC's contractor, URS Company, Inc. (URS).

Subsequent to the start of the RI/FS, from June 1986 to May 1987, removal activities were undertaken by EPA and the potentially responsible parties (PRPs). These actions resulted in the securing of the site by the erection of a fence, the removal of the remaining tanks (Nos. 1, 5, 6, and 8) and the wastes con- tained in these tanks, and the removal of approximately 300 cubic yards of contaminated soil and tar-like waste. In addition, a storm sewer pipe which ran from the site to the Oswego River was partially removed, and the end was plugged in order to prevent the migration of contamination. At the present time, there are no above-ground and no below-ground containerized wastes remaining on-site.

The field work for the RI/FS was completed in March 1986. Subsequently, it was discovered that the holding times for all of the volatile analyses and many of the semi-volatile analyses had been exceeded by the laboratory. The results, therefore, were declared invalid. Resampling was performed in July 1986. An RI/FS report, based upon the new data, was completed in the summer of 1987. However, problems with the data were identified, and it was again declared invalid by NYSDEC.

EPA collected additional soil samples from the site in August and September 1987, to evaluate the need for additional removal activities.

Groundwater, surface water, and stream sediments were resampled by URS during January 1988. A revised RI/FS report based on this new data was completed by URS in February 1988. Based upon the results of the RI/FS report, EPA determined that the available data were not sufficient to fully characterize the contamination at the site. Ebasco Services Inc (Ebasco) was contracted by EPA in September 1988 to perform a supplemental RI/FS in order to complete the characterization of the contamination on-site and to determine the effects, if any, of the off-site transport of contamination into the adjacent Oswego River. Ebasco conducted the supplemental field investigation from January through March 1989. Versar, Inc. was contracted by EPA to conduct a Risk Assessment for the site. In July 1989, Ebasco's RI/FS report and Versar's risk assessment report were released to the public.

ENFORCEMENT HISTORY

Fulton Terminals, Inc was cited by NYSDEC in May 1981 for violations of standards governing hazardous waste storage facilities. On November 10, 1981, a consent order was entered into between NYSDEC and Fulton Terminals, Inc., requiring Fulton Terminals, Inc. to perform a partial cleanup of the site. The cleanup activity was halted in March 1983 when the principals of Fulton Terminals, Inc. were fined by NYSDEC for using an unlicensed PCB hauler during the cleanup.

In regard to the RI/FS at the site, EPA notified the PRPs by letter that they may be liable for the conditions at three NPL sites (Clothier Disposal, Fulton Terminals, and Volney Landfill). That letter also notified them that EPA intended to conduct investigations and corrective measures at the sites unless a responsible party volunteered to do such work. No responsible party volunteered to conduct the RI/FS. An EPA Action Memorandum approved on June 27, 1986 set forth a removal action for removal and disposal of the remaining on-site tanks and drums and the excavation and disposal of visibly contaminated soil.

On August 4, 1986 EPA issued notice letters for the removal action to Fulton PRPs. The Fulton PRPs then formed a steering committee in order to facilitate discussions amongst the parties and EPA.

On September 30, 1986, EPA issued two Administrative Orders for the conduct of removal actions (i.e. a consent order and a unilateral order). Pursuant to the Administrative Order on Consent, 65 PRPs at the Fulton Terminals site agreed to the removal and disposal of the tanks and their contents.

A second Administrative Order unilaterally ordered 7 PRPs who had declined to enter into the Consent Order to join with the consenting PRPs to perform the action required in the Consent Order and to perform other actions set forth in the Action Memorandum. The consenting PRPs performed the work as agreed under the consent order. However, only one of the non-consenting PRPs which were issued the Unilateral Order complied with it.

On September 28, 1987 EPA sent a demand letter to each of the PRPs requesting reimbursement of all costs that have been and will be incurred up to the issuance of the ROD. Discussions regarding the reimbursement of past costs were suspended pending the completion of the RI/FS and the issuance of a ROD for the site.

The PRPs were contacted through the steering committee in September 1988 and were asked whether they would be interested in undertaking the proposed sampling and preparation of a supplemental RI/FS report. An outline of the proposed work was sent to the PRP steering committee. On September 19, 1988, the PRPs informed EPA that they chose not to undertake the proposed work.

COMMUNITY PARTICIPATION

USEPA and NYSDEC have kept the local citizens advised throughout the Superfund process at the Fulton Terminals Site. In September 1988, EPA awarded a Technical Assistance Grant (TAG) to the Fulton Safe Drinking Water Action Committee for Environmental Concerns, Inc. (FSDWAC), a citizens' group, for the hiring of a technical advisor. FSDWAC hired a technical advisor in June 1989.

In June 1987, a public meeting was held to solicit comments on and to discuss the findings of the RI/FS report issued in June 1987 and the proposed remedy that was based on the data presented in that report. The data were later determined not to be valid. The supplemental RI/FS that was initiated by EPA in January 1989 and e Proposed Plan for the Fulton Terminals site were released for public comment in July 1989. A public comment period was held from July 7, 1989 through September 8, 1989. In addition, a public meeting was held on July 26, 1989, to discuss and receive comments on the Supplemental RI/FS and the Proposed Plan. Questions raised at the public meeting and letters received and their corresponding responses are summarized in the Responsiveness Summary, which is part of this Record of Decision.

SCOPE AND ROLE OF RESPONSE ACTION

Prior cleanup actions by the State, EPA and the PRPs have already addressed most of the contamination at the Fulton Terminals site. These actions have resulted in the removal of all above-ground and underground tanks and of 300 cubic yards of contaminated soil. The low levels of soil contamination remaining at the site have been found to present minimal risk to human health.

This remedy considers the fact that the most mobile soil contaminants at the southwestern portion of the site have been released into the groundwater, through rain water infiltration, and that a plume of contaminated groundwater, which currently exceeds State and Federal groundwater quality standards, poses a risk of off-site migration of contaminants to the nearby Oswego River.

The selected remedy addresses the contaminated soils in the southwestern portion of the site and the contaminated groundwater underlying the site. The treatment of soils to remove the most mobile wastes will result in the elimination of a long-term source of groundwater contamination, and it will mitigate the risks to public health and the environment associated with the migration of those contaminants off-site. The selected remedy mitigates those risks by removing the most mobile wastes from the soil, leaving only the less mobile organic and metal compounds in the soil to be placed back into the excavated area (provided that the treated soil has passed the TCLP toxicity test). In addition, the selected remedy achieves federal and state groundwater quality standards for the organic contaminants by providing the required contami- nant removal during treatment of the groundwater utilizing air stripping and carbon adsorption.

The purpose of this response is to ensure protection of the groundwater and surface water from the continued release of contaminants from soil, and to restore the groundwater to levels consistent with state and federal water quality standards. This will be the final response action for this site.

SUMMARY OF SITE CHARACTERISTICS

Eight storage tanks, including five above-ground, one partially above-ground, and two below ground, were known to have been used to store hazardous wastes at the Fulton Terminals site from 1972 to 1977, when the site was used as a staging and storage area for materials scheduled for incineration at the PAS facility in Oswego, New York. Leakage and spillage from these tanks appear to have been the primary source of contamination at the site. The tanks and their contents were removed by the PRPs under EPA oversight in the period from 1981 to 1986. Three hundred cubic yards of visibly-contaminated surface soil were also removed from the site during that same period.

Analyses of soil, groundwater, sediment, and surface water from the site and adjacent areas indicate that the majority of the contamination remaining at the site is concentrated in the soil in the southwestern portion of the site and in the underlying sand and gravel aquifer.

Tables 1, 2, and 3 summarize the range and the maximum contaminants for the soil, groundwater, and surface water/sediment, respectively.

SOIL

The characterization of the soil contamination is based upon 79 soil samples collected from 36 locations in August and September 1987 and in January and February 1989. These samples were analyzed for the full range of compounds specified in the target compounds list (TCL).

Volatile organic contamination in the soil including trichloroethene, vinyl chloride, benzene, xylene, and trans-1,2-dichloroethene is concentrated at the southwest corner of the site. High contaminant levels were detected at the surface and extended to about 8 to 10 feet below ground surface. The locations of soil samples with volatile organic contaminants are depicted in Figure 2. The maximum volatile organic concentration (309 mg/kg) was detected at sample location U3 at 0-2 feet. Volatile compounds present included xylene (99 mg/kg), styrene (79 mg/kg), trichloroethene (44 mg/kg), ethylbenzene (40 mg/kg) and toluene (20 mg/kg). The second highest concentration of total volatile organics (TVOs) was 240 mg/kg, and it occurred at sampling location SB-14 at a depth of 2-4 feet. The sample was composed entirely of xylene. High concentrations of TVOs were also detected in locations SB-6 (64 mg/kg), SB-7 (121 mg/kg), and U2 (26 mg/kg). All of the above locations coincided with or were in the proximity of the former locations of above-ground tank nos 1, 2, and 3.

contamination at SB-14 was 31 mg/kg, and it was found at a depth of 2-4 feet. The concentration of semi-volatile organics at SB-10 was also 31 mg/kg, and it occurred at 8-10 feet. The primary constituents of semi-volatile contamination at location SB-14 were 2-methylnaphthalene (15 mg/kg) and naphthalene (9.4 mg/kg). Primary semi-volatile constituents at location SB-10 included pyrene (16 mg/kg) and phenanthrene (10 mg/kg). Carcinogenic Polynuclear Aromatic Hydrocarbons (CPAHs) were also detected throughout the site and at concentrations comparable to those at off-site sampling locations (SB-25 and SB-27). The maximum concentration of 10 mg/kg occurred at 6-8 feet at SB-3, which also had volatile organics present, and lies within the primary area of soil contamination in the southwestern portion of the site. SB-10, which had the maximum total semi-volatile concentration, had only 0.8 mg/kg CPAHs. Figure 3 depicts the total concentrations of CPAHs and pyrene.

Heavy metal (inorganic) concentrations were generally low and well within the typical values for soil reported for the eastern region of the United States.

GROUNDWATER

Groundwater samples were collected in February and March 1989 from 21 monitoring wells installed on and adjacent to the site. Ten of these wells had also been sampled previously during January 1988. All groundwater samples from both rounds of sampling were subjected to complete TCL analyses.

Volatile organic contaminants were detected in 15 of 21 wells (see Figure 4) predominantly in the shallow aquifer (till, silt and clay, and sand and gravel units).

The highest total volatile organic contamination (17,672 ug/l) in groundwater occurred at Well EBMW-3D, screened in the sand and gravel unit. The primary constituents were cis-1,2-dichloroethene (14,387 ug/l), trichloroethene (2,388 ug/l) 1,1,1-trichloroethane (113 ug/l), vinyl chloride (88 ug/l) and 1,1-dichloroethene (50 ug/l). This well is located at the former location of Tank No. 1, and approximately 20 feet from soil boring SB-6, which had the second highest TVO concentration for soil on-site, and was composed of the same constituents as well EBMW-3D.

The second highest concentration of TVOs (1,621 ug/l) occurred at well FBW-6. Compounds detected included ethylbenzene (432 ug/l), benzene (423 ug/l), chlorobenzene (162 ug/l), and toluene (65 ug/l). Well FBW-6 was screened from 6-10 feet across the structural fill and the silt and clay unit. All other wells showed much lower volatile organic contamination.

Several volatile organic compounds (benzene, ethyl-benzene, and xylene) were also detected in upgradient wells, which is indicative of the existence of other sources contributing to the groundwater contamination at the site.

Specifically, benzene was detected in three shallow aquifer upgradient wells (FSW-1S, EBMW-6S, and EBMW-6D) at concentrations exceeding groundwater quality standards, and ranging from 10 ug/l to 88 ug/l. Upgradient xylene and ethylbenzene concentrations were 106 and 85 ug/l (EBMW-6S), and 88 and 56 ug/l (EBMW-6D), respectively.

Semi-volatile organic contaminants were detected in the groundwater both on-site and off-site, but at low concentrations. The maximum concentration of total semi-volatile organics was 109 ug/l and it was detected in on-site Well FBW-6. Semi-volatile compounds present at FBW-6 included naphthalene (92 ug/l), and 1,2-dichlorobenzene (11 ug/l). Of the semi-volatile organics only 1,2-dichlorobenzene exceeds New York State Groundwater Quality Standards (4.7 ug/l).

Heavy metals were detected in the groundwater at concentrations exceeding groundwater quality standards both at on-site and off-site wells. Metals exceeding groundwater standards included arsenic, barium, cadmium, chromium and lead. The maximum concentrations detected for on-site wells, upgradient wells, and off-site wells are tabulated below. All concentrations are reported in ug/kg (ppb).

	On-Site (Conc./Well No.)	Upgradient (Conc./Well No.)	Off-Site (Conc./Well No.)
Arsenic	48.1/FBW-6	58.2/FBW-1S	19.5/FBW-4S
Barium	2700/FBW-6	11,200/FBW-1D	21,100/FBW-4D
Cadmium	21.4/EBMW-2	60.1/FBW-1D	5.1/FBW-4S
Lead	241/FBW-3	364/FBW-1S	54.1/EBMW-7
Nickel	259/EBMW-5	2,500/FBW-1D	1,190/FBW-4D
Chromium	149/FBW-3	10,800/FBW-1D	1,690/FBW-4S

The above table indicates that metal concentrations in the groundwater surrounding the site are higher than the metal concentrations in the groundwater underlying the site, in different hydrologic units. Therefore, it appears that the metals in the groundwater in the area may be naturally occurring. According to the Oswego County Health Department, four municipal wells, located outside the influence of the site adjacent to the Oswego River, recently taken out of service had shown elevated levels of metals that have been attributed to the naturally high levels of the metals in the lodgement till.

SURFACE WATER AND SEDIMENT

Surface water and sediment samples were taken from a total of 7 locations shown on Figure 5. The sampling locations were upstream, adjacent to and downstream from the Fulton Terminals site. All surface water and sediment samples were subjected to complete TCL analyses.

The surface water samples collected were virtually free of TCL organic contaminants. Heavy metals were detected at uniformly low levels upstream, adjacent to and downstream from the site.

Sediment samples were collected from the same locations as the surface water samples. No volatile organic contaminants were detected in the sediment. Seventeen semi-volatile compounds were detected at similar concentrations upgradient (FSS-1) and, adjacent to the site (FSS-2, and SD-3). The maximum total semi-volatile organics concentration, 9.2 mg/kg, occurred at location SD-3 adjacent to the site. The total semi-volatile organics concentration at the upgradient sediment location was 7.7 mg/kg.

Inorganic concentrations were not elevated in the locations adjacent to the site, as would be expected if the occurrence of semi-volatiles was attributed to the washing of sediment from the site. The semi-volatiles, therefore, are believed to be attributed to activities along the banks of the canal (where a loading dock was utilized for the asphalt manufacturing process), rather than to sediment transport from the site.

SUMMARY OF SITE RISKS

Organic chemicals at the Fulton Terminals site, that were apparently released through spillage and leakage of waste chemicals stored in above- and below-ground tanks, have contaminated the soil and the groundwater underlying the site. Predominant transport routes identified for the migration of those contaminants to other environmental media include: 1) volatilization of the volatile organic compounds from the soil and subsequent releases (emissions) to air; 2) movement through soils (percolation) to groundwater; 3) release to surface water, in the Oswego River adjacent to the site, through discharge of the contaminated groundwater; and 4) surface runoff of soil contaminants to the Oswego River.

CONTAMINANT IDENTIFICATION

The risk assessment for the Fulton Terminals site has identified 10 contaminants of concern. These include four non-carcinogenic and 6 carcinogenic compounds. These compounds or elements were selected because of their highly toxic effects, potentially critical exposure routes, and higher concentrations present in comparison to other contaminants. The indicator chemicals chosen for this study were:

Noncarcinogens	Carcinogens
chlorobenzene	pyrene
1, 2-dichloroethene	benzene
barium	trichloroethene
methylisobutylketone	vinyl chloride
	arsenic
	nickel

The volatile organic compounds were selected because of the frequency of occurrence of these compounds in soils and groundwater, and their toxic effects. Comparison of metals concentrations in soil at the Fulton Terminals site to that of regional averages (see Table 4) shows no appreciable differences. However, arsenic, nickel, and barium were included to address any potential public concerns that may be expressed due to arsenic's high carcinogenic potency factor and the prevalence, concentration, and relative toxicity of nickel and barium. Pyrene was included based on historical operations at the Fulton Terminals site (roofing and asphalt work) that may have contributed to site contamination and also due to its relatively high concentration and toxic effects.

