SOILS AND GROUNDWATER
CONTAMINATION CHARACTERIZATION
OF
BAY CENTER SITE
IN
EMERYVILLE, CALIFORNIA

Prepared for:

County of Alameda

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EXECUTIVE SUMMARY

The Bay Center site consists of 18 acres proposed for offices in Emeryville, California, in the northeast quadrant of 64th Street at Lacoste. Site contamination characterization was performed at the direction of (The Martin Company), the site owners, and Alameda County Hazardous Materials Unit.

This characterization study was initiated in 1986 subsequent to archival searches which revealed that the site had been operated as a bay fill location by the City of Emeryville during the 1930s to 1950s. The site was situated adjacent to several industrial uses including PABCO/Fibreboard near Powell Street. Directed inquiries to former employees of PABCO/Fibreboard indicated that the Bay Center site may not have been used for systematic disposal of that company's wastes. Nevertheless, the site may have received, from other sources, fill material which was not then regulated by the federal, state or local governments.

This report will be used primarily by Alameda County to select the appropriate abatement actions. Because this report will also have a lay readership, the report reiterates certain aspects of the site history, summarizes the significance of the characterization results, and provides recommendations.

The site was used for truck transportation during the late 1950s to 1970s. Both Delta Truck and Garrett Freightlines operated truck terminals on the Bay Center site. Ancillary facilities included several underground fuel storage and waste oil tanks.

Samples of soils and water were tested for a broad range of regulated materials including materials addressed in Title 22 of the California State Administrative Code. These materials include heavy metals, volatile organics, chlorinated pesticides, halogenated hydrocarbons, and others. Regulated materials also include the so-called priority pollutants addressed in federal legislation. Degree of contamination is expressed relative to the Title 22 toxic threshold limit concentrations for soils and soluble threshold limit concentrations for water. These limits are presented with the test results in Section 3 and also in Appendix C.

Those contaminants primarily in evidence are lead, DDT (a pesticide), and hydrocarbons related to historic fuel storage. Soils contamination with lead is best described as widespread and sporadic. Soils contamination with hydrocarbons or DDT can be delineated in two prime areas: i) around underground fuel storage tanks and ii) the south portion of the site near Christie/64th Street. The former area has hydrocarbons contamination, and the latter area has evidence of DDT and/or lead contamination. Three distinct test protocols were used to screen, speciate and verify DDT. EPA Method 9022 was applied first to screen for organic chlorine. Then EPA Methods 608 and/or 624/625 (with pesticides) were applied to identify and verify specific organic chlorine compounds. Individual test results are presented in Section 3.

Specific results indicate that upper level soils, which were excavated and stockpiled during the grading of Christie Street, contain over one part per million (ppm) of DDT. The Total Threshold Limit Concentration (TTLC) for DDT is 1 ppm. Christie Street soils include several hundred cubic yards from the

south portion of the Bay Center site near 64th Street and the existing northern terminus of Christie Street. The subject soils also contain trace amounts of EPA designated priority pollutants. Di(-n-)butyl phthalate (2 ppm) is used in nitrocellulose plastic, resins, paper coatings, linoleum, and shatterproof glass. Di-ethyl phthalate (0.2 ppm) is used in plastics, perfume fixative, insecticide, and synthetic resins. Solubility is 0.04 percent to 0.7 percent by weight in water. Phenanthrene (0.4 ppm) and pyrene (benzo phenanthrene) are organics, ($C_{14}H_{10}$ and $C_{15}H_{10}$, respectively), both of which are insoluble in water. Threshold limit concentrations do not apply to the above pollutants.

Soils remaining in place in the Christie Street alignment are relatively less contaminated than the stockpiled soils. Along portions of the Christie Street alignment, lead levels are nontoxic and halogenated hydrocarbons are nondetectable.

Gas monitoring of pilot holes in Pads A and B, and Monitor Well B, showed the presence of hydrocarbons (as methane) in the hole bottoms, at concentrations of 5.4 percent in the holes. Two distinct test protocols were applied to measure total hydrocarbons as methane and to speciate methane, ethane, propane, and higher weight hydrocarbons. A Gastector explosive level analyzer and gas chromatography were used in the initial screening. Full analysis of the amount of gas emanating from the site, and characterization of the gas, is being prepared by GSS Energy, Inc. Quantification and speciation will satisfy both requirements of the Calderon Bill and Regulation 8, Rule 34 of the Bay Area Air Quality Management District.

Based upon the test results and other considerations, our recommended abatement action for soils contamination is encapsulation of soils at the Bay Center site, wherever practical and wherever volatile organics are not an issue. Selected soils excavated during utility line trenching along the Christie Street extension may be suitable for trench or tank pit backfill. Also, soils stockpiled from the Christie Street grade cut may be suitable for trenchor tank pit backfill. Excess materials which cannot be backfilled can be encapsulated on site (preferred alternative) or disposed off site at an appropriate land fill. Considerations supporting our recommended abatement action are presented in Section 5.

The above abatement action applies solely to soils which are not involved in the hydrocarbons abatement action, in the context of the underground fuel storage tanks. Hydrocarbons characterization and abatement is the subject of a separate report to Alameda County by Aqua Science Engineers.

For gas migration control, abatement measures are being evaluated to protect on site building environments. The estimated methane emission is zero to trace, indicating that gas exists in pockets and gas production is on the decline. Candidate abatement measures in advance of the GSS Energy Inc. report are HVAC and monitoring controls. Final determination will be possible after the GSS Energy Inc. report is available.

1. SITE HISTORY AND EXISTING ENVIRONMENT

1.1 EXISTING AND PROPOSED USE OF SITE

The subject site is located in the City of Emeryville west of Bay Street, east of Lacoste Street and Highway 80, north of 64th Street and south of 65th Street (see Figure 1.1). At the 64th Street boundary, the site is elevated approximately four feet above the grade of 64th Street pavement. The site slopes toward the north, with a high elevation of approximately 14.8 feet (MSL) at 64th Street to a low elevation of 10.8 feet (MSL) at 65th Street.

The site was most recently used as a truck terminal by Garrett Freight Lines. Three buildings and two fuel pump islands with eleven underground storage tanks have been eliminated from the site. Foundation fill material and all materials excavated during removal and demolition of the Garrett Freight facilities remain either in place or under tarps next to tank removal pits. The site remains nearly 100 percent paved with the exception of several minor areas such as landscaping along 64th Street and areas of building demolition. No obvious cracks in the pavement exist, although numerous deep holes exist from fence and underground storage tank removal.

The use of the site proposed by The Martin Company, the current owner, is an office use. Grading and construction of three building pads have been completed. Piles are being driven to support the future structures. Locations of the building pads within the site are shown in subsequent figures in Section 2, Draft Work Plan Amplifications and Clarifications. The site and office project is now commonly referred to as Bay Center.

1.2 HISTORIC LAND RECLAMATION AND DEVELOPMENT

Table 1.1 summarizes the chronology of reclamation and development of the subject site and adjacent sites in Emeryville, California. Reclamation refers here to the creation of land protected from tidal flooding.

The subject site was in the tidal plain of the San Francisco Bay until construction of East Shore Highway in 1954 (Deasy, CALTRANS, 1986) created a levee protecting inland parcels. The subject site was filled by the City of Emeryville in the late 1950s. Fill materials probably included clayey/sandy clean fill and industrial wastes.