All of the contaminants of concern were detected in both the soil and the groundwater with the exception of pyrene that was detected only in soil. The concentrations of the contaminants of concern on which the risk assessment was based are shown on Tables 5 and 6. The concentrations used for soil are the geometric mean of the surface soil contaminant concentrations. The groundwater concentrations represent contaminant concentrations in groundwater discharging into the Oswego River, and they were estimated from actual well concentrations using a model. Direct ingestion exposure to contaminated groundwater is not expected at the site.

EXPOSURE ASSESSMENT

The following potential exposure routes were identified for the Fulton Terminals site:

(1) Direct contact (ingestion) with contaminated soil at the site;

(2) Direct contact (dermal) with contaminated surface water during recreational uses (swimming, boating, fishing) of the Oswego River;

(3) Ingestion of contaminated surface water and fish during recreational use of the Oswego River; and

(4) Inhalation of volatile organics emitted from contaminated soils at the site.

Dermal absorption of contaminants through direct contact with soil is expected to be negligible due to the properties (high partition coefficients) of the site contaminants that favor retention of the contaminants by the soil particles rather than desorption and active transport across the skin barrier.

With regard to the groundwater, the principal concern for exposure stems from the discharge of the contaminated water underlying the site into the Oswego River. No ingestion exposures were identified for groundwater users near the Fulton Terminals s ite. The city of Fulton's water supply source is derived from wells south of the city limits (Great Bear Wells) and augmented by lake water piped in from Lake Ontario which is not expected to be influenced by any groundwater contamination from the Fulton Terminals site.

Soil

Exposures through direct contact (ingestion) with soil are expected to be minor as the site is fenced and secure from unauthorized entry. The exposure scenario developed for the risk assessment, however, is a worst case scenario that assumes free access to the site by neighborhood children.

Mean contaminant concentrations in shallow soil samples of 0 to 2 feet (Table 5) were used to calculate direct contact exposures. Thirty-six samples comprise the population of surface soil samples. Each sample concentration was given equal weight in the determination of mean contaminant concentration.

Surface Water (Oswego River)

Two distinct exposure routes were identified related to contaminants that migrate to the Oswego River. Dermal exposures may occur to individuals who use the river for recreation. Ingestion exposures may occur to those consuming fish from the river. Contaminants are generally sorbed onto soil particles at the soil surface or they exist in a dissolved state around soil particles. During rainfall events, these soil particles are conveyed by runoff streams from the Fulton Terminals site into the Oswego River.

The amount of contaminants that will be conveyed to the Oswego River from the Fulton Terminals site during a runoff event, both in suspended form (PX) and in dissolved form (PQ), have been estimated using a model and are shown below.

CALCULATION OF SORBED AND DISSOLVED CONTAMINANT LOADS TO OSWEGO RIVER FROM SURFACE WATER RUNOFF

Contaminant	PX (kg)	PQ (kg)
arsenic	4.82E-06	3.28E-07
barium	9.44E-08	9.00E-07
benzene	7.08E-09	2.97E-00
chlorobenzene	8.62E-09	8.39E-07
1, 2-dichloroethene (total)	5.16E-09	3.07E-06
4-methyl-2-pentanone (MIKB)	9.51E-09	1.58E-05
nickel	1.17E-08	6.90E-08
pyrene	1.82E-07	1.54E-07
trichloroethene	8.46E-09	2.16E-06
vinyl chloride	9.83E-09	5.54E-06

The transport of contaminants to the Oswego River through discharge of the contaminated groundwater underlying the Fulton Terminals site has also been estimated using a model that relies on the concentration of contaminants measured in the monitoring wells. The loading of contaminants to the Oswego River through groundwater discharge is shown in Table 6.

Air

Volatile organic compounds found in the soil at Fulton Terminals are expected to volatilize, that is evaporate to the atmosphere. The risk assessment has estimated releases (emission rates) of the organic contaminants of concern by using weighted average concentrations of the volatiles for areas exhibiting soil contamination above 0.8 mg/kg. This value was chosen because areas with less than 0.8 mg/kg were too discontinuous and separated to be representative of overall contamination.

Emission rates for the 5 chemicals of concern most likely to evaporate to the atmosphere were estimated for short-term and long-term exposures ranging from 10 days to 365 days (short-term) and 70 year (long-term), as shown in Table 7.

Populations potentially exposed at the Fulton Terminals site include recreational users of the Oswego River near the site and neighborhood children trespassing on to the site.

Total body burden rates were computed based on all potential exposure routes using an average body mass of 70 kg (adult) or 10 kg (child), an inhalation rate of 22.0 cubic meters/day, and an average 70-year lifetime. It was assumed that dermal exposures (swimming, wading, etc.) would occur in 20 out of the 70-year average lifetime, while ingestion exposures (fishing) would occur in 40 out of an average 70-year lifetime. Estimated short- and long-term time-weighted average daily doses for each chemical subchronic oral intake ranged from 4.68E mg/kg/day (chlorobenzene) to 2.22E-03 mg/kg/day (barium). Subchronic intake levels for inhaled toxic substances were lower, ranging from 1.57E-08 mg/kg/day (chlorobenzene) to 9.59E-08 mg/kg/day (trichloroethene).

TOXICITY ASSESSMENT SUMMARY

Cancer potency factors (CPFs) have been developed by EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CPF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Cancer potency factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help ensure that the

RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

The cancer potency factors and the RFDS for the contaminants of concern at the Fulton Terminals site are listed in Table 8.

RISK CHARACTERIZATION SUMMARY

Risk characterization for the Fulton Terminals site included an assessment of risk associated with exposures to noncarcinogens and carcinogens. Noncarcinogenic risks were assessed using a hazard index computed from expected daily intake levels (subchronic and chronic) and reference levels (representing acceptable intakes). Hazard index scores of 5.05E-02 (subchronic) and 1.34E-04 (chronic) were obtained. The hazard index scores are well below unity indicating a negligible noncarcinogenic health impact.

Potential carcinogenic risks were computed by multiplying chronic (long-term) intake levels by a respective carcinogenic potency factor. The cumulative upper bound excess lifetime risk for all carcinogens (all routes) was 2.35E-07. The highest risk computed for a given chemical (arsenic) was 1.72E-07, all derived from oral exposures (predominately from ingestion of contaminated soil).

The quantified carcinogenic risks for each contaminant of concern as well as the combined carcinogenic risks for all contaminants of concern for the major exposure routes (inhalation and ingestion) at Fulton Terminals are presented in Table 9.

The potential for noncarcinogenic effects for each contaminant of concern and the combined potential for noncarcinogenic effects as expressed by hazard indices (HI) are presented in Tables 10 and 11.

Excess lifetime cancer risks are probabilities that are generally expressed in scientific notation (e.g., 1x10 or 1.0 E-06). An excess lifetime cancer risk of 1.0E-06 indicates that, as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at a site.

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ) (or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminant's reference dose). By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the Hazard Index (HI) can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media.

The context within which to judge the relative risk from each of the pathways has been established by EPA. For carcinogens, the target risk range is a E-07 to E-04 excess lifetime cancer risk. For noncarcinogens, where the sum of expected dose/Rfd ratios exceeds unity (1.0), observed concentrations pose unacceptable risks of exposure.

For the Fulton Terminals site, the upper-bound risk from potential carcinogens was calculated to be 2.35E-07. Therefore, the existing site condition is already at the lower limit of the acceptable risk range. Both the chronic and sub-chronic hazard indices were less than unity, which implies that daily intake of the noncarcinogenic contaminants would not present any adverse effects to human health. Therefore, the site poses minimal threat to human health.

Environmental impacts overall are expected to be minimal; however, localized impacts are expected in stream bed sediments because of the presence of several semi-volatile organic com- pounds. These compounds may directly impact benthic organisms (predominantly invertebrate species). Estimated (modeled) contaminant concentrations in the Oswego River were well below all acute toxicity criteria for fresh water.

CLEANUP LEVELS FOR THE CONTAMINATED MEDIA

Groundwater

The groundwater at the Fulton Terminals site was classified by New York State as class "GA", which indicates that the water is suitable as a drinking water supply. The RI has determined that contaminants from the site have contaminated the on-site groundwater. A plume of contaminated groundwater presents a risk of off-site migration of contaminants to the nearby Oswego River. The remedial response objectives therefore include the following:

- ensure protection of groundwater and surface water from the continued release of contaminants from soils; and

- restore groundwater to levels consistent with state and federal water quality standards.

Several federal and New York State standards regarding the quality of groundwater suitable for drinking are listed in Table 12. A comparison of the concentrations of the contaminants of concern in the groundwater to these standards reveals that most volatile organic compounds exceed the regulatory concentrations. As a result, the groundwater cleanup levels should meet the most stringent of the federal and state standards listed in Table 12.

However, benzene, ethyl benzene and xylene may exceed drinking water standards at the end of the remediation, since they were detected at higher concentrations in off site upgradient wells. If this is the case, a separate investigation will be undertaken by NYSDEC to define and eliminate the source of the upgradient contamination, and to treat the groundwater, if required, to meet drinking water standards.

Many of the metal concentrations in the groundwater at Fulton Terminals exceed both Federal Safe Drinking Water Act maximum Contaminant Levels (MCLs) and New York State drinking water standards. Upgradient and off-site groundwater samples were obtained and analyzed for the same contaminants. The following is a tabulation of the maximum concentration detected from site, upgradient, and off-site samples for selected metals. However, the values for each parameter are not necessarily from the same hydrologic unit.

Metal	Site (ppb)	Upgradient (ppb)	Off-Site (ppb)
Arsenic	48.1	58.2	19.5
Barium	2,700	11,200	21,100
Cadmium	21.4	60.1	5.1
Chromium	149	10,800	1690
Lead	241	364	54.1
Nickel	259	2,500	1,190

The above table shows the occurrence of high metal concentrations in the groundwater throughout the area surrounding the site and in wells outside the influence of the site which seems to indicate that these metals are naturally occurring.

Soil

In order to remediate the groundwater, it is necessary to remediate volatile organic contaminants detected in the soil. The contaminants must be remediated to concentrations where leaching into groundwater will result in levels below MCLs.

The most mobile of the contaminants of concern (the volatile organic compounds) were used to calculate soil cleanup levels. Xylene was also included in the cleanup calculations since it was detected at high levels in the area around borehole SB-14.

Pyrene, arsenic, barium, and nickel were also used as contaminants of concern for the risk assessment. Pyrene is relatively immobile compared to volatile organics and was not detected in any of groundwater samples. Arsenic, barium, and nickel were all found to be present in groundwater samples. However, these inorganics are widespread on-site and off-site with concentration ranges within the typical values of the eastern United States. Therefore,

cleanup levels for pyrene, arsenic, barium, and nickel are not warranted.

Cleanup calculations assumed that eight inches per year of rainwater will percolate through the contaminated zone and will mix with the groundwater. A dilution factor is calculated from the mixing with groundwater. To meet the applicable or relevant and appropriate federal and state requirements (ARARs) the soil cleanup levels would be:

DCE	1 ppm
TCE	2 ppm
Benzene	1.4 ppm
Vinyl Chloride	0.4 ppm
Xylene (total)	8 ppm
Chlorobenzene	5.5 ppm
MIBK	2.5 ppm

The soil cleanup levels were compared to the contaminant concentrations identified in each soil boring sample. Any samples with contaminant concentrations below the cleanup levels are considered clean.

It should be noted that these cleanup levels were calculated based on an estimated area of contamination. The soil cleanup levels will be recalculated during the remedial design, after the boundaries of contamination in the southwestern portion of the site have been more precisely defined by additional sampling. Futhermore, the extent of contamination in the northeastern portion of the site will be defined by additional sampling between soil borings U4 and U6, where xylene was detected at 8.8 and 3.8 mg/kg, respectively, and the surrounding clean borings.

The depth of contamination varies with each borehole. For a conservative estimate, it is assumed that contamination has reached the groundwater table, which is approximately twelve feet deep within this area. For source control remediation, it is not necessary to excavate and remediate the soil below the water table, as any contaminated soil below the water table will be remediated by the groundwater alternative. Therefore, the depth of contamination for the source control remedy will be defined as twelve feet below the ground surface. Using the same criteria, the depth of contamination at boring SB-14 is defined as approximately eight feet below the surface. The approximate volume of contaminated soils above the soil cleanup levels at the Fulton Terminals site is 4,000 cubic yards.

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DOCUMENTATION OF SIGNIFICANT CHANGES

There are no significant changes from the preferred alternative presented in the Proposed Plan.

DESCRIPTION OF ALTERNATIVES

All the above ground and underground storage tanks and approximately 300 cubic yards of visibly-contaminated surficial soil have been removed from the site. The levels of soil contamination on-site present risk levels which are within EPA's acceptable range. However, contaminants remaining at the site have contaminated the underlying groundwater exceeding federal and state groundwater quality standards. Specifically, a source of soil contamination at the southwestern portion of the site is releasing organic contaminants into the groundwater through rainwater infiltration, and a plume of contaminated groundwater exceeds ARAR and poses a risk of off-site migration of contami- nants to the nearby Oswego River. The alternatives described below address the remaining soil contamination at the site and the contamination in the groundwater underlying the site.

A total of seven alternatives were evaluated in detail for remediating the site. Four remedial alternatives address the contaminated soils that contribute to groundwater contamination at the Fulton Terminals site. In addition, three alternatives address the contamination in the groundwater beneath the site. These alternatives are as follows:

Soil Alternatives

Alternative SC-1: No Action

The Superfund program requires that the "no-action" alternative be considered at every site. Under this alternative, EPA would take no further action to control the source of contamination. However, long-term monitoring of the site (for a minimum period of 30 years) would be necessary to evaluate the performance of SC-1, and to monitor contaminant migration. Monitoring would consist of annual soil, sediment, and surface water sampling and analyses for a variety of contaminants. Samples would be analyzed for Target Compound List parameters. Finally, the 6-foot high chainlink fence that was installed around the site will be retained.

Because this alternative would result in contaminants remainig on-site, CERCLA requires that the site be reviewed every five years. If justified by the review, remedial actions might be implemented at that time to remove or treat wastes. The estimated present worth cost for this alternative is $342,000.

Alternative SC-2: Excavation and Disposal

This alternative involves excavating the contaminated soil down to the water table, placing it in trucks and disposing of the material in a Resource Conservation and Recovery Act (RCRA) authorized hazardous waste landfill.

The approximate area of contaminated soil that would be excavated is shown in Figure 6. The contaminated areas consist of two circles, one with a 100-foot diameter surrounding borings SB-6, SB-7, U2, and U3 and another with a 50-foot diameter surrounding boring SB-14 in the vicinity of the removed Tanks Nos. 1, 2, and 3. Contaminated soils were found at depths ranging from 0 to 2 feet at the eastern boundary of the excavation area to depths of 6-8 feet at the southwestern boundary. Additionally, the areas surrounding soil borings U4 and U6 might have to be excavated, if the contamination in these areas exceeds the recalculated cleanup levels, as stated on page 20.

Prior to the excavation of site soils, a field investigation would be performed to delineate areas of contamination within the cleanup goals. This investigation will focus in defining the exact boundaries of contaminated soil in the southwestern portion of the site. Approximately 4,000 cubic yards (CY) of soil is estimated to be contaminated with volatile and semi-volatile organics and would be excavated and then transported to an off-site RCRA-permitted landfill for disposal.

RCRA manifest requirements, under 40 CFR 262 and 263, must be complied with for all wastes shipped off-site. Effective November 8, 1990, VOC-contaminated soil and debris resulting from a response action taken under Section 104 or 106 of CERCLA or a corrective action required under Subtitle C of RCRA are prohibited from land disposal without treatment. Until that date, these wastes may be disposed in a landfill only if such a unit is in compliance with the requirements specified in 40 CFR 268.5(h)(2). In addition, a treatability variance for soil and debris must be obtained from EPA under 40 CFR 268.44. To obtain a site-specific treatability variance, it must be shown that the waste is a contaminated soil and debris and the current treatment standards for contaminants detected in soil and debris cannot be met or the treatment technology upon which the current standards are based is not appropriate. In order to gain administrative approval of this alternative, the remedial action must be implemented and completed prior to November 8, 1990 deadline.