No records of previous site occupancy, prior to occupancy by Garrett Freight Lines, were discovered. Historic development of contiguous and adjacent parcels was researched to confirm presence or absence of previous development. Adjacent and contiguous parcels were reclaimed from the effect of San Francisco Bay tidal flooding at much earlier dates.

The parcel contiguous with the subject site, south of 64th Street, was leased/operated by the City of Emeryville as a municipal disposal site. This parcel, bounded by 64th Street on the north, East Shore Freeway on the west, SPRR on the east, and 63rd Street on the south, was filled during 1935 to 1937 (DOHS, Winter 1980). Later (circa 1957) Fibreboard (jointly owned by PABCO and Zellerbach) constructed resin, paint, and insulation manufacturing facilities on the contiguous parcel. All buildings except for the main 50,000 square foot building were demolished around 1964, to make way for a new industrial park. Demolition spoils could not have been disposed on the subject site which had already been occupied by Garrett Freight Lines by 1960.

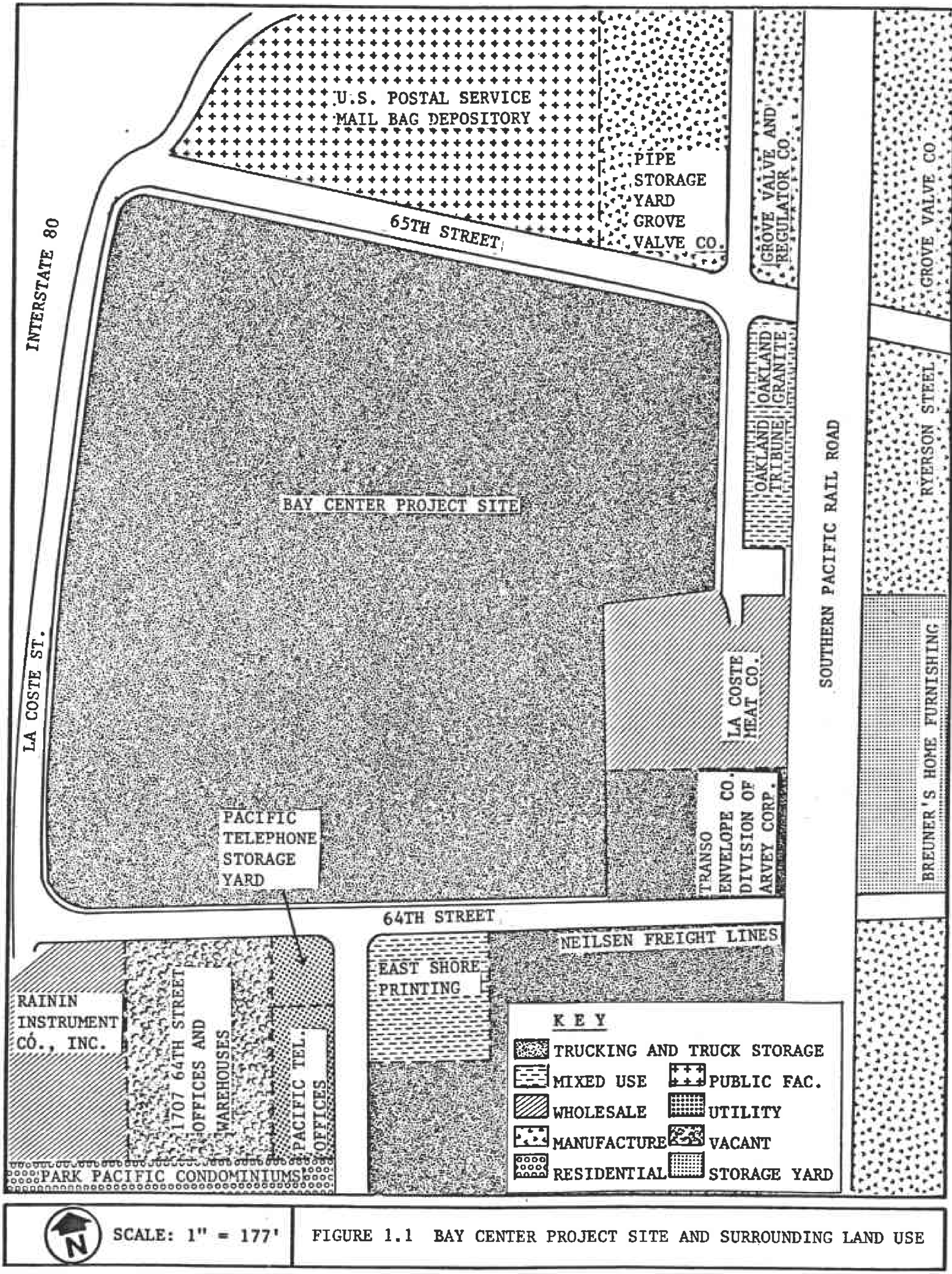


FIGURE 1.1 BAY CENTER PROJECT SITE AND SURROUNDING LAND USE

TABLE 1.1. CHRONOLOGY OF RECLAMATION AND DEVELOPMENT OF THE SUBJECT SITE AND ADJACENT SITES AT BAY CENTER, EMERYVILLE

Late 1800s:	Emeryville shoreline has been extended baywards by artificial fill over bay mud. The composition of the fill is highly variable imported clayey and/or sandy soils combined with construction spoils and industrial waste. (1)
1884:	The first of the Paraffine Companies, Inc. plants was started. (6)
1902 to 1904:	The Paraffine Companies, Inc. initiated the manufacture of roofing felt, roofing paper and linoleum. Asphalt was refined on the manufacturing plant property at the foot of Powell Street. The manufacturing site consisted of less than 30 acres. (2,3,4)
1915:	Map of Berkeley/Emeryville indicates bay shoreline immediately west of SPRR tracks. The subject site is in the San Francisco Bay tidal plain.
1920s:	The Paraffine Companies, Inc. changed its name to PABCO. (5)
1927:	Aerial view of PABCO indicates facilities on a site of approximately 30 acres. (4) The PABCO site does not overlap the subject property north of 64th Street, the subject property being underwater.
1929:	PABCO leased from the City of Emeryville a 400 foot wide strip of municipally owned tidelands in the San Francisco Bay to be used as a shipping lane/harbor. (7)
1932:	The PABCO property has expanded to encompass a land area of 30 acres. PABCO owned property also includes 140 acres in the San Francisco Bay, adjoining the 30 acres. (6)
1935 to 1937:	The site contiguous with the subject property, which is bounded by 64th Street on the north, 63rd Street on the south, East Shore Freeway on the west, and SPRR on the east, was filled by the City of Emeryville. (2) The fill material is presumed to be a combination of clean fill and industrial waste. (1) The subject site has not been reclaimed. Mr. Frank Thomas, who had worked for the City of Emeryville Public Works Department since the 1930s, verified use of the subject site and adjacent sites as municipal fill sites. (8)

TABLE 1.1 (CONTINUED). CHRONOLOGY OF RECLAMATION AND DEVELOPMENT OF THE SUBJECT SITE AND ADJACENT SITES AT BAY CENTER, EMERYVILLE

1957:	PABCO sold its property to Fibreboard, a company owned jointly by PABCO and Zellerbach. (2) In addition to continuing the original manufacturing plants, Fibreboard added resin, paint, and insulation manufacturing plants. The above manufacturing plants were constructed on the filled site bounded by 64th Street on the north, 63rd Street on the south, East Shore Freeway on the west and SPRR tracks on the east.
Late 1950s:	The existing Garrett Truck Lines site (subject site) was filled by the City of Emeryville. (11)
1960:	The Garrett Freight Company building was constructed. (11,12)
Mid 1960s:	Fibreboard began to divest the former PABCO land holdings. (2)
1964:	Van Bokkelen-Cole Construction company of Oakland purchased 27.6 acres of the former PABCO land holdings from Fibreboard. The 27.6 acres are bounded generally by Powell Street on the south, East Shore Freeway on the west, SPRR tracks on the east, and the Garrett Truck Lines building on the north. All buildings except for a 50,0000 square foot building were demolished, to make way for a new industrial park. (9) <u>Note</u>: The Garrett Truck Lines property mentioned above is the subject property.
1968:	Consolidated Equity Companies of Beverly Hills, new owners of the 27.6 acres purchased from Van Bokkelen-Cole, attempted to recondition the main 50,000 square foot PABCO warehouse for use as a commercial complex. Eighty percent of the retail project had been completed when Consolidated Equity Companies went bankrupt in 1975. (2,10)
1975:	Equity Financial and Management Corporation of Chicago acquired the "Emeryville Market" 27.6 acre site on January 1, 1976. (10)

(1) City of Emeryville, Emeryville Redevelopment Project Draft EIR, 1977 (Pages 16 and 17).

(2) DOHS, Internal Memorandum on "The Marketplace", 5800 Shellmound Avenue (undated, circa Winter 1980).

(3) <u>Emeryville Herald</u>, Thirty Third Anniversary Edition, December 6, 1929, Supplement (Page 14).

(CONTINUED)

TABLE 1.1 (CONTINUED). CHRONOLOGY OF RECLAMATION AND DEVELOPMENT OF THE SUBJECT SITE AND ADJACENT SITES AT BAY CENTER, EMERYVILLE

(4) "Oakland Outlook", December 1927, Advertisement (Page 21).

(5) California Magazine of the Pacific, December 1937, "It Started From 'Black Paraffine'" by Stuart O. Blythe (Pages 4 through 7, 32 and 33).

(6) "Oakland Outlook", November 1932 (Page 2).

(7) Oakland Tribune, June 15, 1929, "Tideland Lease Insures Port at Emeryville".

(8) DOHS, Memo of Call, January 3, 1980 (DOHS personnel taking or making call: JEC).

(9) Oakland Tribune, September 17, 1964, "Industrial Park for Emeryville".

(10) Oakland Tribune, September 12, 1976, "Rebirth for Market" by Lon M. Carlston.

(11) Earth Metrics Incorporated, Contact Report, February 21, 1986 (Earth Metrics personnel taking or making call: SH).

(12) Alameda, County of, Assessor's Office, microfiche for APN49-1491-3-3 and APN49-1491-3-4.

Researched by: Earth Metrics Incorporated, 1986.

No record of lease of the contiguous parcel from PABCO to the City of Emeryville, for use as a disposal site, was discovered during this research. An aerial view of the PABCO development in 1927 and information contained in the Oakland Tribune and "Oakland Outlook" indicate that the extent of PABCO land holdings from 1932 to 1964 probably encompassed all of the contiguous parcel consisting of approximately ten acres. Divestiture in 1964 transferred these ten acres and an additional 17.6 acres to Van Bokkelen-Cole Construction Company (Oakland Tribune, 9/17/64). These combined 27.6 acres are sometimes called the "Emeryville Market".

PABCO/Fibreboard was a building materials manufacturing concern at the foot of Powell Street, founded *circa* 1884. By 1927, it had expanded from a site of approximately three acres to a site of approximately 30 acres bounded by the San Francisco Bay on the west, Landregan Street and the SPRR on the east, 63rd Street on the north, and Powell Street on the south. Much of the land west of the SPRR represents reclaimed land relative to the 1915 shoreline. By 1929 PABCO/Fibreboard land holdings included the above 30 acres plus 140 acres in the San Francisco Bay (Emeryville Herald, 12/6/29). In addition, PABCO/Fibreboard leased from the City of Emeryville a 400 foot by 4,000 foot strip for use as a shipping lane/harbor (Oakland Tribune, 6/15/29).

Evidence of Systematic Disposal of Potentially Hazardous Materials. Directed inquiries were made by Earth Metrics Incorporated with regard to PABCO/Fibreboard and potential systematic land disposal of raw materials and waste by products. Inquiries were made owing to the known historic presence of paint and resin manufacturing on land contiguous with the subject site, south of 64th Street. Findings were negative, meaning that if any land disposal of waste by products or finished products on the subject site have occurred, then the disposal was random disposal by the City of Emeryville of a variety of heterogeneous fill materials which may or may not have included materials used or made by PABCO/Fibreboard.

Municipal fill sites were operated by the City of Emeryville during the 1930s, 1940s, and 1950s along a strip of land between the East Shore Freeway and SPRR, north and south of the PABCO/Fibreboard site. Generally, the sites were used for disposal of clean fill, demolition spoils, and industrial wastes. Municipal solid waste may also have been disposed.

The subject site itself was identified by former Public Works Department personnel as a municipal fill site. However, the former personnel and additional investigation by Earth Metrics Incorporated revealed no evidence of systematic use of the site for disposal of potentially hazardous materials used by PABCO, including paint, resins, roofing paper and raw materials related to PABCO/Fibreboard. Instead, the fill materials came from a variety of locations and varied in nature.

1.3 GEOLOGY

The hills above Emeryville consist of Tertiary sediments and volcanics overlying Jurassic-Cretaceous bedrock of the Franciscan Assemblage. The hills are part of the California Coast Range, and result from repeated episodes of deformation by folding and faulting over the last three million years. This uplift contributed to rapid erosion and deposition of a thick sequence of poorly consolidated alluvial fan deposits. Fluctuation in sea level, as a result of continental glaciation, accelerated this process. As much as 540 feet of this late Tertiary early Quaternary sediment is believed to overlie bedrock in the Emeryville area.

The oldest alluvial fan deposits consist of poorly consolidated interbedded silts, sands and gravels known as the Alameda Formation (Qa). These in turn are overlain by 10 to 15 feet of alluvium and stream deposited sands and silts of the Temescal formation (Qtc). North of Powell Street in the area of the project site, the Temescal sands and silts are overlain by 30 feet of Merritt sand, a generally fine grained and well sorted beach and windblown sand deposit. Overlying these sands in this area are 10 to 20 feet of Bay Mud.

Artificial Fill. Since the late 1800s the Emeryville shoreline has been progressively extended baywards by imported fill. Approximately one third of the land area of the City of Emeryville presently consists of fill placed over bay mud. The composition of the fill is highly variable, and in general it appears to consist of imported clayey and/or sandy soils combined with construction and industrial waste materials (City of Emeryville, Emeryville Redevelopment Project Draft EIR, 1977).