Upon completion of the excavation, all excavated areas would be backfilled with clean fill, a one-foot layer of purchased clean top soil would be placed on the site, the site would be regraded to promote drainage, and it would be revegetated to prevent erosion.

The excavation of contaminated soil and subsequent disposal in a RCRA landfill would significantly decrease the risks to public health and the environment associated with leaching of contaminants into groundwater. The estimated present worth cost for this alternative is $2,927,000. The estimated time to implement the alternative is approximately 15 months.

Alternative SC-3: Low Temperature Thermal Extraction

This alternative involves the excavation and on-site treatment of approximately 4,000 CY of contaminated soils by low temperature thermal treatment. The excavated soil would be fed to a mobile thermal treatment unit brought to the site, where hot air injected at a temperature above the boiling points of the organic contaminants of concern would allow the moisture and the organic contaminants to be volatilized into gases and escape from the soil. The organic vapor extracted from the soil would then be treated in an air pollution control unit to ensure acceptable air quality emmisions. Several thermal treatment methods (such as heated screw conveyors, rotary calcination devices etc.) may be applicable. A variety of air pollution control options are also available, including after- burners, activated carbon absorbers, and condensers. The specific type of the thermal treatment method and of the air pollution control would be determined in the Remedial Design phase through engineering design and analysis and the competitive bidding process.

All the residuals from the treatment (such as spent carbon from the carbon adsorption units) would be sent to an off-site hazardous waste facility for treatment and disposal. Air pollution control systems would be an integral part of the treatment plant to limit emissions to within the regulatory requirements. The treated soils would be replaced into the excavated areas from which they were removed, one-foot of clean top soil would be placed on the site, and the site would be regraded and revegetated to prevent soil erosion.

Long-term monitoring is not required with Alternative SC-3 since contaminated soils would be successfully treated. The contaminated soils are currently exempt from the RCRA Land Disposal Restrictions until November 8, 1990. However, the existing data indicated that the treatment process would meet the regulations even if they were applicable. Since all contaminated soil above the cleanup level would be treated, it is expected that clean closure of the site would be achieved.

At the completion of the implementation of this alternative, the most mobile of the organic contaminants in the soil would be reduced to concentrations that would result in groundwater levels below the federal and state standards when leached to the groundwater through rainwater infiltration. The estimated present worth cost of this alternative is $1,847,000. The estimated time to implement this alternative is approximately 18 months.

Alternative SC-4: Off-Site Incineration

This alternative involves excavation of the contaminated soil and transportation to a permitted off-site incinerator for treatment and disposal. The facility would include a landfill for disposal of treated soil.

Following excavation, the contaminated materials would be placed into 20 cubic yard trucks for shipment. The loaded trucks would proceed to the nearest available incinerator permitted to receive bulk solid wastes. The receiving facility would be responsible for proper disposal of the incinerator ash. Clean fill would be used to backfill the excavation area, one foot of top soil would be placed on the site, and the site would be regraded and revegetated. No long-term monitoring would be required.

The recently promulgated RCRA land disposal restrictions have been considered during evaluation of SC-4 since the treated soil would be disposed at the incinerator operator's landfill. These regulations, to be phased in over the next several years, require hazardous wastes to be treated to the best demonstrated available technology (BDAT) before being placed or replaced on the land. Incineration of the contaminated soil should meet proposed land ban requirements.

The estimated present worth cost for this alternative is $11,303,000. The estimated time for the implementation of this alternative is 15 months.

Groundwater Alternatives

Alternative MM-1: No Action

This alternative includes the use of 18 existing wells to conduct a long-term monitoring program. The program would monitor the groundwater underlying the site for a period of 30 years to evaluate changes in contaminant concentrations and the migration of contaminants and to assess the need for future remediation. The groundwater would be analyzed for TCL organic compounds. This alternative would also require a five-year review because the contaminants would remain on site. The estimated total present worth cost for this alternative would be $571,000.

Alternative MM-2: Air Stripping and Carbon Adsorption

Under this alternative, a well system would be installed at the site to withdraw contaminated groundwater, treat it on-site by air stripping and carbon adsorption, and reinject the treated water into the ground. Groundwater would be removed from the sand and gravel unit by extraction wells located at the center of the contaminated area and it would enter the air stripper which would be designed to strip out the volatile organic contaminants (VOCs).

The air and VOC mixture exiting the air stripper would then be treated by a vapor phase carbon adsorption unit for the removal of the stripped VOCs. The clean air would be emitted to the atmosphere. The air-stripped groundwater, which may contain some contaminants would be processed through liquid phase carbon adsorbers. The treated groundwater would be directed to a reinjection system. The number of extraction wells and their locations as well as the type of reinjection system would be determined during the Design Phase. Should the pumping tests, conducted during the remedial design, reveal that the treated groundwater can not be reinjected into the soil (i.e. due to low hydraulic conductivity in the silt and clay layer) an alternate recharge technique would be used. Also, the spent carbon in the carbon adsorption unit would be removed for off-site regenera- tion or incineration, thus destroying all organic contaminants.

Environmental monitoring would be required during the life of the treatment process. In addition, monitoring of the groundwater at the site would be conducted for a period of 3 years after completion of the remediation, to ensure that the goals of the remedial action have been meet.

Groundwater would be treated to drinking water standards before reinjection. The discharges from the air stripper would meet the requirements of 52 FR 3748, 6NYCRR 201,211 and 212, and Air Guide -1. The residues resulting from the treatment system include filtered suspended solids (precipitated metallic hydroxides and fine particles) and spent carbon. It is estimated that about 200 pounds per day of solids would be shipped to an off-site RCRA facility for treatment and disposal.

At the completion of this remedial alternative, the organic contaminants found in groundwater would meet groundwater quality standards, and the migration of those contaminants to the Oswego River would be prevented.

The present worth cost for this alternative is estimated to be $2,184,000. The time required to complete the implementation of this alternative (from design to complete aquifer remediation) is estimated to be approximately 4 years. The remedial action undertaken by the source control (soil) alternative, though, may affect the time needed for the groundwater remediation.

Alternative MM-3: UV/Oxidation

This alternative consists of groundwater extraction, on-site treatment of the extracted groundwater, and reinjection of the treated water into the ground using the same system described under Alternative MM-2. The treatment process, however, uses both ozone and hydrogen peroxide as the oxidizing agents to destroy the VOCs in the groundwater. Specifically, the contaminated groundwater would be mixed with hydrogen peroxide, after pretreatment (precipitation/filtration) to reduce the suspended solids content, and then fed to the UV/oxidation reactor to react with ozone gas. In this reaction, the ozone oxidizes the VOCs to final products of carbon dioxide, water and chlorine while the ultraviolet (UV) light accelerates the degradation process. The treated groundwater would be reinjected into the ground and the off-gas, together with excess ozone, would be directed to the catalytic ozone decomposer for destruction of the ozone, before being emitted to the atmosphere.

Based on the groundwater analysis, a total of 27 pounds/day of carbon dioxide and 34 pounds/day of chlorine gas would be produced from the volatiles present in the groundwater and would be discharged to the environment dissolved in the treated water. These gases would not pose any potential health risks in such dilute concentrations. The groundwater would be treated to drinking water standards before reinjection.

The pretreatment residues, which are mostly metallic oxides such as iron oxide, and amount to about 200 lbs/day, would be disposed of off-site in a RCRA landfill.

Based on past performances, the overall removal of the VOC contaminants in groundwater was estimated and the results are summarized and presented in Table 13. The actual performance of the UV/oxidation treatment process must be substantiated by pilot testing and full scale application at the site.

This alternative would reduce the level of most organic contaminants in the groundwater to levels below the federal and state standards. However, one of the contaminants of concern (4-methyl-2-pentanone) cannot be treated effectively by this alternative, unless the UV groundwater treatment system is augmented by liquid carbon adsorption for treatment of the groundwater prior to reinjection.

The estimated present worth cost for this alternative is $1,861,000. The time estimated for completion of this alternative (from design to complete aquifer remediation) is approximately 4 years.

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

During the detailed evaluation of remedial alternatives, each alternative is assessed against nine evaluation criteria, namely short-term effectiveness, long-term effectiveness and permanence, reduction of toxicity, mobility or volume, implementability, cost, compliance with ARARs, overall protection of human health and the environment, state acceptance and community acceptance.

Each criterion will be briefly addressed, in order, with respect to the alternatives for both soil and groundwater.

Soil

A. Short-Term Effectiveness

All alternatives, with the exception of the no-action alternative, include activities such as contaminated soil excavation and transport that could result in potential exposure of residents to volatilized contaminants and contaminated dust. However, mitigative measures to reduce the probability of exposure would be implemented. In addition to excavation, Alternatives SC-2 and SC-4 include off-site transport and disposal of contaminated soils.

Alternative SC-3 provides treatment on-site, thereby reducing potential risks to residents along transportation routes.

Alternatives SC-2, SC-3, and SC-4 would result in worker exposure to volatilized contaminants and dermal contact with contaminated soils during waste excavation and handling. In addition, Alternative SC-3 might result in low-level emissions exposure from the on-site treatment unit. The threat to on-site workers, however, would be mitigated through the use of protection equipment and the control of emissions would be accomplished by emissions treatment. Additionally, scrubber wastewater would require removal and treatment prior to complete demobilization from the site.

All of the alternatives (with the exception of SC-1 which requires no action) could be implemented within a period of 1 1/2 to 2 years.

B. Long-Term Effectiveness and Permanence

Alternative SC-3 would effectively treat the most mobile wastes in on-site soil, thus permanently removing the source of ground- water contamination. Alternatives SC-2 and SC-4 would also provide a high degree of effectiveness, since the contaminated soil would be removed from the site. In contrast, under Alternative SC-1, the contaminants would be left untreated in the soil and a long-term monitoring program will be implemented to determine if the contamination was migrating from the site.

C. Reduction of Toxicity, Mobility or Volume

Alternative SC -3 and Alternative SC-4 would result in significant reductions in the toxicity, mobility, or volume of the treated material. Material toxicity would be reduced by thermal destruction of VOCs and semi-volatile organics.

Alternative SC-2 would provide a reduction in contaminant mobility at the site, but no reduction in toxicity or volume. The reduction in mobility would reduce the ability for contaminants to move toward the groundwater.

Alternative SC-1 would provide no reduction in toxicity, mobility, or volume.

D. Implementability

All of the alternatives would utilize relatively common construction equipment and materials. Little construction difficulty would be encountered with any of the alternatives.

The technologies proposed for use in the alternatives are proven and reliable in achieving the specified process efficiencies and performance goals. Low temperature thermal extraction, the selected remedy, has been successfully pilot tested and has performed on full-scale basis with similar organic contaminants.

E. Cost

The capital cost for Alternative SC-3 is $1,847,000. Because of the short duration of implementation of this alternative, the cost associated with this alternative was considered to be a capital expenditure with no operating and maintenance (O&M) component. Also, since the alternative would meet the cleanup goals, there will be no long-term monitoring at the site and no five-year review would be required. Therefore, the capital cost represents the total worth cost of the selected remedy for the soil.

The total capital, annual O&M, and present worth costs for all soil alternatives are presented in Table 14 for comparison purposes.

F. Compliance with ARARs

All technologies proposed for use in Alternatives SC-2 through SC-4 would be designed and implemented to satisfy all action-specific regulations. No federal or New York State regulations specify cleanup levels for contaminants in the soil. Target levels for the soils for the purpose of removing potential sources of groundwater contamination were developed. Alternative SC-3 along with Alternatives SC-2 and SC-4, would be quite effective in reducing contaminant loading from the soils to the groundwater to levels which would be below ARARs.

G. Overall Protection of Human Health and the Environment

The low levels of soil contamination remaining at the site, following the removal of all above-ground and underground tanks and 300 cubic yards of contaminated soil, present minimal risk to human health.

The treatment of soils to remove the most mobile wastes will result in the elimination of a long-term source of groundwater contamination and it will mitigate the risks to public health and the environment associated with the migration of those contaminants off-site. Alternative SC-3 would effectively mitigate those risks by removing the most mobile wastes from the soil leaving only the less mobile organic and metal compounds in the soil to be landfilled on-site (provided that the treated soil has passed the TCLP toxicity test).

Alternatives SC-2 and SC-4 would also mitigate the risks to public health and the environment associated with the leaching of contaminants into the groundwater and their migration off-site. Under Alternative SC-1, contaminants would continue to leach from the soil into the groundwater and continued off-site migration of contaminants would occur. Monitoring would be implemented to observe contaminant migration, but an indeterminate amount of time would elapse between detection and the implementation of mitigation measures.

H. State Acceptance

NYSDEC concurs with the preferred soil alternative.

I. Community Acceptance

In general the community has expressed support for the selected remedy for the remediation of the soil. It has also expressed two principal concerns, namely: 1) that, in addition to the volatile organic compounds, the semivolatile organic compounds as well as the inorganic compounds that were detected in the soil on-site should be fully addressed by the remedial action; and

2) that several of the contaminants found in the soil at the Fulton Terminals site might not be amenable to the off-gas incineration at the end of the low temperature thermal extraction process and that there should be continuous air monitoring during the

remediation to ensure against emissions of all potential air contaminants.

These concerns are addressed as follows:

1) The risk assessment for the Fulton Terminals site has demonstrated that there are minimal risks associated with direct contact with the soil on the site. The soil remediation was developed for the purpose of providing protection of the groundwater from the continued release of contaminants from the soils. Therefore, in order to protect the groundwatr, it is necessary to remediate for the most mobile of the contaminants detected in soil, namely the volatile organic contaminants.

2) The off-gas incineration is only one of several options available for the treatment of gases generated during the low temperature thermal extraction process. Other options, such as carbon adsorption of the off-gases, would also be evaluated during the design phase. If off-gas incineration is implemented, its effectiveness would be verified through a trial run prior to full scale remediation. In addition, air monitoring for particulates and organic vapor emissions will be performed during the remediation period. Emissions from the treatment unit will meet the Air Emission standards listed in Table 12.

GROUNDWATER

A. Short-Term Effectiveness

Both Alternative MM-2 and Alternative MM-3 include activities that could result in potential exposure of workers to volatilized contaminants during the installation of the groundwater extraction and reinjection systems. The threat to on-site workers, however, would be mitigated through the use of protective equipment by on-site workers.

The implementation of Alternative MM-1 would result in no additional risk to the community during implementation.

In terms of implementation times, Alternative MM-1 could be implemented in less than a year. Alternative MM-2 or MM-3 could be implemented in about 4 years.

B. Long-Term Effectiveness and Permanence

Alternative MM-2 and Alternative MM-3 would effectively reduce the potential risks associated with the migration of contaminants in the groundwater by extracting the contaminated groundwater, treating it to remove contaminants and returning the treated water to the aquifer.

The time to achieve these risk reductions, however, is limited by the residual contamination emanating from off-site and upgradient sources, which are the subject of separate investigations conducted by NYSDEC.

Alternative MM-1 would not reduce the risks associated with migration of the contaminants in the groundwater.

C. Reduction in Toxicity, Mobility, or Volume

Alternative MM-2 and Alternative MM-3 would effectively reduce the toxicity, mobility, and volume of the most mobile organic contaminants in the groundwater. Alternative MM-1 would not reduce the toxicity, mobility and volume of contaminants.

D. Implementability

All components (extraction, treatment and reinjection) of Alternative MM-2 utilize relatively common construction equipment and materials and could be easily implemented. In addition, the air stripping and carbon adsorption technologies that comprise the treatment are proven and reliable in achieving the specified performance goals are readily available.

In contrast, the treatment technology for Alternative MM-3 (UV/oxidation), although successful in pilot runs, has had limited use to date. Therefore, site-specific pilot scale studies would be required to confirm its adequacy for the Fulton Terminals site. In addition, UV/oxidation is currently available from only two sources nationwide.

All components of Alternative MM-1 would be easily implemented.

E. Cost

The capital cost for Alternative MM-2 is estimated to be $823,000. The annual operating and maintenance costs are approximately $732,000. The total present worth cost, calculated using a five percent discount rate over two years, is $2,184,000.

Table 14 lists all the costs for the three groundwater alternatives for comparison purposes.

F. Compliance with ARARs

Alternative MM-2 would achieve federal and state groundwater quality standards for the organic contaminants by providing the required contaminant removal during the treatment stage utilizing air stripping and carbon adsorption.