Bore holes north of the project site indicate that thicknesses of the artificial fill material in this area range from approximately 15 to 25 feet (City of Emeryville, 1975). Boring logs from the project site suggest that artificial fill material is probably not much greater than 15 feet overlying bay mud (Geomatrix, 1986). Analysis of these logs suggests stratification of the fill material. The upper 1.5 to 4.0 feet of fill on the subject site consists of asphalt, aggregate base, and imported select fill. The underlying three to five feet of fill consists of a heterogeneous mixture of clay and sand with assorted miscellaneous debris including metal, glass, brick, and burnt wood. Maximum concentrations of these materials appear at approximately six feet below grade.

Logs of the soils borings reveal materials that are part of the historic municipal use of the subject site for land disposal. Metal and slag could have originated from early industrial uses located in Emeryville/Oakland, such as Judson Steel and scrap yard. Brick, glass, and wood could have been transported from building demolition sites in Emeryville. Burnt materials could have been disposed on the subject site from fire damaged buildings.

Historic municipal disposal of scrap metal, spent welding rods, and other ferrous materials is probable. Iron was tested in twelve (12) samples and determined to be in the range of 6,700 mg/kg to 140,000 mg/kg. Metal was visually confirmed in the boring logs. Owing to the shallowness of the fill overlying the Bay Mud, rain and moisture had been oxidizing solid metal and leaching metallic ions for a period of several years, prior to encapsulation of the subject site with asphaltic pavement by Garrett Freight Lines.

At depths greater than six feet below grade, clay content of the fill material is seen in the bore logs to increase substantially. At approximately ten to 12 feet, a layer of oily slag and organic material is seen in numerous bore hole locations throughout the site. Petroleum odors are also reported from numerous samples taken at this depth.

1.4 HYDROLOGY

Major fresh water aquifers in the vicinity of Emeryville include most of the porous sands and gravels of the Alameda, Temescal and Merritt sand formations. Porous members of the older Franciscan assemblage are also known as fresh water sources throughout many subbasins in the San Francisco Bay Area, but this source is limited due to extreme deformation and faulting since its deposition.

Fresh water enters the aquifers through natural rainwater recharge areas wherever these formations surface in the east bay hills. The water then flows down gradient into porous sediments underlying the bay mud deposits below San Francisco Bay. It can be assumed that at least some of these porous sediments come into direct contact with deeper bay waters which will enter the aquifers during dry seasons when pressure from the outflowing meteoric water decreases.

Bay mud is extremely clay rich and is virtually saturated with mineral bound water. Flow of water through this layer is minimal; therefore, communication between waters in layers above and below the bay mud deposits can be assumed to be virtually nil.

Artificial fill layers tend to be such heterogeneous mixtures of material that some degree of porosity would be expected. Since the fill material was deposited directly onto tidal flats it can be assumed that saline groundwaters may ebb and flow to some degree through the artificial fill layer at the Emeryville site.

Surface Water Runoff. Storm runoff flows generally from east to west across the site and into storm drainage beneath Lacoste Street. These waters are ultimately discharged untreated into San Francisco Bay. There were no known oil or gas traps functioning at the site during occupation by Garrett Freight.

Prior to the asphalt surfacing of the site by Garrett Freight, the landfill area was exposed to years of rainwater percolating through the fill material.

2. DRAFT WORK PLAN AMPLIFICATIONS AND CLARIFICATIONS

Contaminant characterization has been performed pursuant to the Draft Work Plan and Draft Work Plan Addendum submitted to Alameda County, Hazardous Materials Unit, on May 19 and June 11, 1986. The Draft Work Plan has further been modified to incorporate directives of the Hazardous Materials Unit in its letter of June 26, 1986. These further modifications are discussed below.

2.1 WEST PORTION OF SITE

The west portion of the site consists of the land bounded by Christie Street extended on the east, 64th Street on the south, Lacoste Street on the west, and 65th Street on the north. The following amendments have been included in the characterization process at the direction of the Alameda County Hazardous Materials Unit.

Metals Parameters. At the direction of the Hazardous Materials Unit, these are arsenic (As), barium (Ba), copper (Cu), cadmium (Cd), lead (Pb), mercury (Hg), and nickel (Ni). Copper and nickel were substituted for selenium (Se) and silver (Ag), relative to the Draft Work Plan metals parameters. Other metals, in addition to the above listed metals, such as selenium, silver, and iron, were tested in selected samples on a discretionary basis.

EPA Method 9022. EPA Method 9022 was developed by the Environmental Research Group for determining concentrations of halogenated hydrocarbons in water. Halogenated hydrocarbons are groups of hydrocarbon compounds wich contain chlorine, bromine, or iodine. DDT and PCBs are examples of halogenated hydrocarbons, as both represent molecules composed of carbon, hydrogen, and chlorine.

EPA Method 9022 is equally effective for screening soils samples for potential contamination by halogenated hydrocarbons. EPA Method 9022 is based on measurement of gamma emissions from the unstable isotopes of the subject halogenated hydrocarbon compounds. These gamma emissions are independent of the physical state of the sample, whether solid, liquid, or gaseous. EPA Method 9022 is attached in Appendix A.

Because EPA Method 9022 does not distinguish among individual chemical species (e.g., both DDT and PCB are detected as chlorine), EPA Method 9022 is useful primarily for screening samples for presence of halogenated hydrocarbons groups. Also, as explained below, EPA Method 9022 can be used for making inferences about maximum potential concentrations of individual toxic compounds.

DDT, for example, has a particularly low Total Threshold Limit Concentration (TTLC) of one ppm. A soil sample having an EPA Method 9022 test result of 0.5 ppm (chlorine) could have as much as one ppm DDT. The 0.5 ppm (chlorine) concentration was used as the critical concentration which triggered further sampling and chemical speciation.

DDT has the chemical formula: CCl3 CH (C6H4Cl)2. By inspection of this formula, one can calculate that the percentage of chlorine in a DDT molecule is approximately 50 percent (by weight). Therefore, if 0.5 ppm of chlorine are detected in a sample, then the sample can contain up to one ppm DDT, assuming that DDT were present as the only chlorinated hydrocarbon in the sample.

If other chlorinated hydrocarbons were present, the actual DDT concentration would be less than the TTLC. One ppm, therefore, represents an upper limit of the potential DDT concentration in the sample. Also, the EPA Method 9022 test is not a verification test for the actual presence of any individual compound, including DDT. At the request and direction of the Hazardous Materials Unit, "composite" sampling is clarified and distinguished from "grab" sampling.

Grab and Composite Samples. "Composite" samples were proposed in the Draft Work Plan for characterizing the in place soils from Strata I, II, III, IV and V as well as from Garrett and Delta Building Foundation fill material. As it is often difficult or impossible to obtain true "composite" samples from deep subsurface strata, both the Garrett Foundation fill and subsurface in place soils throughout the site were sampled through acquisition of cores. Only the Delta Building Foundation fill material, through use of a backhoe, and soils penerated by water Monitor Wells A and B, by careful logging of drill cuttings, were true "composite" samples of subsurface materials able to be obtained. These composite samples we collected in one liter amber glass jars and kept refigerated.