Groundwater quality standards for metals may not be met since the background concentrations for metals are higher than the concentration of metals in the groundwater underlying the site.

The ability of Alternative MM-3 to achieve the groundwater quality standards for the organic contaminants is of a lower certainty than the preferred alternative's because of limited experience with the UV/oxidation treatment process.

Alternative MM-1 would not comply with state or federal drinking water standards or criteria or those ARARs required for protection of the groundwater resources.

G. Overall Protection of Human Health and the Environment

Alternative MM-2, would provide the highest degree of protection to human health and the environment among the three alternatives, since it would remove the treat the organic contaminants found in groundwater and would prevent their migration off-site. The higher degree of protection associated with Alternative MM-3 is due to the higher certainty for contaminant treatment associated with the air stripping and carbon adsorption technologies versus the UV/oxidation treatment technology of Alternative MM-3.

H. State Acceptance

NYSDEC concurs with the preferred ground water alternative.

I. Community Acceptance

The community has, in general, expressed support for the selected remedy for the remediation of the groundwater. The community has also voiced certain concerns, namely:

1) Whether the inorganic as well as the semivolatile organic compounds detected in the groundwater will be removed during the groundwater treatment; and

2) Whether the remediation of the groundwater at the Fulton Terminals site through the "pump and treat" process would effect and/or be effected by off-site sources of contamination such as the adjacent Sixth Ward and Van Buren hazardous waste sites.

In addition, FSDWAC, the citizen's group at Fulton, has suggested that the selected remedy be combined with in-situ bio-remediation of the groundwater at the site as a potentially, more effective way of addressing on-site migration of contaminants serving from areas adjacent to the site.

These concerns are addressed as follows:

1) Heavy metals and semivolatile organic compounds detected in the groundwater would be removed during the pre-treatment and treatment of the extracted groundwater. The treated groundwater will meet the drinking water standards before recharge into the ground.

2) During the pump and treat process for the groundwater, the withdrawal system will be designed such that the area of dewatering (cone of depression) will primarily affect the groundwater underlying the site. Reinjection of the treated groundwater will divert some portion of the upgradient groundwater to both sides of the site. A slight increase in groundwater flow towards the Sixth Ward site may occur. No measurable effect is expected towards the Van Buren site.

To date, based on NYSDEC's investigations, there is no indication that the Van Buren and Sixth Ward sites are sources of contamination for the Fulton Terminals site. The high concentrations of benzene, ethyl benzene, and xylene in off-site wells upgradient to Fulton Terminals could be attributed to localized upgradient contaminant sources.

If, following remediation of the organic contaminants in the groundwater at the site, the three upgradient contaminant concentrations still exceed ARARs, NYSDEC will continue to treat the groundwater at the site until the groundwater ARARs are achieved for those three contaminants. If it is determined that the "pump and treat" process is not effectively reducing the concentration of benzene, ethyl benzene and xylene, a separate investigation would be undertaken by NYSDEC to define and eliminate the source of the upgradient contamination and to treat the groundwater to achieve the most stringent groundwater quality standards for those three contaminants.

THE SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, the detailed analysis of the alternatives, and public comments, both EPA and NYSDEC have determined that Alternative SC-3, low temperature thermal extraction, for treatment of the contaminated soil, and Alternative MM-2, air stripping and carbon adsorption, for treatment of the groundwater underlying the site, is the most appropriate remedy for the Fulton Terminals site. The major components of the selected remedy are as follows:

- Approximately 4,000 cubic yards of VOC contaminated soil will be excavated from the southwestern portion of the site, in the area of the former storage tank Nos. 1,2, and 3. The lateral extent of the excavation, which is defined by the clean borings SB-1, SB-2, SB-3, SB-8, SB-12, SB-13, and SB-5, will be more precisely delineated by additional soil sampling in the southwestern portion of the site during the design phase of the remediation.

Contaminated soil may also be excavated from the areas surrounding soil borings U4 and U6 as stated previously on pages 20 and 22. Soil in the contaminated area will be excavated down to the water table (approximately 12 feet below the ground surface). Fugitive emissions will be controlled during the excavation by such techniques as water spraying, vapor suppression forms, etc.

- The VOCs in the soil will be treated using a low temperature thermal treatment technology. Approximately 99.99 percent of the VOCs will be removed by this treatment process.

- The treated soils, which will still contain some less mobile organic compounds and metals, will be tested for TCLP toxicity to determine whether they constitute a RCRA hazardous waste and will be placed back into the excavation areas from which they were removed. One foot of clean top soil will be placed on the site, and accordingly the site will be regraded and revegetated to prevent soil erosion.

- In the unlikely event that the treated soils do not pass the TCLP Toxicity Test, they will be stabilized by fixation prior to their placement in the excavated areas.

- Following remediation of the soil, the groundwater underlying the site will be treated.

- Contaminated groundwater will be removed from the sand and gravel unit of the aquifer by a system of extraction wells, located at the contaminated area. It will be treated on-site for removal of the VOCs using a combination of air stripping and carbon adsorption technologies, and the treated water will be reinjected in the ground through a reinjection system. The groundwater will be treated to drinking water standards before recharge. The exact number and location of the extraction wells, the pumping routes and the type of the reinjection system will be specified during the design phase. If reinjection of the treated groundwater proves to be impractical (due to site specific hydraulic conditions) an alternate recharge technique would be used.

- All residuals from the treatment of the soil and of the groundwater will be shipped to an off-site RCRA hazardous waste facility.

- Air monitoring will be performed prior to, during, and following construction at the site. Air emissions from the treatment units during both the soil and groundwater remediation will meet the Air Emission ARARs. Environmental monitoring will be required during the life of the treatment process. In addition, monitoring of the groundwater at the site will be conducted for a period of 3 years after completion of the remediation, to ensure that the goals of the remedial action have been met.

- Institutional controls will be applied, to the extent possible, to prevent the utilization of the underlying groundwater due to the high concentrations of metals naturally occurring in the groundwater throughout the area surrounding the site. These controls will include well construction permits and water quality certifications and will be consistent with New York State law.

- The groundwater treatment will continue until federal and state standards for the organic contaminants have been achieved. Three of those contaminants, namely benzene, ethylbenzene and xylene, have been detected in upgradient wells at levels exceeding the groundwater standards. Thus, a separate investigation will be undertaken by NYSDEC to define and eliminate the source of the upgradient contamination. A remedial response action would then be undertaken, if needed, to ensure that the federal and state standards for these contaminants would be achieved.

- A floodplains assessment will be prepared during the design phase. This floodplains assessment should include a delineation of the extent of the 500-year floodplain, a description of the potential effects on the floodplain associated with implementation of remedial actions, a discussion of measures to minimize potential adverse impacts to the floodplain, and the design considerations proposed to protect treatment units and other remediation equipment from flooding and flood damage.

Remediation Goals

The risk assessment has concluded that, with the contamination presently remaining on-site, minimal threat to human health and the environment exists. Existing conditions at the site have been determined to pose an excess lifetime cancer risk of 2.3 E-07, predominantly from ingestion of contaminated soil at the site. This is within US EPA's range of acceptable risk. However, the federal and state ARARs for several of the VOCs in groundwater are being exceeded.

The purpose of this response action is to restore the groundwater underlying the site to levels consistent with state and federal ARARs and to ensure protection of the ground and surface water (in the Oswego River adjacent to the site) from the continued release of contaminants from soils. Since no federal or state ARARs exist for soil, the action level for the VOCs in soil was determined through a site-specific analysis. This analysis used fate and transport modeling to determine levels to which VOCs in soils should be reduced in order to ensure no leaching of contaminants to groundwater above MCL levels.

STATUTORY DETERMINATIONS

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that achieve protection of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences. These specify that when complete, the selected remedial action for this site must comply with applicable or relevant and appropriate environmental standards established under federal and state environmental laws unless a statutory waiver is justified. The selected remedy also must be cost effective and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that employ treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as their principal element. The following sections discuss how the selected remedy meets these statutory requirements.

Protection of Human Health and the Environment

The low levels of soil contamination remaining at the site, following the removal of all above-ground and underground tanks and 300 cubic yards of contaminated soil, present minimal risk to human health. The selected remedy further protects human health and the environment through the removal and treatment of the organic contaminants in groundwater, using air stripping and carbon adsorption. In addition, treatment of the contaminated soils through a low temperature thermal extraction process will remove the most mobile wastes from the soil, resulting in the elimination of a long-term source of groundwater contamination, and it will mitigate the risks to public health and the environment associated with the migration of those contaminants off-site. There are no short-term threats associated with the selected remedy that cannot be readily controlled.

Compliance With Applicable or Relevant and Appropriate Requirements

The selected remedy of excavation and on-site low temperature thermal extraction of contaminated soils along with air stripping and carbon adsorption of the groundwater will comply with all chemical-, action-, and location-specific ARARs. It should be noted, though, that the groundwater quality standards for metals may not be met, as naturally occurring metal concentrations in the groundwater surrounding the site are higher than the metal concentrations in the groundwater underlying the site.
The ARARs are presented in Table 12.

Cost Effectiveness

The selected remedy is cost effective because it provides overall effectiveness proportional to its cost; the net present worth value being $4,031,000. The cost of the soil treatment component of the selected remedy ($1,847,000) is only 60 percent of the cost of the excavation and off-site disposal alternative and only 16 percent of the cost of the alternative involving off-site incineration, and yet the selected remedy mitigates as effectively as those alternatives all the risks posed by the contaminants at the site. The cost of the groundwater component of the remedy is approximately 17 percent higher than the cost for the UV/oxidation alternative, but it offers a much higher degree of certainty with regard to the effective removal of all the VOCs from the contaminated groundwater.

Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

EPA and the New York State have determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the final source control operable unit at the Fulton Terminals site. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA NYSDEC have determined that this selected remedy provides the best balance of tradeoffs in terms of long-term effectiveness and permanence, reduction in toxicity, mobility or volume achieved through treatment, short-term effectiveness, implementability, and cost, also considering the statutory preference for treatment as a principal element and considering state and community acceptance.

With regard to the most mobile wastes in the soil that pose the major risks at the site, the selected remedy will offer as high a degree of long-term effectiveness and permanence as the other treatment alternative, incineration, by permanently removing the source of groundwater contamination. In addition, the selected remedy will result in significant reductions in the toxicity of the contaminated material (comparable to the reductions achieved by incineration) through thermal destruction of the organic contaminants. The selected remedy is as effective as the other remedial action alternatives in the short-term offering the additional advantage of on-site treatment, thereby reducing potential risks to residents along transportation routes. The implementability of the selected remedy is comparable to the other alternatives. The selected remedy is also the least costly treatment option and also is less expensive than off-site disposal.

The selection of treatment of the contaminated soil is consistent with program expectations that indicate that highly toxic and mobile wastes are a priority for treatment and often necessary to ensure the long-term effectiveness of a remedy. Since all of the alternatives are reasonably comparable with respect to long-term effectiveness, the toxicity, mobility, and volume reductions achieved and the implementability, the major tradeoffs that provide the basis for the selection of the soil portion of the remedy are short-term effectiveness and cost. The selected remedy can be implemented with less risk to the area residents and at less cost than the other remedial action alternatives and, therefore, is determined to be the most appropriate solution for the contaminated soils at the Fulton Terminals site.

The selected remedy for the groundwater offers as high a degree of long-term effectiveness and permanence as the other treatment option of UV/oxidation, and it reduces the toxicity, mobility and volume to the same extent as UV/oxidation through the destruction of organic contaminants.

The selected remedy is as effective in the short-term as UV/oxidation. With regard to implementability, the components of the selected remedy are easily implemented, proven technologies and are readily available. In contrast, the treatment technology for UV/oxidation, although successful in pilot runs, has had limited use to date. In addition, UV/oxidation is currently available from only two sources nationwide.

The cost of the selected remedy is only slightly higher (17 percent) than the UV/oxidation treatment option.

Since both of the treatment options for the groundwater are reasonably comparable with respect to long-term effectiveness, toxicity reductions, short-term effectiveness, and cost, the major tradeoff that provides the basis for the selection of the air-stripping and carbon adsorption as the remedy for the groundwater is implementability. The technology for the selected remedy is proven and readily available.

Preference for Treatment as a Principal Element

By treating the VOC-contaminated soils in a low temperature thermal extraction unit, and by treating the groundwater by air stripping and carbon adsorption the selected remedy addresses the principal threats posed by the site through the use of treatment technologies. Therefore, the statutory preference for remedies that employ treatment as a principal element is satisfied.

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TABLE 1
FULTON TERMINALS
TCL VOLATILE ORGANICS IN SOIL

COMPOUND	CONCENTRATION RANGE	NUMBER OF OCCURRENCES	LOCATION AND DEPTH OF MAXIMUM
Vinyl Chloride	20,000	1	SB-6, 4-6 ft
Acetone	17-180,000(B)	14	SB-16, 8-10 ft
1,1-Dichloroethene	100	1	SB-6, 4-6 ft
1,1-Dichloroethane	67	1	SB-6, 4-6 ft
trans-1,2-Dichloroethene	31-30,000	3	SB-6, 4-6 ft
Chloroform	2	1	SB-8, 0-2 ft
2-Butanone	23-11,000(B)	2	SB-27, 4-6 ft
1,1,1-Trichloroethane	380	1	SB-6, 4-6 ft
Trichloroethene	270-110,000	4	SB-7, 0-2 ft
Benzene	5-93	3	SB-6, 4-6 ft
4-Methyl-2-Pentanone	2-1300	2	SB-4, 0-2 ft
Tetrachloroethene	33-5800	3	SB-7, 0-2 ft
Toluene	3-49	3	SB-1, 8-10 ft
Chlorobenzene	9	1	SB-18, 8-10 ft
Ethyl Benzene	2-17	3	SB-1, 8-10 ft
Xylene	7-240000	4	SB-14, 2-4 ft

Note: Lower end of each range is from samples with detected values only.
All concentrations in ug/kg (ppb).
B = Compound detected in blanks.