Subsurface in place soil "grab" samples were taken from various depths throughout the Bay Center site, (including the Garret building foundation) by use of a hollow stem auger and percussion sampler. Soils sample cores were taken at various depths within three foot intervals corresponding to predefined "strata" at the site. The cores were generally collected in "pairs" of four inch brass tubes (one directly below the other). Of each pair, the one selected for heavy metals analysis was capped with plastic and sealed with duck tape. The other, selected for TOX (total organic halogens) analysis, was capped with aluminum foil, on top of which was placed a plastic cap and sealed with duck tape. All samples were kept refigerated.

Each sample of Strata I, II, III, IV or V in place soils is representative of the proximate soils contamination in the immediate vicinity of the "point" from which they were collected. Each sample, therefore, is unique to a "point" in the Bay Center site and does not individually represent average conditions in any volume of material much larger than the sample container volume.

Composite samples were taken in one liter amber glass jars from all stockpiled soils regardless of the size of the stock piles. Composite samples were taken on various pilot hole drill cuttings in VOA (volatile organic analysis) bottles for TOX analysis. All samples were kept refigerated.

In all contexts, composite and grab samples have been clearly distinguished in all field notes and chains of custody. Pursuant to the directive of the Hazardous Materials Unit the location of each subcomposite comprising the composite sample has been recorded and the mixing procedure documented. These guidelines apply in particular to the continuing characterization of excavated materials at the Bay Center site prior to potential disposal off site at appropriate landfill facilities.

2.2 EAST PORTION OF SITE

The east portion of the site consists of the land bounded by Christie Street extended on the west, 64th Street on the south, 65th Street on the north, miscellaneous existing uses (e.g., Oakland Tribune, LaCoste Meat Company) on the east, and 64th Street on the south. The following amendments have been included in the characteerization process at the direction of the Alameda County Hazardous Materials Unit.

Metals Parameters. These are the same as described previously for the west portion of the site.

EPA Method 9022. The same discussion applies to the east portion characterization as applies to the west portion characterization.

Grab and Composite Samples. The previous discussion also applies to characterization of materials in the east portion of the Bay Center site.

Hygiene and Safety Plan. Pursuant to the directive of the Hazardous Materials Unit a Hygiene and Safety Plan was prepared by a Certified Industrial Hygienist for the Bay Center site. The Hygiene and Safety Plan addresses, among other issues, action levels relative to hydrocarbons which would trigger special precautions and/or work stoppage. The Hygiene and Safety Plan has been transmitted to the Hazardous Materials Unit and other concerned parties. The plan and addenda are reproduced in Appendix B.

Fuel and Waste Oil Tank Pits. At the direction of the Hazardous Materials Unit the following tests have been performed to characterize the air, soils, and water in the vicinity of the fuel and waste oil tank pits in the eastern portion of the Bay Center site.

AIR. In the vicinity of the gasoline tank pits, benzene and EDB. These tests were performed by Aqua Sciences.

SOILS. For the soils samples, lead and hydrocarbons. Also, in particular, for the soils around waste oil tank pits, chlorinanted hydrocarbons.

WATER. For water in two groundwater monitoring wells, near field and far field, CAM metals, EPA Method 629/625 analytics including pesticides (GC/MS).

Monitor Wells. Two groundwater monitor wells were emplaced within the Bay Center site. Monitor Well A is located approximately 40 feet southeast of the diesel and gasoline storage tank pits. Monitor Well B is located near the west end of the site approximately midway between 64th and 65th Streets (see Figure 2.1).

Both wells were drilled by Aqua Science Engineers on July 3, 1986. Monitor Well A was completed at 3:30 P.M. and Monitor Well B at 10:40 A.M. The wells were drilled to 15 feet and were completed with sand packed slotted PVC liners. Water samples were collected using a teflon sampling tube. Each sample was collected in four VOA bottles and a one liter amber glass jar, and were refrigerated. The groundwater level in both wells was measured at 5'6" above mean sea level.

Water samples were also collected through a hollow stem auger at locations W9 and W15 (Figure 2.1), using the same equipment and method as for Monitor Wells A and B. Water levels in these holes were not so easily determined however, but were located approximately at 6'1" (W9) and 6'8" (W15) above mean sea level.

2.3 SAMPLING LOCATIONS

The following Figures 2.1 through 2.6 are derived from the Draft Work Plan and actual sampling performed at the Bay Center site. Locations of water sampling (Figure 2.1), in-place soils sampling (Figures 2.2, 2.3, 2.4, and 2.5), and disturbed (excavated or other) soils sampling (Figure 2.6) are illustrated. Also illustrated in Figures 2.2, 2.3, 2.4, and 2.5 are locations of the initial soil borings which were screened for lead, zinc, chromium, and iron. Figure 2.7 illustrates sample locations of Christie Street storm drain and Pad A footing trench spoils. Sampling results are presented in Section 3 without further graphic presentation of sampling locations.

FIGURE 2.1
WATER SAMPLES LOCATIONS

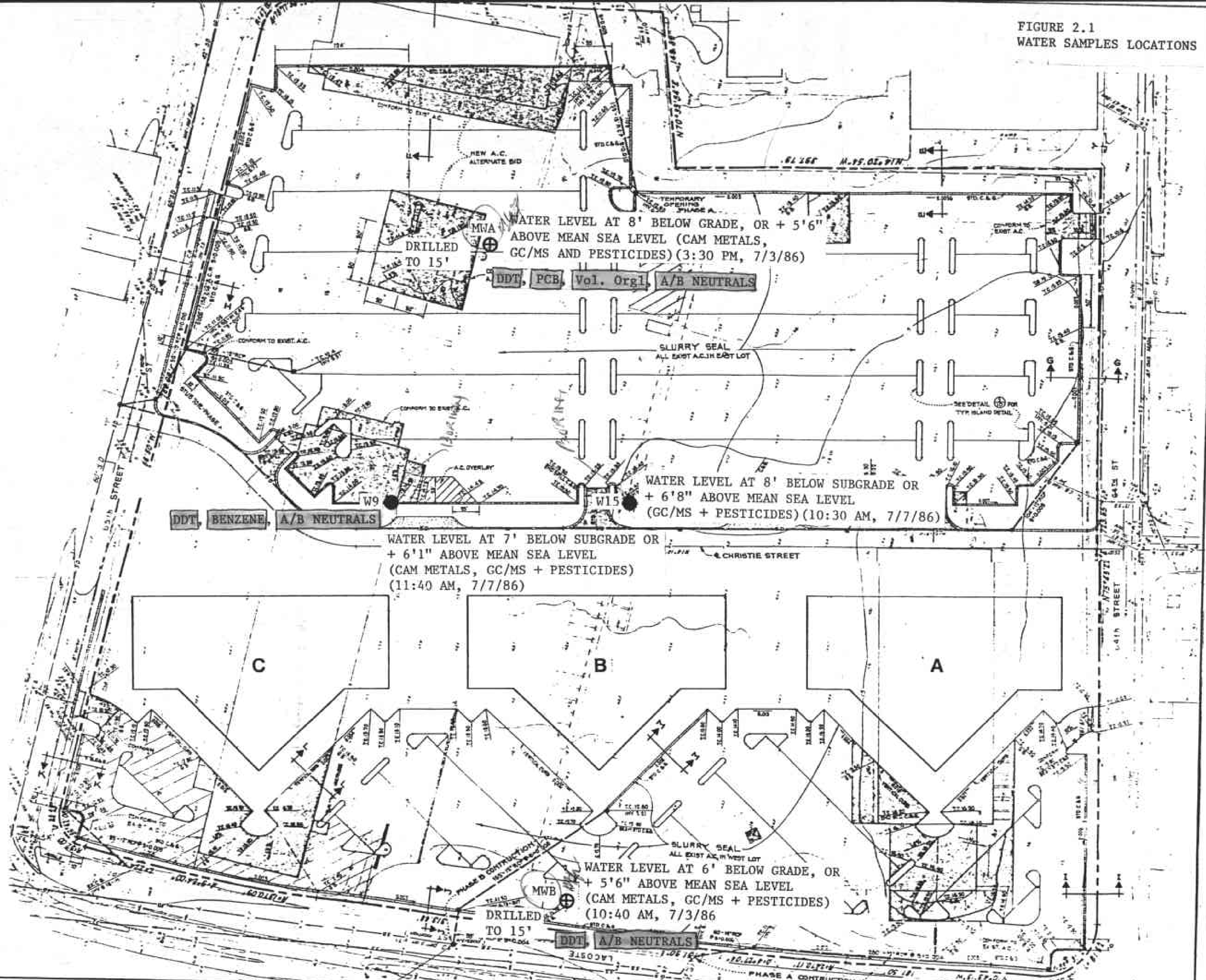


FIGURE 2.2
STRATUM I SAMPLE LOCATIONS

FEET ABOVE (+) OR BELOW (-)

SAMPLE LOCATION	ORIGINAL ASPHALT SURFACE	GRADE	FINISHED GRADE
3	+1'6"		0'
4	+1'6"		0'
9	-1'0"		+0'6"
15	-1'11"		-0'5"
21	-1'11"		-0'5"
26	-3'6"		-2'0"