TABLE 1 (Cont.)
FULTON TERMINALS
TOTAL CONCENTRATION OF TCL SEMI-VOLATILE ORGANICS IN SOIL

	SAMPLE DEPTH				
LOCATION	0-2	2-4	4-6	6-8	8-10
SB-1	318/152	--	--	--	1,376/660
SB-2	58/U	--	--	U	--
SB-3	724/333	--	--	21,470/10,240	--
SB-4	334/124	--	--	--	1,924/420
SB-5	U/U	--	--	--	1,297/402
SB-6	U/U	--	792/U	--	--
SB-7	10,660/U	200/U	--	--	--
SB-8	1,271/469	--	--	467/240	--
SB-9	6,264/2,860	3,118/1,149	--	--	--
SB-10	U/U	--	--	--	31,480/780
SB-11	2,169/827	--	--	--	480/139
SB-12	492/232	--	--	--	690/U
SB-13	993/620	--	U/U	--	--
SB-14	180/U	31,270/U	--	--	--
SB-15	1,191/202	U/U	--	--	--
SB-16	1,653/640	--	--	--	U/U
SB-17	755/143	--	--	--	749/U
SB-18	U/U	--	--	--	U/U
SB-19	970/U	--	--	--	7,023/404
SB-20	1,019/U	--	--	--	1,756/U
SB-21	860/U	--	474/U	--	--
SB-22	5,329/830	--	403/173	--	--
SB-23	860/U	--	--	--	20,600/U
SB-24	1,053/U	--	--	292/U	--
SB-25	--	2,845/980	--	--	81/U
SB-26	160/U	--	--	89/U	--
SB-27	4,118/1,576	--	2,527/835	--	--

Total semi-volatiles/total carcinogenic polynuclear aromatic hydrocarbons (CPAHs)

Notes: All concentrations in ug/kg (ppb)
U = none detected
-- = not sampled

TABLE 1 (Cont.)
FULTON TERMINALS
SUMMARY OF TCL INORGANIC CONCENTRATIONS IN SOIL

CONSTITUENT	CONCENTRATION RANGE mg/kg (ppm)	LOCATION AND DEPTH OF MAXIMUM CONCENTRATION	AVERAGE OF OFF-SITE BORINGS (SB-25, SB-26, SB-27)	CONCENTRATIONS UPSTATE NY (a)	TYPICAL BACKGROUND EASTERN U.S. (b)
Aluminum	2,370-21,400	SB-15, 0-2 ft	5318	50,000	7,000-100,000
Antimony	U-6.3	SB-27, 0-2 ft	5.1 V	<1	<150-500
Arsenic	2.1-79.7	SB-3, 6-8 ft	6.4	4.1	<0.2-73
Barium	18.4-1710	SB-16, 8-10 ft	80.6	300	15-1,000
Beryllium	U-1.6	SB-2, 6-8 ft and SB-18, 8-10 ft	0.53	<1	<1-7
Cadmium	0.58-2.2	SB-26, 0-2 ft	1.4 V	--	<1-1
Calcium	898-56,100	SB-15, 0-2 ft	9786	7,900-12,000	<100-160,000
Chromium	5.4-140	SB-15, 0-2 ft	9.3 R	30	1-100
Cobalt	1.7-18.9	SB-22, 4-6 ft	5.3	3-5	<3-70
Copper	6.1-347	SB-26, 0-2 ft	129	20	<1-150
Iron	5710-35,500	SB-4, 0-2 ft	14,742	20,000	100->100,000
Lead	3.8-479	SB-09, 0-2 ft	83.9	15	<7-300
Magnesium	1,120-20,800	SB-15, 0-2 ft	2493	5,000-7,000	50-50,000
Manganese	110-9,050	SB-16, 8-10	625	200-300	<2-7,000
Mercury	U-0.75	SB-26, 0-2 ft	0.75 V	--	--
Nickel	5.8-137	SB-05, 8-10 ft	10.5	7-10	<3-700
Potassium	298-1,630	SB-18, 8-10 ft	715	16,000	50-37,000
Selenium	U-1.3	SB-3, 6-8 ft	0.68 V	0.15-0.2	<0.1-1.4
Silver	J-3.0	SB-8, 6-8 ft	U	--	<0.5-5
Sodium	37.2-686	SB-18, 0-2 ft	113 V	7,000	<200-15,000
Thallium	U-0.59	SB-4, 8-10 ft	U	--	--
Vanadium	5.9-133	SB-6, 4-6 ft	10.1	70	<5-300
Zinc	17.3-1060	SB-26, 0-2 ft	225	45	<5-400

Note: U = Not detected
V = Average does not include undetected concentrations
R = Average does not include rejected data
(a) = Background values from Syracuse, NY area soils in Upstate New York (Shacklette and Bolmgen, 1984)
(b) = Background values from "B" horizon soils in the Eastern U.S. (Shacklette, 1975)

TABLE 2
FULTON TERMINALS
TCL VOLATILE ORGANICS IN GROUNDWATER

COMPOUND	NUMBER OF OCCURRENCES	CONCENTRATION RANGE	LOCATION OF MAXIMUM	NYSDOH STANDARDS(A)	NYS GUIDANCE VALUE
Vinyl Chloride	4	1.8-88	EBMW-3D	2	5 S
Methylene Chloride	1	185.9	EBMW-3D	5	50
Acetone	1	973	EBMW-3D	50	--
1,1-Dichloroethene	2	2.7-49.6	EBMW-3D	5	0.07
1,1-Dichloroethane	3	5.8-24.3	EBMW-3D	5	50
cis-1,2-Dichloroethene	11	1.6-14,387	EBMW-3D	5	--
1,1,1-Trichloroethane	1	113.2	EBMW-3D	5	50
Trichloroethene	8	0.6-2388	EBMW-3D	5	10 S
Benzene	5	10-422.7	FBW-6	5	ND
4-Methyl-2-Pentanone	1	393	EBMW-3D	50	--
Tetrachloroethene	2	0.6-6.8	EBMW-3D	5	0.7
Toluene	6	0.4-64.9	FBW-6	5	50
Chlorobenzene	3	1.3-162	FBW-6	5	20
Ethyl Benzene	4	2.4-432.5	FBW-6	5	50
Xylene	5	1.4-303	FBW-6	5	50

Note: S = NYS Standard
A = Revision to Part 5 of the NY State Sanitary Code (1/89)
ND = Not Detected
All concentrations in ug/l (ppb)

TABLE 2 (Cont.)
FULTON TERMINALS
SEMI-VOLATILE ORGANICS IN GROUNDWATER

COMPOUND	NO. OF OCCURRENCES	RANGE	LOCATION OF MAXIMUM	NYS STANDARD
Phenol	1	11	EBMW-3S	--
1,2-Dichlorobenzene	2	7-11	FBW-6	4.7
Benzoic Acid	1	47	EBMW-3S	--
Naphthalene	3	7-92	FBW-6	10 G
2-Methylnapthalene	3	3-4	FBW-6 and EBMW-6S	--
Bis(2-ethylhexyl)phthalate	11	2-62	FBW-1D	4200
Di-n-octyl phthalate	1	3	FBW-1D	--

Note: G = NYS Guidance Value
All concentrations in ug/l (ppb)

TABLE 2 (Cont.)
FULTON TERMINALS
SUMMARY OF TCL INORGANIC CONCENTRATIONS IN GROUNDWATER

CONSTITUENT	RANGE	LOCATION OF MAXIMUM	NYS STANDARD
Aluminum	47.1-139,000	EBMW-6S	--
Antimony	U-57.8	FBW-1D	3 G
Arsenic	U-58.2	FBW-1S	25
Barium	262-21,000	FBW-4D	1,000
Beryllium	1.2-8	EBMW-6S	3 G
Cadmium	U-60.1	FBW-1D	10
Calcium	93,300-951,000	FB-3	--
Chromium	31.2-10,800	FBW-1D	50
Cobalt	U-200	FBW-1D	--
Copper	15.2-1,120	FBW-1D	1,000
Iron	514-916,000	FBW-1D	--
Lead	8-364	FBW-1S	25
Magnesium	8,510-278,000	EBMW-5	35,000 G
Manganese	42-32,100	FBW-6	300
Mercury	U-1.1	FBW-1S	2
Nickel	15.3-2,500	FBW-1D	--
Potassium	141-38,400	FBW-1D	--
Selenium	U	--	20
Silver	U-12.7	FBW-6	50
Sodium	55,900-1,350,000	EBMW-6S	--
Thallium	U	--	4 G
Vanadium	4.2-253	EBMW-5	--
Zinc	34.2-1,820	FBW-1D	5,000

Notes: G = NYS Guidance Value
U = Not Detected
All concentrations in ug/l (ppb)

TABLE 3
FULTON TERMINALS
SEMI-VOLATILES IN SURFACE WATER AND SEDIMENT

SEMI-VOLATILES IN SURFACE WATER

	CRDL	SW-1	SW-2	SW-3	SW-4
SEMI-VOLATILE ORGANIC (ug/l)					
Bis(2-Ethylhexyl)Phthalate	330	U	U	U	21

SEMI-VOLATILES IN SEDIMENT

	CRDL	SD-1	SD-2	SD-3	SD-4
SEMI-VOLATILE ORGANIC (ug/kg)					
Acenaphthene	330	U	U	120 J	U
Anthracene	330	U	U	220	U
Benzo(a)Anthracene	330	85 J	U	820	U
Benzo(a)Pyrene	330	68 J	U	720	U
Benzo(b)Fluoranthene	330	79 J	U	T	U
Benzo(g,h,i)Perylene	330	U	U	370 J	U
Benzo(k)Fluoranthene	330	81 J	U	T	U
Benzofluoranthene (Total)	330	U	U	1600 J	U
Bis(2-Ethylhexyl)Phthalate	330	U	U	U	210 J
Chrysene	330	88 J	U	810	U
Dibenzo(a,h)Anthracene	330	U	U	140 J	U
Fluoranthene	330	140 J	U	1900	U
Fluorene	330	U	U	87 J	U
Indeno(1,2,3-cd)Pyrene	330	U	U	370 J	U
Naphthalene	330	U	U	65 J	U
Phenanthrene	330	75 J	U	820	U
Pyrene	330	150 J	U	1200	U

Note: CRDL = Contract Required Detection Limit
U = Compound Below Detection Limit
J = Estimated Concentration
T = Reported as Total Benzofluoranthene

TABLE 3 (Cont.)
FULTON TERMINALS
INORGANICS IN SURFACE WATER

	CRDL	SW01	SW02	SW03	SW04
INORGANIC (ug/l)					
Aluminum	200	*	R	R	1020 J
Antimony	60	*	U	23.6	24.2 J
Arsenic	10	*	2.8	2.2	2.4 J
Barium	200	*	38.5	39.7	69.0 J
Beryllium	5	*	U	U	UJ
Cadmium	5	*	U	U	U
Calcium	5000	*	63300	66000	67400 J
Chromium	10	*	U	U	U
Cobalt	50	*	U	U	7.6 J
Copper	25	*	U	U	7.9 J
Iron	100	*	R	R	1770 J
Lead	5	*	2.6	4.6	7.1 J
Magnesium	5000	*	12400	12900	13700 J
Manganese	15	*	R	R	248 J
Mercury	.2	*	U	U	U
Nickel	40	*	U	U	U
Potassium	5000	*	2230	2280	2540
Selenium	5	*	2.7	U	R
Silver	10	*	U	U	U
Sodium	5000	*	42600	44200	47300 J
Thallium	10	*	U	U	UJ
Vanadium	50	*	U	U	U
Zinc	20	*	U	U	37.9 J

Note: CRDL = Contract Required Detection Limit
U = Compound Below Detection Limit
R = Rejected During Data Validation
J = Estimated Concentration
* = Data Not Available

TABLE 3 (Cont.)
FULTON TERMINALS
INORGANICS IN SEDIMENT

	CRDL	SD-01	SD-02	SD-03	SD-04
INORGANIC (mg/kg)					
Aluminum	40	5620	4220	9000	6580
Antimony	12	UJ	UJ	U	UJ
Arsenic	2	7.3	2.0	6.2 J	7.2
Barium	40	99.9	34.8	160.0	72.2
Beryllium	1	1.3	0.9	1.2	0.31
Cadmium	1	U	U	U	U
Calcium	1000	64600	33100	32200	21800
Chromium	2	9.3	7.3	R	8.4
Cobalt	10	5.0	3.4	6.7	5.9
Copper	5	14.8 J	12.8 J	41.2 J	17.8 J
Iron	20	11700	14400	15700	13900
Lead	1	18 J	8.4 J	111.0 J	4.8
Magnesium	1000	9000	9660	7710	8600
Manganese	3	313	1060	278	476
Mercury	.04	U	U	1.4 J	U
Nickel	8	13.0	11.2	16.4	12.0
Potassium	1000	338.0	464.0	1600	1100
Selenium	1	UJ	U	0.99	0.64 J
Silver	2	UJ	UJ	U	U
Sodium	1000	214.0	128.0	191.0	170.0
Thallium	2	UJ	UJ	UJ	UJ
Vanadium	10	10.7 J	7.6 J	13.3 J	13.1 J
Zinc	40	R	R	91.8 J	32.8

TABLE 4
TOTAL COMPARISON OF METAL CONCENTRATIONS IN SOIL
FULTON TERMINALS SITE

METALS	Observed Concentration Ranges	Geometric Mean (All Samples)	National Range (a)	Typical Background Concentrations in Shale Bedrock (b)
ALUMINUM	2370 - 21400	6834.5		
ANTIMONY	0.55 - 6.3	1.6	ND - 150	0.7
ARSENIC	0.38 - 79.7	5.7	0.10 - 194	7.0
BARIUM	18.4 - 1710	101.2		
BERYLLIUM	0.14 - 1.6	0.8		
CADMIUM	0.027 - 2.2	0.3	0.01 - 7.0	0.3
CALCIUM	898 - 56100	4858.5		
CHROMIUM	3 - 140	10.4	5.0 - 3,000	62.5
COBALT	1.7 - 18.9	5.4		
COPPER	2.9 - 228	26.0	2.0 - 100	23.5
IRON	5710 - 35500	14701.6		
LEAD	3.1 - 1670	25.1	1.0 - 888	13.5
MAGNESIUM	1120 - 20800	3348.2		
MANGANESE	110 - 9050	501.4		
MERCURY	0.05 - 0.75	0.1		
NICKEL	2.8 - 137	14.5	1.0 - 1,530	35.0
POTASSIUM	298 - 1630	684.5		
SELENIUM	0.125 - 1.3	0.4		
SILVER	0.08 - 3.3	0.7	0.1 - 8.0	0.07
SODIUM	23.1 - 672	98.4		
THALLIUM	0.025 - 0.75	0.1	No Data	1.10
VANADIUM	5.9 - 133	16.1		
ZINC	17.3 - 1060	56.4	10.0 - 2,000	55.5

Notes: (a) As revised by McClanahan (1984).
(b) Adapted from Drever (1979)

TABLE 52

Geometric mean of contaminants of concern in soil

CHEMICAL	Soil Concentration (ug/kg)*
Arsenic	4884
Barium	27680
Benzene	8.15
Chlorobenzene	5.85
1,2-DCE (tot)	6.26
MIBK	12.86
Nickel	12634
Pyrene	202
TCE	9.66
Vinyl Chloride	12.2

TABLE 6

CONTAMINANT LOADING TO THE OSWEGO RIVER FROM THE GROUND WATER AT FULTON TERMINALS

	Loading (ug/l)
Arsenic	13.46
Barium	6723.28
Benzene	12.29
Chlorobenzene	4.32
1,2-dichloroethene	710.59
4-Methyl-2-Pentanone	21.32
Nickel	749.59
Trichloroethene	106.11
Vinyl Chloride	7.59

TABLE 7
CUMULATIVE SHORT-TERM AND LONG-TERM INHALATION EXPOSURES TO EACH INDICATOR CHEMICAL
FULTON TERMINALS SITE

Population Exposed and Exposure to Benzene Emissions

Concentration Level (ug/m^3)	Cumulative Population Exposed		Time-Weighted Average Dose (mg/kg/day)
	Persons	%	
Short Term			
8.45E-05	2,139	32.91	2.66E-08
Long Term			
3.77E-05	2,139	32.91	1.18E-08

Population Exposed and Exposure to Chlorobenzene Emissions

Concentration Level (ug/m^3)	Cumulative Population Exposed		Time-Weighted Average Dose (mg/kg/day)
	Persons	%	
Short Term			
4.99E-05	2,139	32.91	1.57E-08
Long Term			
2.65E-05	2,139	32.91	8.33E-09

Population Exposed and Exposure to Vinyl Chloride Emissions

Concentration Level (ug/m^3)	Cumulative Population Exposed		Time-Weighted Average Dose (mg/kg/day)
	Persons	%	
Short Term			
1.77E-04	2,139	32.91	5.56E-08
Long Term			
1.77E-04	2,139	32.91	5.56E-08

TABLE 7
CUMULATIVE SHORT-TERM AND LONG-TERM INHALATION EXPOSURES TO EACH INDICATOR CHEMICAL
FULTON TERMINALS SITE
(Continued)

Population Exposed and Exposure to 1,2-dichloroethene Emissions

Concentration Level (ug/m^3)	Cumulative Population Exposed Persons	%	Time-Weighted Average Dose (mg/kg/day)
Short Term			
2.27E-04	2,139	32.91	7.13E-08
Long Term			
6.86E-05	2,139	32.91	2.16E-08

Population Exposed and Exposure to Trichloroethene Emissions

Concentration Level (ug/m^3)	Cumulative Population Exposed Persons	%	Time-Weighted Average Dose (mg/kg/day)
Short Term			
3.05E-04	2,139	32.91	9.59E-08
Long Term			
2.89E-04	2,139	32.91	9.08E-08

TABLE 8
CRITICAL TOXICITY VALUES FOR INDICATOR CHEMICALS AT THE FULTON TERMINALS SITE

	AIS (mg/kg/day)	AIC mg/kg/day	Carcinogenic Potency Factor 1/(mg/kg/day)
Inhalation Route			
Arsenic @	U	U	1.50E+01
Barium	1.40E-03	1.40E-04	NA
Benzene	U	U	2.90E-02
Chlorobenzene	5.30E-02	5.70E-03	NA
1,2-DCE (total)	U	U	NA
MIBK	U	5.00E-02	NA
Nickel @	2.00E-02	1.00E-02	1.19E+00
Pyrene @	U	U	U
TCE @	U	2.62E-02	1.70E-06
Vinyl Chloride	U	U	2.95E-01
Ingestion Route			
Arsenic @	U	1.00E-03	1.80E+00
Barium	U	5.10E-02	NA
Benzene	U	U	2.90E-02
Chlorobenzene	2.70E-01	2.70E-02	NA
1,2-DCE (total)	U	U	NA
MIBK	5.00E-01	U	NA
Nickel @	2.00E-02	U	NA
Pyrene @	U	U	U
TCE @	U	1.00E-02	1.10E-02
Vinyl Chloride	U	9.47E-07	2.30E+00

@ - potential carcinogen
U - unavailable
NA - not applicable

AIS = Acceptable Intake, Subchronic

AIC = " " " , Chronic

TABLE 9

RISK ESTIMATES FOR CARCINOGENS

CHEMICAL	Exposure Route	CDI (mg/kg.day)	Carcinogenic Potency Factor 1/(mg/kg.day)	Route-Specific Risk	Total Chemical-specific Risk
Arsenic	Oral	9.57E-08	1.8	1.72E-07	1.72E-07
	Inhalation	NA	15	NA	
Barium	NA	NA	NA	NA	NA
	NA	NA	NA	NA	
Benzene	Oral	1.70E-10	0.029	4.92E-12	3.47E-10
	Inhalation	1.18E-08	0.029	3.42E-10	
Chlorobenzene	NA	NA	NA	NA	NA
	NA	NA	NA	NA	
1,2-DCE (tot)	NA	NA	NA	NA	NA
	NA	NA	NA	NA	
MIBK	NA	NA	NA	NA	NA
	NA	NA	NA	NA	
Nickel	NA	NA	NA	NA	NA
	NA	NA	NA	NA	
Pyrene	Oral	3.98E-09	11.5 *	4.57E-08	4.57E-08
	Inhalation	NA	NA	NA	
TCE	Oral	3.66E-10	1.10E-02	4.03E-12	4.18E-12
	Inhalation	9.08E-08	1.70E-06	1.54E-13	
Vinyl Chloride	Oral	2.40E-10	2.3	5.52E-10	1.70E-08
	Inhalation	5.56E-08	0.295	1.64E-08	
			Total Upper Bound Risk =		2.35E-07

Notes: * based on CPF for benzo(a)pyrene

NA Not Available

Notes: * Based on CPF for benzo(a)pyrene, Carcinogenic Assessment Group (CAG) Risk Value (Clement, 1985)

CDI = Chronic Daily Intake

TABLE 10
CALCULATION OF CHRONIC HAZARD INDICES

CHEMICAL	Inhalation			ORAL		
	CDI	AIC	CDI:AIC	CDI	AIC	CDI:AIC
Arsenic	NA	NA	NA	9.57E-08	0.001	9.57E-05
Barium	NA	1.00E-04	NA	1.04E-06	5.10E-02	2.04E-05
Benzene	1.18E-08	U	U	1.70E-10	U	U
Chlorobenzene	8.33E-09	5.00E-03	1.67E-06	1.21E-10	3.00E-02	4.04E-09
1,2-DCE (tot)	2.16E-08	U	U	3.06E-10	U	U
MIBK	NA	2.00E-02	NA	2.54E-10	0.05	5.09E-09
Nickel	NA	1.00E-02	NA	2.53E-07	2.00E-02	1.26E-05
Pyrene	NA	NA	NA	3.98E-09	U	U
TCE	9.08E-08	2.60E-02	3.49E-06	3.66E-10	1.02E-02	3.59E-08
Vinyl Chloride	5.56E-08	U	U	2.40E-10	U	U
	HAZARD INDEX:		5.16E-06	HAZARD INDEX:		1.29E-04

Notes: U Unavailable
NA Not Applicable

TABLE 11
CALCULATION OF SUBCHRONIC HAZARD INDICES

CHEMICAL	Inhalation			ORAL		
	SDI	AIS	SDI:AIS	SDI	AIS	SDI:AIS
Arsenic	NA	NA	NA	3.91E-04	U	U
Barium	NA	1.00E-03	NA	2.22E-03	U	U
Benzene	2.66E-08	U	U	6.52E-07	U	U
Chlorobenzene	1.57E-08	5.00E-02	3.14E-07	4.68E-07	3.00E-01	1.56E-06
1,2-DCE (tot)	7.13E-08	NA	NA	5.02E-07	U	U
MIBK	NA	2.00E-01	NA	1.03E-06	5.00E-01	2.06E-06
Nickel	NA	2.00E-02	NA	1.01E-03	2.00E-02	5.05E-02
Pyrene	NA	NA	NA	1.62E-05	U	U
TCE	9.59E-08	U	U	7.74E-07	U	U
Vinyl Chloride	5.56E-08	U	U	9.76E-07	U	U
	* HAZARD INDEX:		3.14E-07	HAZARD INDEX:		5.05E-02

Notes: U Unavailable
NA Not Applicable

SDI = Subchronic Daily Intake

TABLE 12
CHEMICAL-SPECIFIC ARARS, CRITERIA, AND GUIDANCE
FULTON TERMINALS SITE

REGULATORY LEVEL	ARAR IDENTIFICATION	STATUS	REQUIREMENT SYNOPSIS
Federal	CWA Water Quality Criteria (WQC) for Protection of Human Health and Aquatic Lifes	Applicable	Contaminant levels regulated by WQC are provided to protect human health for exposure from drinking water and from consuming aquatic organisms (primary fish) and from fish consumption alone.
Federal	RCRA Maximum Concentration Limits (MCLs)	Applicable	Provides standards for 14 toxic compounds and pesticides for protection of groundwater. These standards are equal to the MCLs established by the NPDWS. This regulation also provides basis for application of alternate concentration limit (ACL) on a site specific basis.
Federal	SDWA Maximum Contaminant Levels (MCLs) - 40 CFR 141	Relevant and Appropriate	Provides standards for 30 toxic compounds, including the 14 compounds adopted as RCRA MCLs, for public drinking system.
Federal	SDWA MCL Goals	To Be Considered	EPA has promulgated 9 contaminants and has proposed 40 others (50 FR 46936) for the public water system. The MCLGs are non-enforceable health goals and are set at levels that would result in no known or anticipated adverse health effects with an adequate margin of safety.
New York State	6 NYCRR Groundwater Quality Regulations Part 703.5	Applicable	Provides quality standards for groundwater. Certain contaminant levels are specified.
New York State	10 NYCRR Part 170	Applicable	Provides quality standards for public water supply.
New York State	Revision to Part 5 of the State Sanitary Code	Relevant and Appropriate	Establishes maximum contaminant levels (MCLs) or standards for Principal Organic Contaminants (POC) and Unspecified Organic Contaminants (UOC).

TABLE 12 (Cont.)
CHEMICAL-SPECIFIC ARARS FOR VOLATILE ORGANICS IN GROUNDWATER
FULTON TERMINALS SITE

		FEDERAL ARARS				NY AMBIENT WATER QUALITY STANDARDS/ GUIDANCE VALUES		
		CWA Protection of Human Health		SDWA				
CONTAMINANTS	MAXIMUM CONCENTRATION DETECTED AT SITE	WATER & FISH INGESTION	FISH CONSUMPTION	MCLs	MCLG	GUIDANCE VALUE	PART 5, STATE SANITARY CODE	STANDARD
Volatiles								
Acetone	973.4	NC	NC	--	--	NC	50	NC
Benzene	422.7	0.66	40	5	0	NS	5	ND
Chlorobenzene	162.0	NS	NS	100*	100*	20	5	NS
Ethyl Benzene	432.5	1,400	3,280	700*	700*	50	5	NS
Methylene Chloride	185.9	NS	NS	--	50	50	5	NS
N Propylbenzene	27.7	NC	NC	--	--	NC	5	NC
Toluene	64.9	14,300	424,000	2,000*	2,000*	50	5	NS
4-Methyl-2-Pentanone	393.0	NC	NC	--	--	NC	50	NS
cis-1,2-Dichloroethene	14,387.0	NS	NS	7	7	NC	5	NC
1,1-Dichloroethane	24.3	NC	NC	--	--	50	5	NS
1,1-Dichloroethene	49.6	$3.1x10^{-2}$	1.85	--	--	0.07	5	NS
1,1,1-Trichloroethane	113.2	18,400	1,030,000	200	200	50	5	NS
Tetrachloroethene	6.8	0.8	8.85	5*	0*	0.7	5	NS
Trichloroethene	2,388	2.7	80.7	5	0	NS	5	10
Vinyl Chloride	88	2	525	2	0	NS	2	5
Xylenes (Total)	303	NC	NC	10,000*	10,000*	50	5	NS

Note: All Concentrations in ug/l (ppb)
NS = Included in the Listing But Limits Not Specified
NC = Not a Listed Contaminant
ND = Not Detected
* = Proposed Value "To Be Considered"

TABLE 12 (Cont.)
CHEMICAL-SPECIFIC ARARS FOR INORGANICS IN GROUNDWATER
FULTON TERMINALS SITE

		FEDERAL ARARS		NY AMBIENT WATER QUALITY STANDARDS/ GUIDANCE VALUES	
CONTAMINANT	MAXIMUM CONC. DETECTED AT SITE	RCRA MAXIMUM CONCENTRATION LIMIT	SDWA MCLS	DRINKING WATER	G.W. FOR DRINKING
Inorganics					
Aluminum	154,000	NC	NC	NS	NS
Antimony	27.9	NC	NC	50	3
Arsenic	48.1	50	50	50	25
Barium	2,700	1,000	1,000	1,000	1,000
Beryllium	6	NC	NC	NC	NC
Cadmium	21.4	10	10	10	10
Calcium	2,564,000	NC	NC	NC	NC
Chromium	229	50	50	50	NS
Cobalt	119	NC	NC	NS	NS
Copper	724	NC	NC	200	1,000
Iron	280,000	NC	NC	300	300
Lead	241	50	50	50	25
Magnesium	278,000	NC	NC	35,000	35,000
Manganese	32,100	NC	NC	300	300
Mercury	.6	2	2	2	2
Nickel	259	NC	NC	NS	NS
Potassium	37,900	NC	NC	NC	NC
Selenium	ND	10	10	10	20
Silver	28.7	50	50	50	50
Sodium	275,000	NC	NC	NC	NC
Thallium	ND	NC	NC	4	4
Vanadium	253	NC	NC	NS	NS
Zinc	692	NC	NC	300	5,000

Note: All Concentrations in ug/l (ppb)
NS = Included in the Listing But Limits Not Specified
NC = Not a Listed Contaminant
ND = Not Detected

TABLE 12
ACTION-SPECIFIC ARARS FOR SOIL AND GROUNDWATER TREATMENT
FULTON TERMINALS SITE

ARARS	STATUS	REQUIREMENT SYNOPSIS
A. COMMON TO ALL ALTERNATIVES:		
OSHA - General Industry Standards (29 CFR 1910)	Applicable	These regulations specify the 8-hour time-weighted average concentration for worker exposure to various organic compounds. Training requirements for workers at hazardous waste operations are specified in 29 CFR 1910.120.
OSHA - Safety and Health Standards (29 CFR 1926)	Applicable	This regulation specifies the type of safety equipment and procedures to be followed during site remediation.
OSHA-Record Keeping, Reporting and Related Regulations (29 CFR 1904)	Applicable	This regulation outlines the record keeping and reporting requirements for an employer under OSHA.
USEPA Groundwater Protection Strategy - USEPA Policy Statement, August 1984	To Be Considered	Identifies groundwater quality to be achieved during remedial actions based on the aquifer characteristics and use.
RCRA - Standards for Owners/Operators of Permitted Hazardous Waste Facilities (40 CFR 264.10-264.18)	Relevant And Appropriate	General facility requirements outline general waste analysis, security measures, inspections, and training requirements.
RCRA - Preparedness and Prevention (40 CFR 264.30-264.31)	Relevant And Appropriate	This regulaton outlines the requirements for safety equipment and spill control.
RCRA - Contingency Plan and Emergency Procedures (40 CFR 264.50-264.56)	Relevant And Appropriate	This regulation outlines the requirements for emergency procedures to be used following explosions, fires, etc.
RCRA - Groundwater Protection (40 CFR 264.90-264.101)	Relevant And Appropriate	This regulation details requirements for a groundwater monitoring program to be installed at the site.
RCRA - Closure and Post-Closure (40 CFR 264.110-264.120)	Relevant And Appropriate	The regulation details specific requirements for closure and post-closure of hazardous waste facilities.
Waste Transportation:		
DOT Rules for Transportation of Hazardous Materials (49 CFR Parts 107, 171.1-172.558)	Applicable	This regulation outlines procedures for the packaging, labeling, manifesting, and transporting of hazardous materials.

TABLE 12 (Cont'd)
Page 2 of 6

ARARS	STATUS	REQUIREMENT SYNOPSIS
Waste Transportation (Cont'd):		
Standards Applicable to Transporters of Hazardous Waste - RCRA Section 3003, 40 CFR 262 and 263, 40 CFR 170 to 179[1]	Applicable	Establishes the responsibility of off-site transporters of hazardous waste in the handling, transportation, and management of the waste. Requires a manifest, recordkeeping, and immediate action in the event of a discharge of hazardous waste.
Disposal:		
RCRA Land Disposal Restrictions (40 CFR 268, Subpart D)	Relevant And Appropriate	After November 8, 1988, movement of excavated materials to new location and placement in or on land will trigger land disposal restrictions (for non-CERCLA actions). CERCLA actions will be regulated under this requiremnet beginning on November 8, 1990.
EPA Administered Permit Program: The Hazardous Waste Permit Program RCRA Section 3005, 40 CFR 270, 124[2]	Applicable	Covers the basic permitting, application, monitoring and reporting requirements for off-site hazardous waste management facilities.
B. SOIL TREATMENT:		
Excavation:		
CAA - NAAQS for Total Suspended Particulates (40 CFR 129.105, 750)	Relevant And Appropriate	This regulation specifies maximum primary and secondary 24-hour concentrations for particulate matter. Fugitive dust emissions from site excavation activities must be maintained below 260 ug/m^3 (primary standard).
40 CFR 262: RCRA	Applicable	Establishes standards for generators of hazardous wastes including waste determination, manifests, and pre-transport requirements.
40 CFR 264, Subpart L	Applicable	Provides requirements to design and operate waste piles.
40 CFR 264: RCRA	Applicable	Requires owner/operator to control wind dispersal of particulate matter.
40 CFR 50: NAAQS	Applicable	Provides air quality standards for particulate matter and lead.

ARARS	STATUS	REQUIREMENT SYNOPSIS
Excavation (Cont'd):		
6 NYCRR Part 373	Applicable	Requires owner/operator to cover or otherwise manage to control wind dispersal of particulate matter.
6 NYCRR Part 211	Applicable	Provides General Prohibitions for release of air contaminants.
Clean Closure:		
RCRA - General Standards (40 CFR 264.111)	Relevant And Appropriate	General performance standard requires minimization of need for further maintenance and control; minimization or elimination of post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products. Also requires disposal or decontamination of equipment, structures, and soils.
Thermal Treatment:		
40 CFR 60.52: NSPS	Applicable	Provides particulate emission limits for incinerators.
40 CFR 264: Subpart O	Applicable	Provides performance standards for hazardous waste incinerators.
6 NYCRR Part 201	Relevant And Appropriate	Requires permit to construct and permit to operate an air contamination source.
6 NYCRR Part 211	Applicable	Provides General Prohibitions for release of air contaminants.
6 NYCRR Part 212	Applicable	Requires control and prohibits release of air contaminants from any new or existing process or exhaust and/or ventilation system.
Air Guide-1	Applicable	Guidelines for control of toxic ambient air contaminants.
6 NYCRR Part 219	Applicable	Provides emission standards for incinerators.
6 NYCRR Part 373	Applicable	Provides performance standards for hazardous waste incinerators.