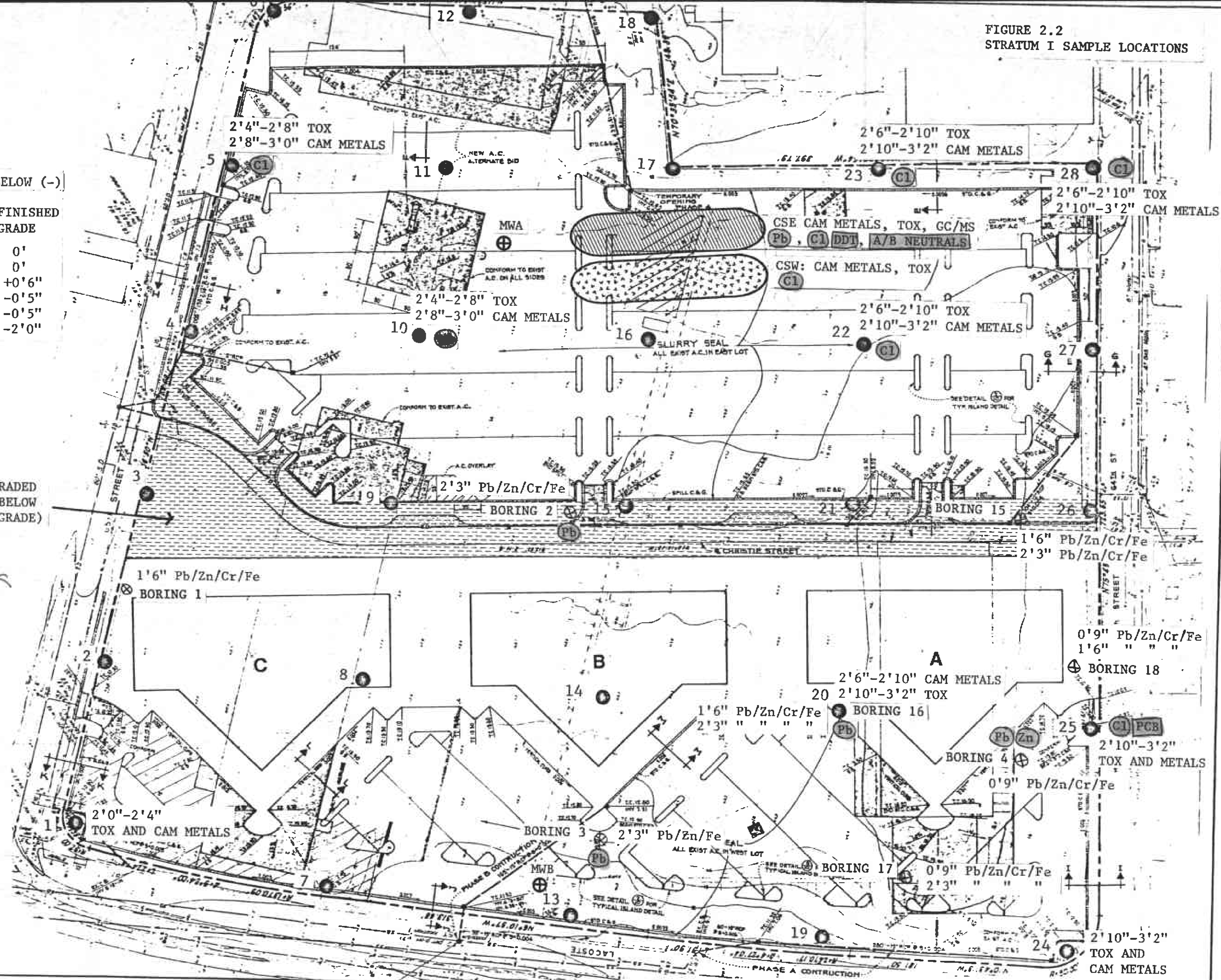


Table 3.1 Boring - Brown & Caldwell

FIGURE 2.3
STRATUM II SAMPLE LOCATIONS

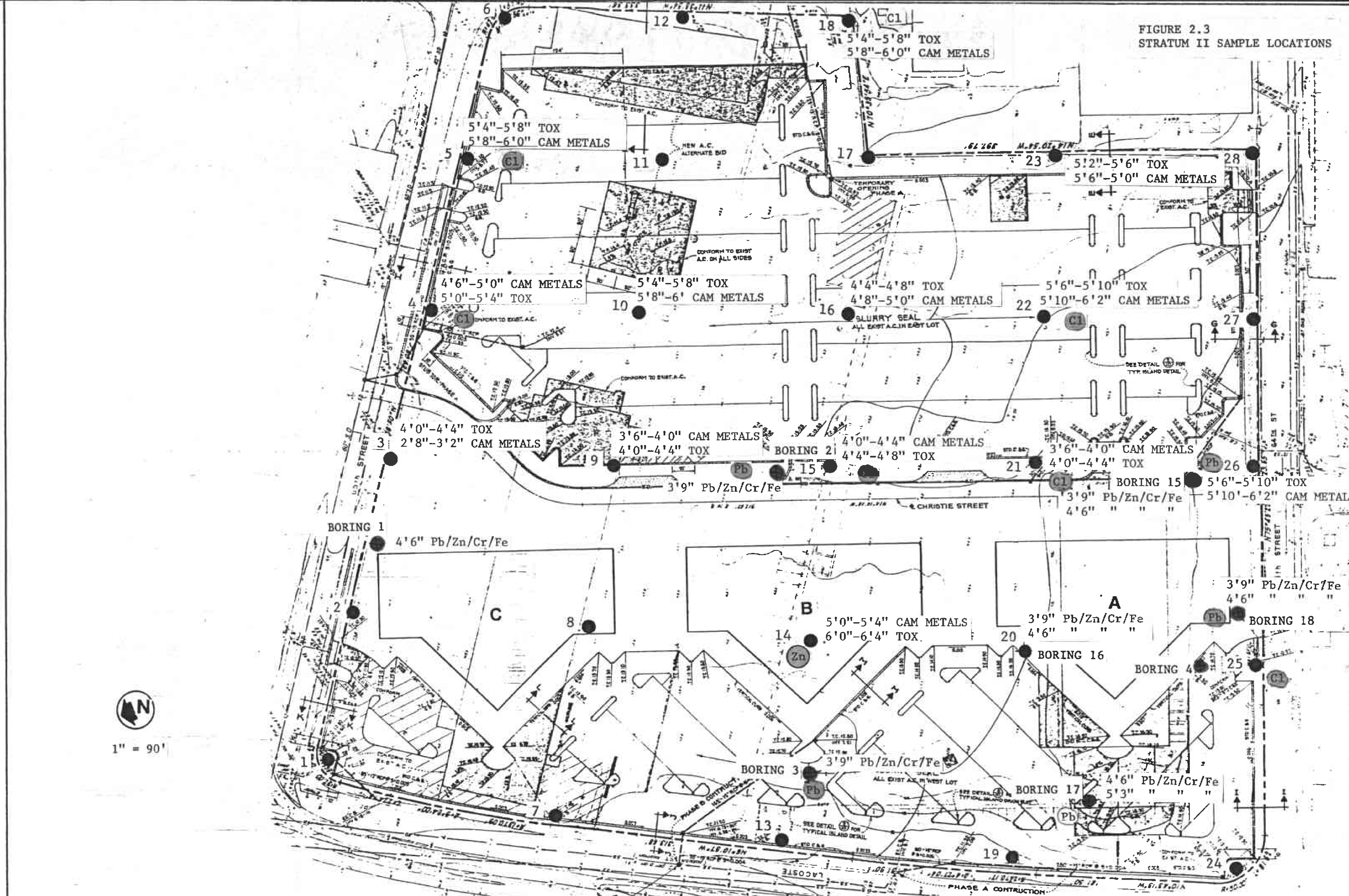
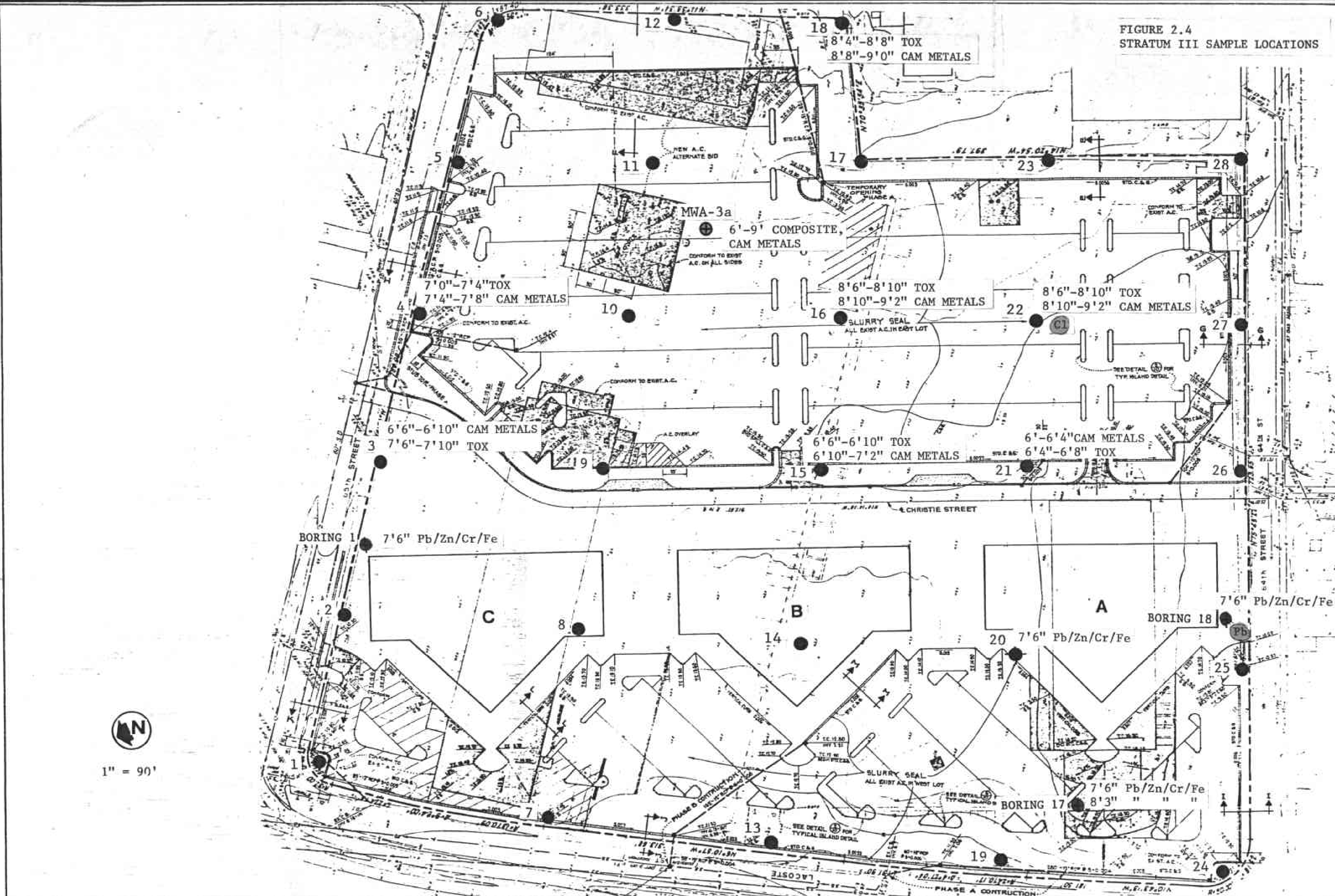