ARARS	STATUS	REQUIREMENT SYNOPSIS
Thermal Treatment (Cont'd)		
40 CFR 264.351	Applicable	Provides requirements for disposal of incinerated ash, scrubber water, and scrubber sludge.
CAA - NAAQS (40 CFR 1-99)	Applicable	Applies to major stationary sources such as treatment units that have the potential to emit significant amounts of pollutants such as NO_x, SO_2, CO, lead, mercury and particulates (more than 250 tons/year). Regulations under CAA do not specifically regulate emissions from hazardous waste incinerators, but it is likely that Prevention of Significant Deterioration (PSD) provisions would apply to an on-site treatment facility.
Interim RCRA/CERCLA Guidance on Non-Contiguous Sites and On-Site Management of Waste and Treated Residue (USEPA Policy Statement, March 27, 1986)	To Be Considered	If a treatment or storage unit is to be constructed for on-site remedial action, there should be a clear intent to dismantle, remove, or close the unit after the CERCLA action is completed. Should there be plans to accept commercial waste at the facility after the CERCLA waste has been processed, it is EPA policy that a RCRA permit be obtained before the unit is constructed.
CAA - NAAQS for Particulate Matter Less Than 10 Microns in Diameter (40 CFR Part 60, Appendix J)	Relevant And Appropriate	This regulation specifies maximum annual arithmetic mean and maximum 24-hour concentrations for particulate matter.
C. GROUNDWATER TREATMENT:		
Discharge of Treated Groundwater:		
40 CFR 122.41 and 44	Relevant And Appropriate	Requires use of best available technology (BAT) to control toxic and nonconventional pollutants; use of best conventional pollutant control technology (BCT) for conventional pollutants. Technology-based limitations may be determined on a case-by-case basis.

ARARS	STATUS	REQUIREMENT SYNOPSIS
Discharge of Treated Groundwater (Cont'd):		
40 CFR 125.100 and 40 CFR 125.104	Relevant And Appropriate	Requires development and implementation of a Best Management Practices program to prevent the release of toxic constituents to surface water.
40 CFR 136.1-136.4	Relevant And Appropriate	Approved test methods for waste constituents to be monitored must be followed. Detailed requirements for analytical procedures and quality controls are provided. Sample preservation procedures, container materials, and maximum allowable holding times are prescribed.
40 CFR Part 262	Applicable	Establishes standards for generators of hazardous wastes.
40 CFR 262.34	Applicable	Requires generator status if waste is stored for over 90 days on-site.
40 CFR Part 268	Applicable	Prohibits dilution as a substitute for treatment.
40 CFR 144.12, 144.13, 144.16, 144.28, 144.51, 144.55, 40 CFR 144.55	Relevant And Appropriate	Provides criteria for injection of treated groundwater.
40 CFR 146.4, 146.12, 146.13	Relevant And Appropriate	Provides criteria for determining whether an aquifer may be determined to be an exempted aquifer, which include current and future use, yield, and water quality characteristics. Regulates injection conditions and monitoring requirements.
40 CFR 147	Relevant And Appropriate	Provides requirements to comply with State underground injection regulations.
40 CFR 268.2	Relevant And Appropriate	Hazardous waste to be injected is subject to land ban regulations. Treated groundwater that meets the definition of hazardous waste and is to be injected also is subject to land ban regulations.
NYCRR Part 750	Applicable	Provides discharge requirements for the New York State Pollution Discharge Elimination System.

TABLE 13
PERFORMANCE OF A UV/OXIDATION SYSTEM
FULTON TERMINALS FEASIBILITY STUDY

VOLATILE	FEED (ppb)	EFFLUENT (ppb)
Acetone	973.4	584
4-Methyl-2-Pentanone	393.0	236
1,1-DCE	49.6	<5
cis-1,2-DCE	14,387.0	<5
TCE	6.8	<5
PCE	6.8	<5
1,1-DCA	24.3	<5
1,1,1-TCA	113.2	70
Benzene	20.8	<5
Toluene	6.8	<5
Xylene	3.1	<5
Chlorobenzene	3.1	<5
Ethylbenzene	2.4	<5
N-Propylbenzene	27.7	<5
Methylene Chloride	185.9	38
Vinyl Chloride	88.0	<2

Process Flow Rate: 150 gpm

Note: Treatment efficiency for lowest cost removal of 1,1-DCE, cis-1,2-DCE, PCE, benzene, vinyl chloride.

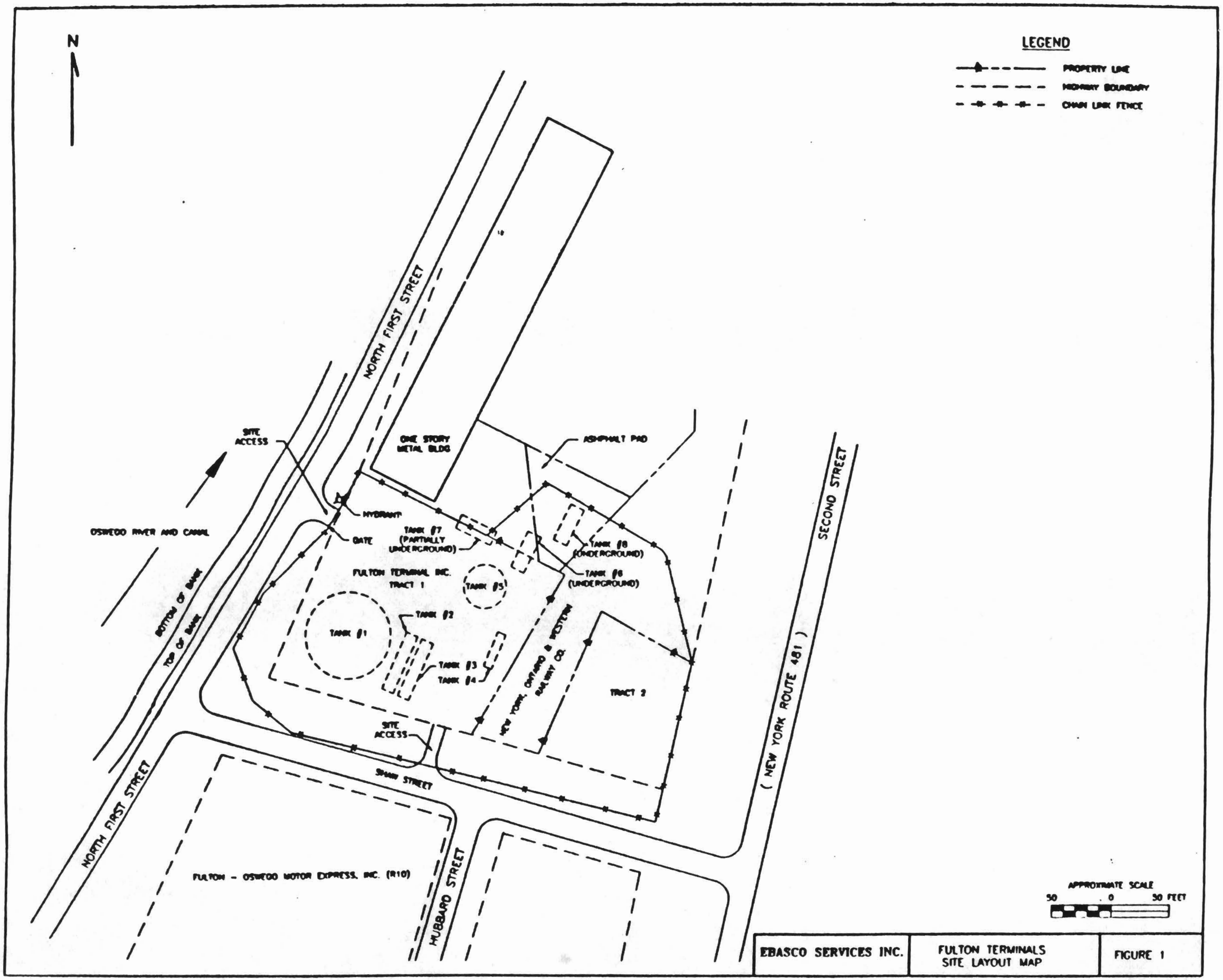
TABLE 14

COST ESTIMATE SUMMARY OF ALTERNATIVES

Alternative	Capital Cost	Annual O&M	5-Year Review	Total Present Worth 5% Discount Rate
SOIL				
SC-1 - No Action	0	$20,400	$10,000	$ 342,000
SC-2 - Excavation and Disposal	$2,927,000	0	0	2,927,000
SC-3 - Low Temperature Thermal Extraction	1,847,000	0	0	1,847,000
SC-4 - Off-Site Incineration	11,303,000	0	0	11,303,000
GROUNDWATER ALTERNATIVES				
MM- 1 No Action	$ 0	$35,300	$10,000	$571,000
MM- 2 Air Stripping/ Carbon Adsorption	823,000	732,000	0	2,184,000
MM- 3 UV/Oxidation	911,000	511,000	0	1,861,000

Notes: 1. All capital costs incorporate contingency and design factors.

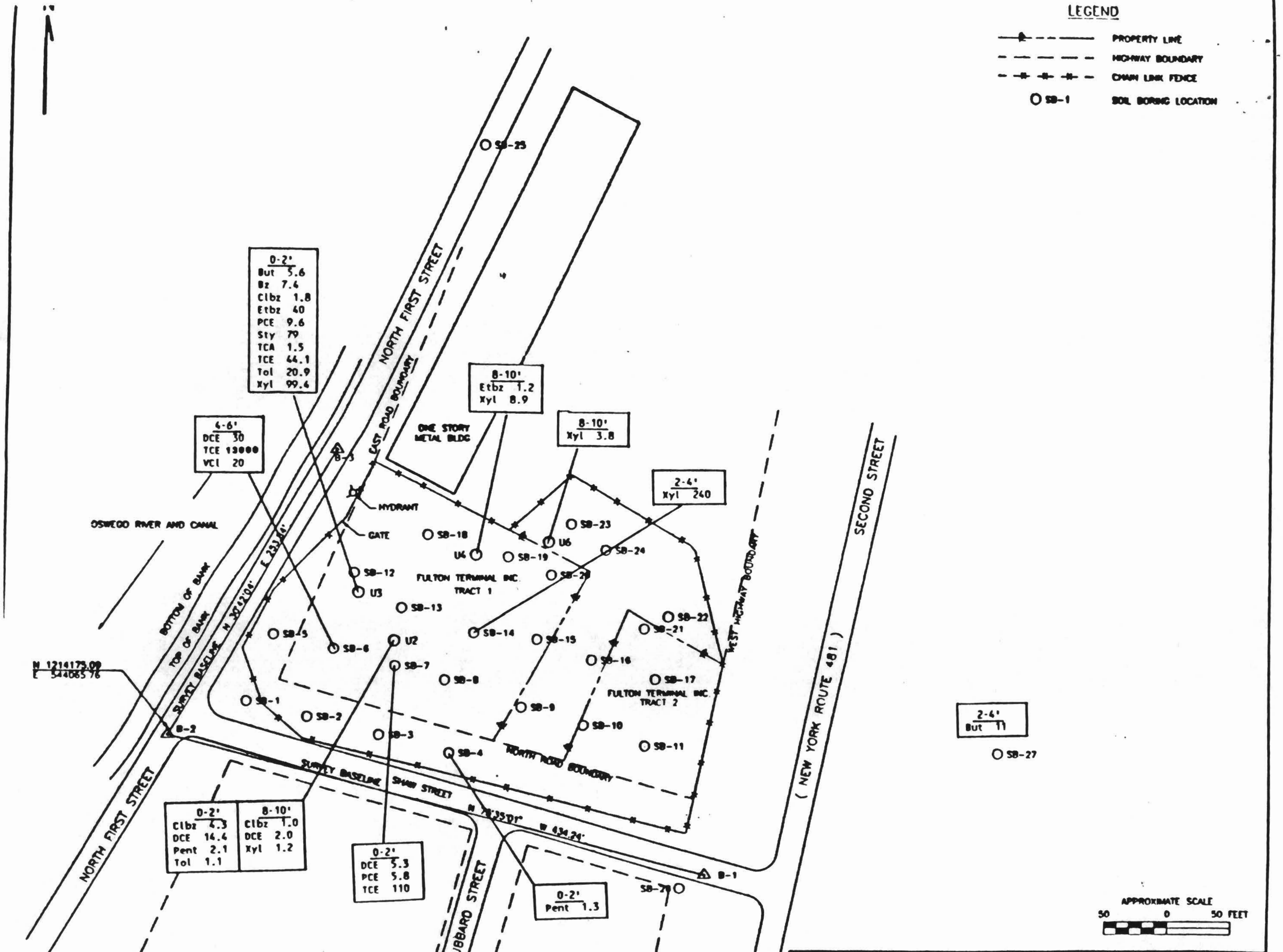
2. All costs rounded to the nearest thousand.



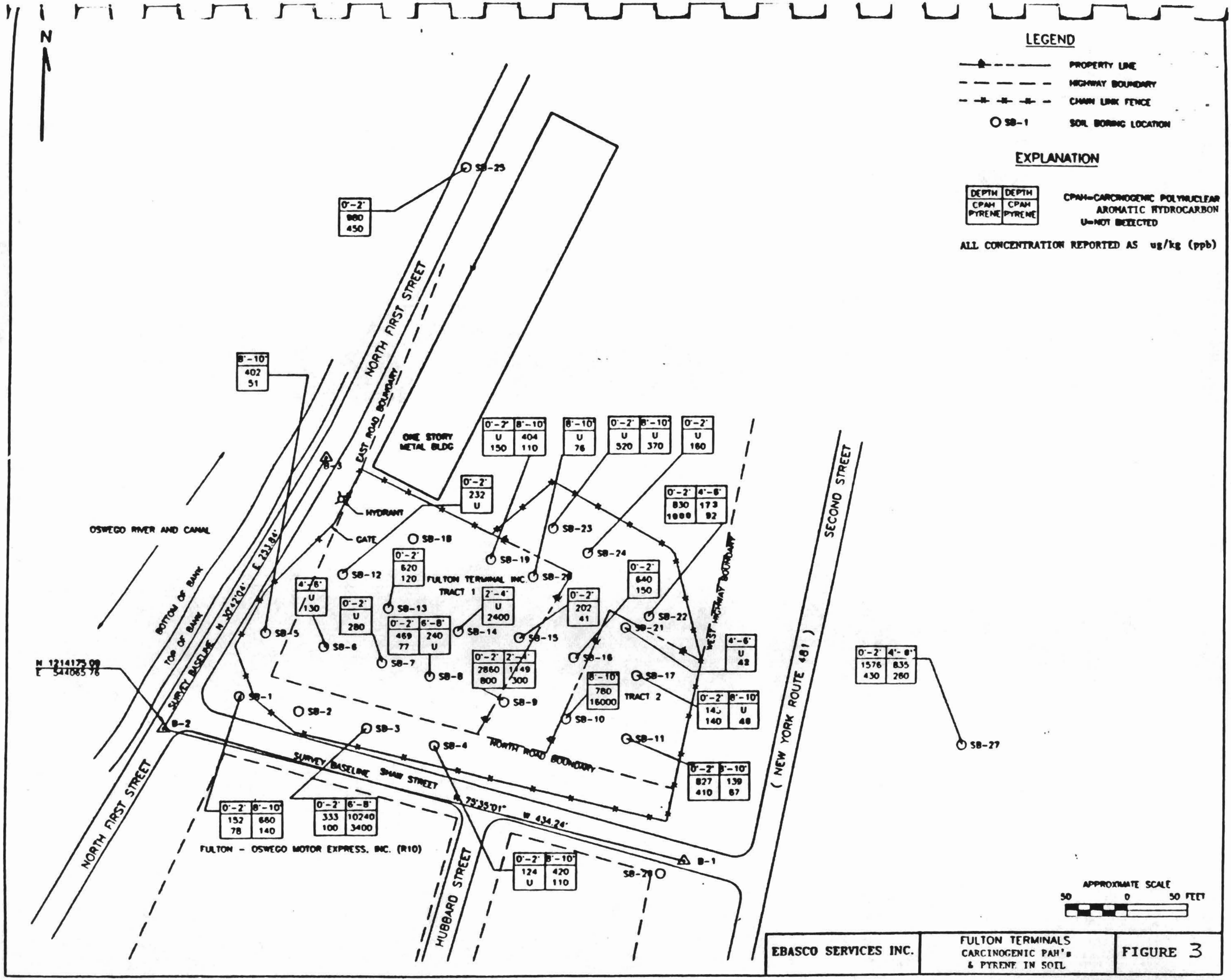
EBASCO SERVICES INC.

FULTON TERMINALS
SITE LAYOUT MAP

FIGURE 1



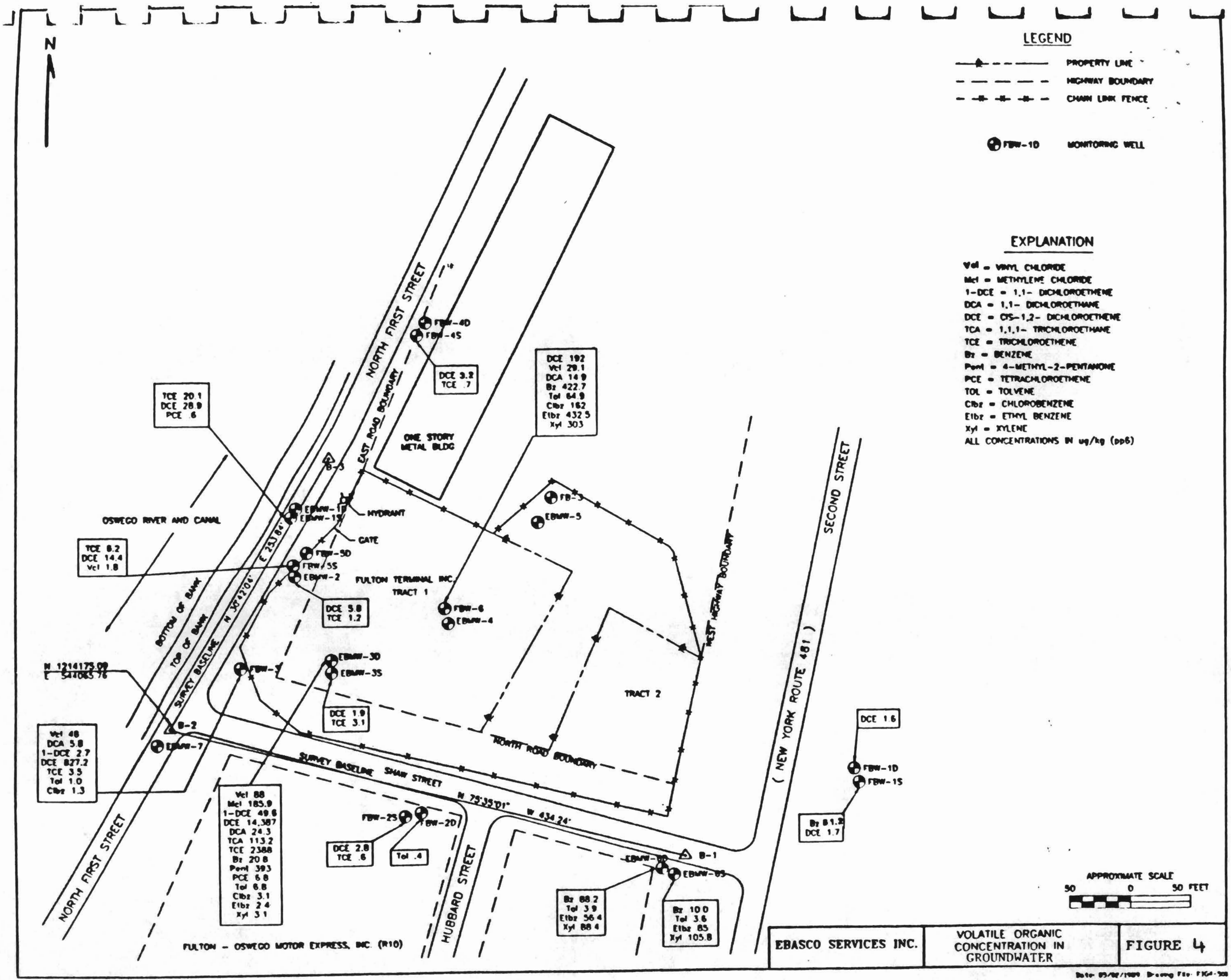
EBASCO SERVICES INC.	FULTON TERMINALS VOLATILE ORGANICS IN SOIL	FIGURE 2



EBASCO SERVICES INC.

FULTON TERMINALS
CARCINOGENIC PAH's
& PYRENE IN SOIL

FIGURE 3



EXPLANATION

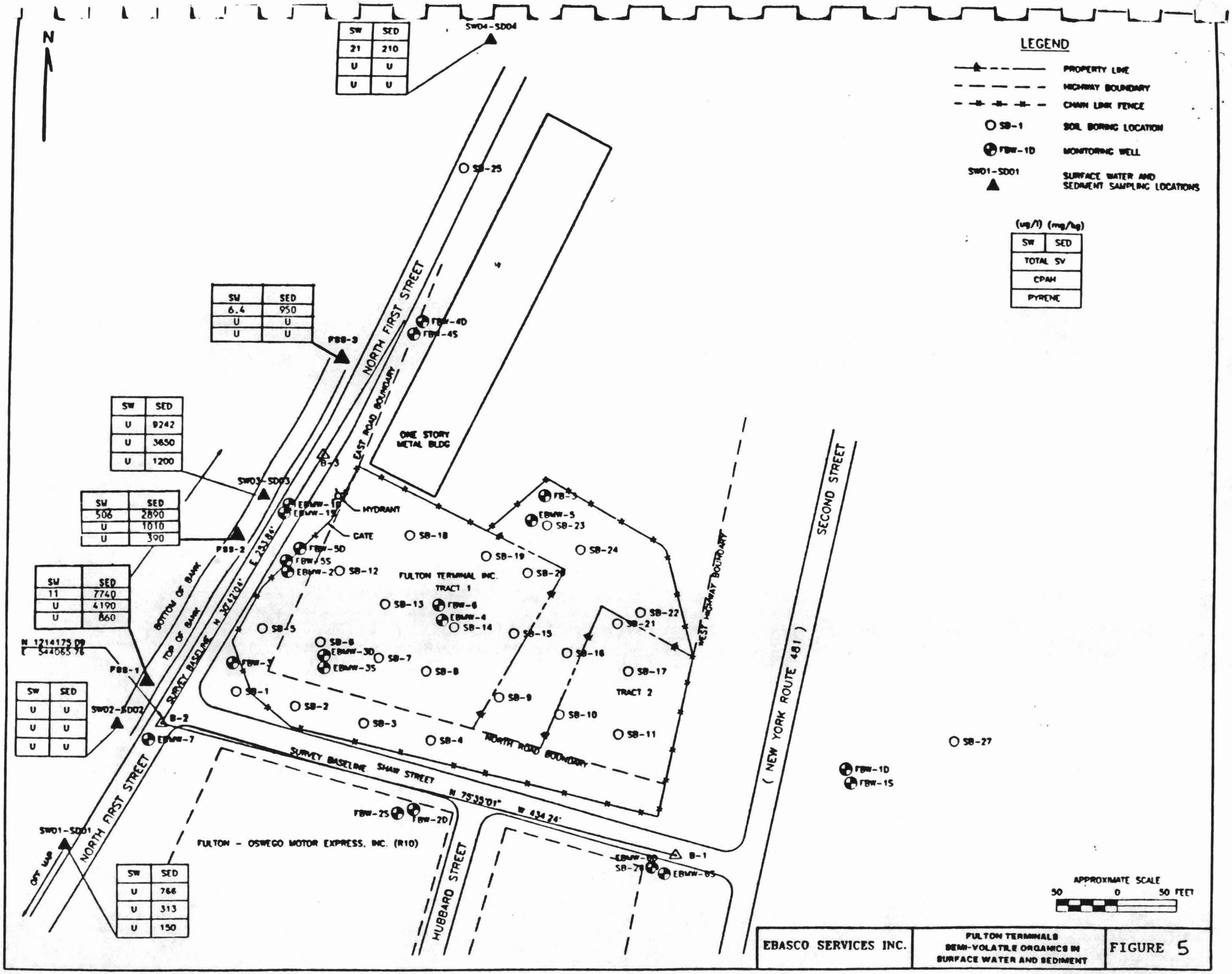
Vcl = VINYL CHLORIDE
Mcl = METHYLENE CHLORIDE
1-DCE = 1,1- DICHLOROETHENE
DCA = 1,1- DICHLOROETHANE
DCE = CIS-1,2- DICHLOROETHENE
TCA = 1,1,1- TRICHLOROETHANE
TCE = TRICHLOROETHENE
Bz = BENZENE
Pent = 4-METHYL-2-PENTANONE
PCE = TETRACHLOROETHENE
TOL = TOLUENE
Clbz = CHLOROBENZENE
Elbz = ETHYL BENZENE
Xyl = XYLENE
ALL CONCENTRATIONS IN ug/kg (ppB)

EBASCO SERVICES INC.

VOLATILE ORGANIC
CONCENTRATION IN
GROUNDWATER

FIGURE 4

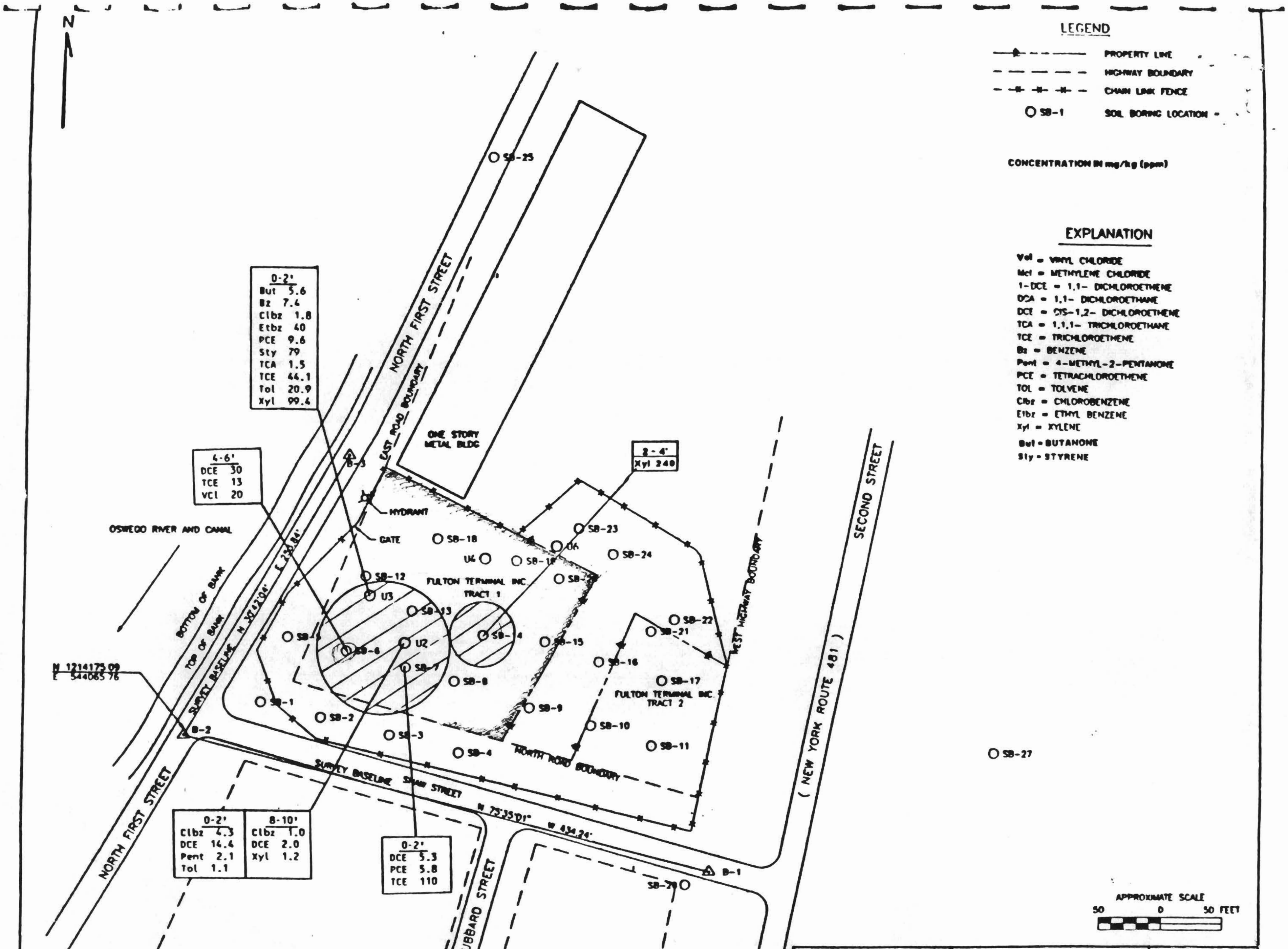
Date: 05/02/1989 Drawing File: FIG4-[illegible]
Drawn: BI [illegible]



EBASCO SERVICES INC.

FULTON TERMINALS
SEMI-VOLATILE ORGANICS IN
SURFACE WATER AND SEDIMENT

FIGURE 5



EBASCO SERVICES INC.

FULTON TERMINALS
AREAS EXCEEDING CLEANUP LEVELS

FIGURE 6

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233 - 7010

Thomas C. Jorling
Commissioner

September 29, 1989

Mr. William J. Muszynski, P.E.
Acting Regional Administrator
United States Environmental
Protection Agency
Region II
26 Federal Plaza
New York, NY 10278

Dear Mr. Muszynski:

RE: Fulton Terminals Site
NYSDEC Site Code: 7-38-023
Record of Decision
Letter of Concurrence

The State of New York has reviewed the Record of Decision (ROD), dated September 1989, for the Fulton Terminals Site, which includes excavation of contaminated soil, low-temperature thermal extraction of the contaminated soil, recovery of contaminated groundwater and air stripping and carbon adsorption of the recovered groundwater.

The State of New York concurs with the ROD with the understanding that this concurrence is subject to the following:

> Although the State of New York accepts the soil cleanup criteria presented in the ROD as being protective of public health, recalculation of soil cleanup criteria will be performed during the remedial design using an analysis mutually acceptable to the State and United States Environmental Protection Agency (USEPA).

Sincerely,

Edward O. Sull

Edward O. Sullivan
Deputy Commissioner

MDK:slj

bcc: E. Sullivan (2)
M. O'Toole (2)
C. Goddard
J. Slack
R. Lupe
M. Kauffman

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Fulton Terminals Site, City of Fulton, Oswego County, New York.

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Fulton Terminals site. The selected remedial alternative was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Contingency Plan (NCP). This decision is based on the administrative record for this site. The attached index identifies the items that comprise the administrative record upon which the selection of the remedial action is based.

The State of New York has concurred with the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present a current or potential threat to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

The selected remedy will address residual soil contamination at the site and contaminated groundwater in the underlying aquifer. Prior cleanup actions have resulted in the removal of visibly-contaminated surface soil and all storage tanks containing hazardous substances.

The major components of the selected remedy are:

- Excavation and treatment, via on-site low temperature thermal extraction, of approximately 4,000 cubic yards of contaminated soil.

- Placement of the treated soils into the excavated areas;

- Extraction and treatment, via air-stripping and carbon adsorption, of the groundwater underlying the site, and reinjection, or another type of recharge technique, to recharge the treated water into the ground; and

- Disposal of the treatment residuals at an off-site Resource Conservation and Recovery Act (RCRA) hazardous waste facility.

The groundwater treatment will continue until federal and state standards for the organic contaminants have been achieved. Because benzene, ethylbenzene and xylene have been detected in upgradient wells at levels exceeding groundwater standards, a separate investigation will be undertaken by the New York State Department of Environmental Conservation (NYSDEC) to define and eliminate the source of the upgradient contamination if these contaminants remain elevated at the time when federal and state standards for the other organic contaminants have been achieved.

It should be noted that the groundwater quality standards for metals may not be achieved, as naturally occurring metal concentrations in the groundwater surrounding the site are higher than the metal concentrations in the groundwater underlying the site. As a result, the quality of the groundwater at the end of this remedial action may not be adequate for use as a potable water supply. Therefore, institutional controls will be established to prevent the utilization of the groundwater at the site for such purposes. Any institutional controls, including, without limitation, well construction permits and water quality certifications, shall be consistent with New York State law.

DECLARATION

Consistent with CERCLA, as amended by SARA, and the NCP, I have determined that the selected remedy is protective of human health and the environment, attains federal and state requirements that are applicable or relevant and appropriate to the remedial action, and is cost effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. Because this remedy will not result in hazardous substances remaining on-site above health based levels, the five-year review will not apply to this action.

William J

9-29-89

William J. Muszynski, P.E.
Acting Regional Administrator

Date