FIGURE 2.4
STRATUM III SAMPLE LOCATIONS



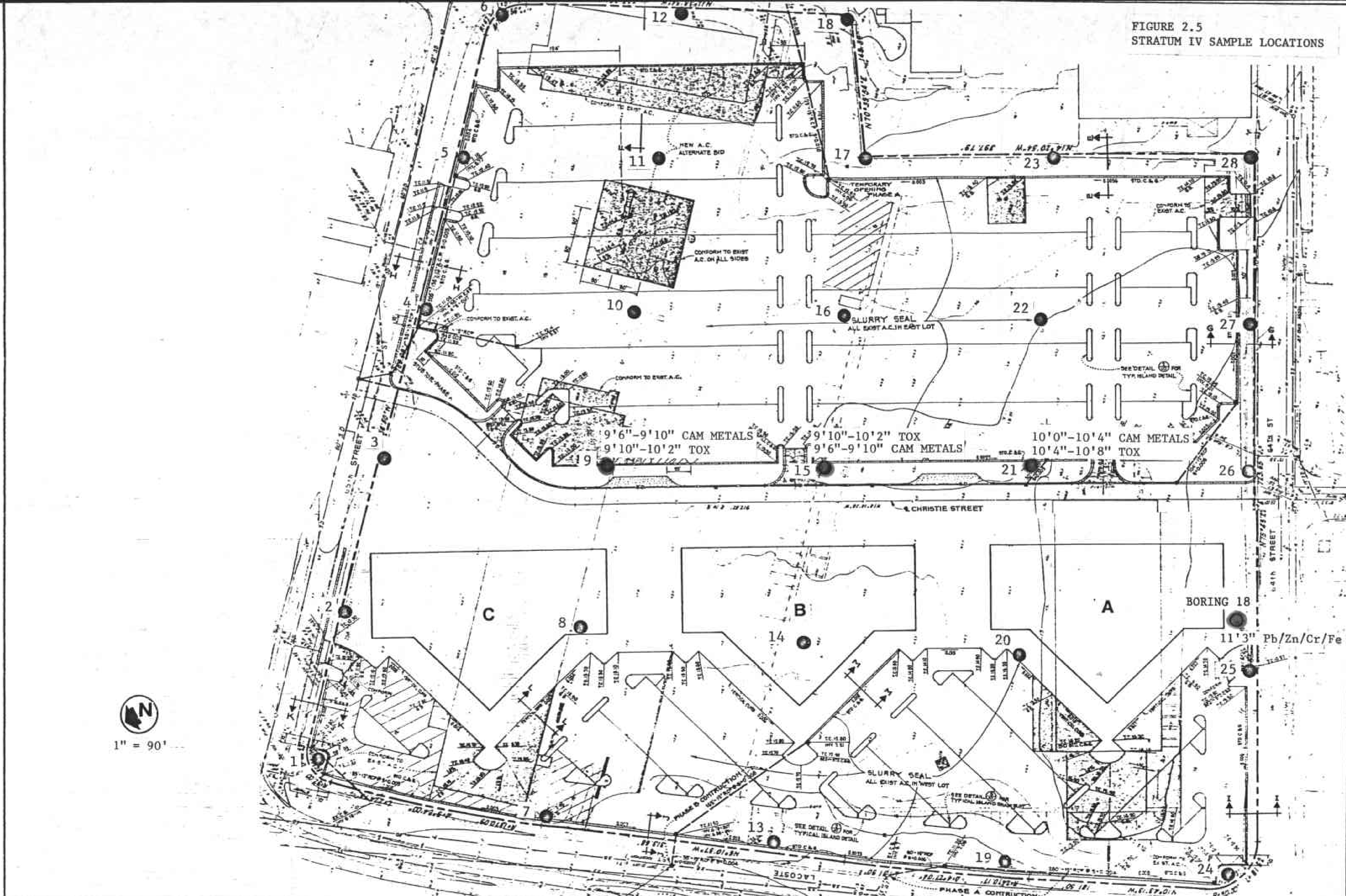


FIGURE 2.5
STRATUM IV SAMPLE LOCATIONS

FIGURE 2.6
SOIL STOCKPILES AND PILOT HOLE SAMPLING LOCATIONS

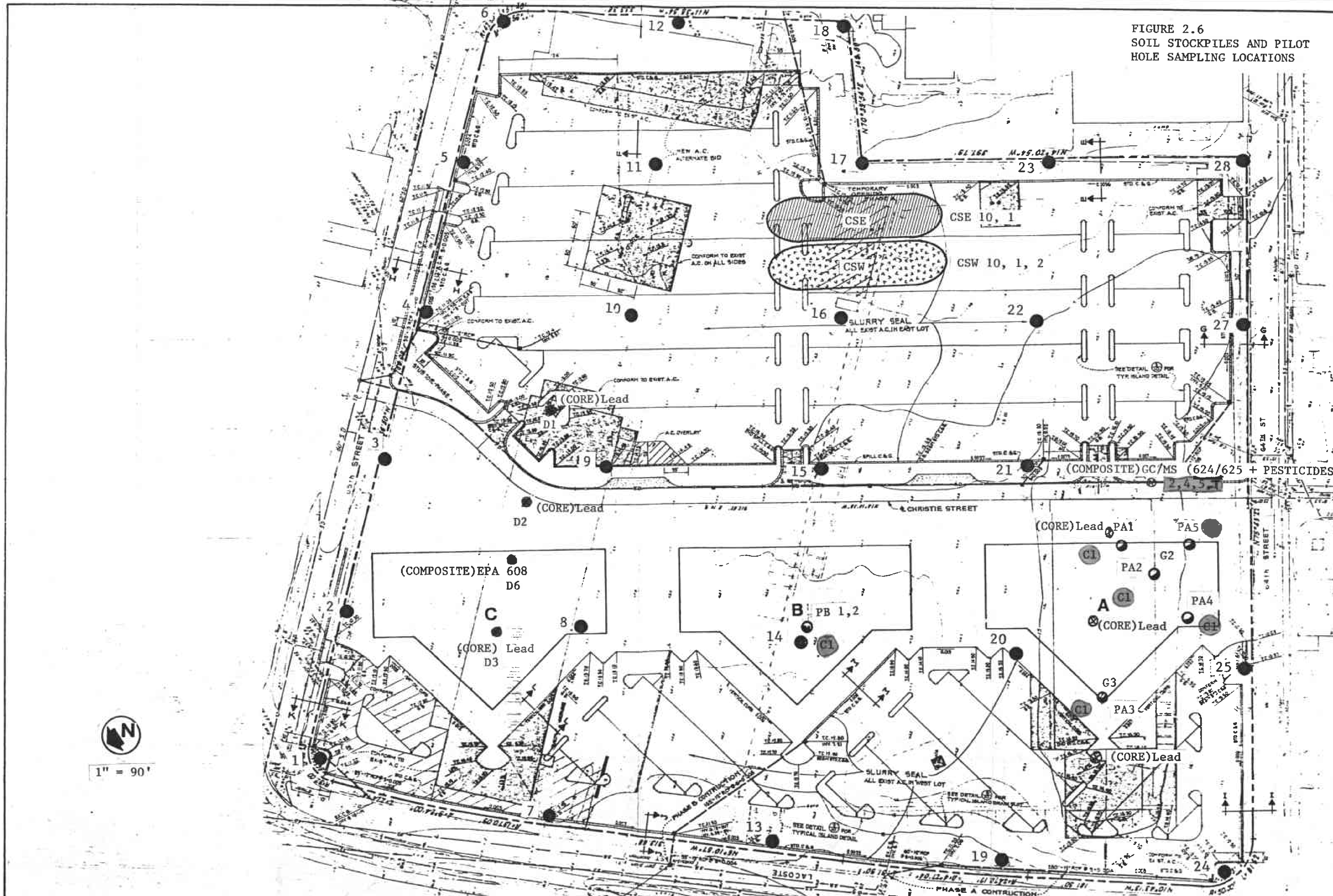
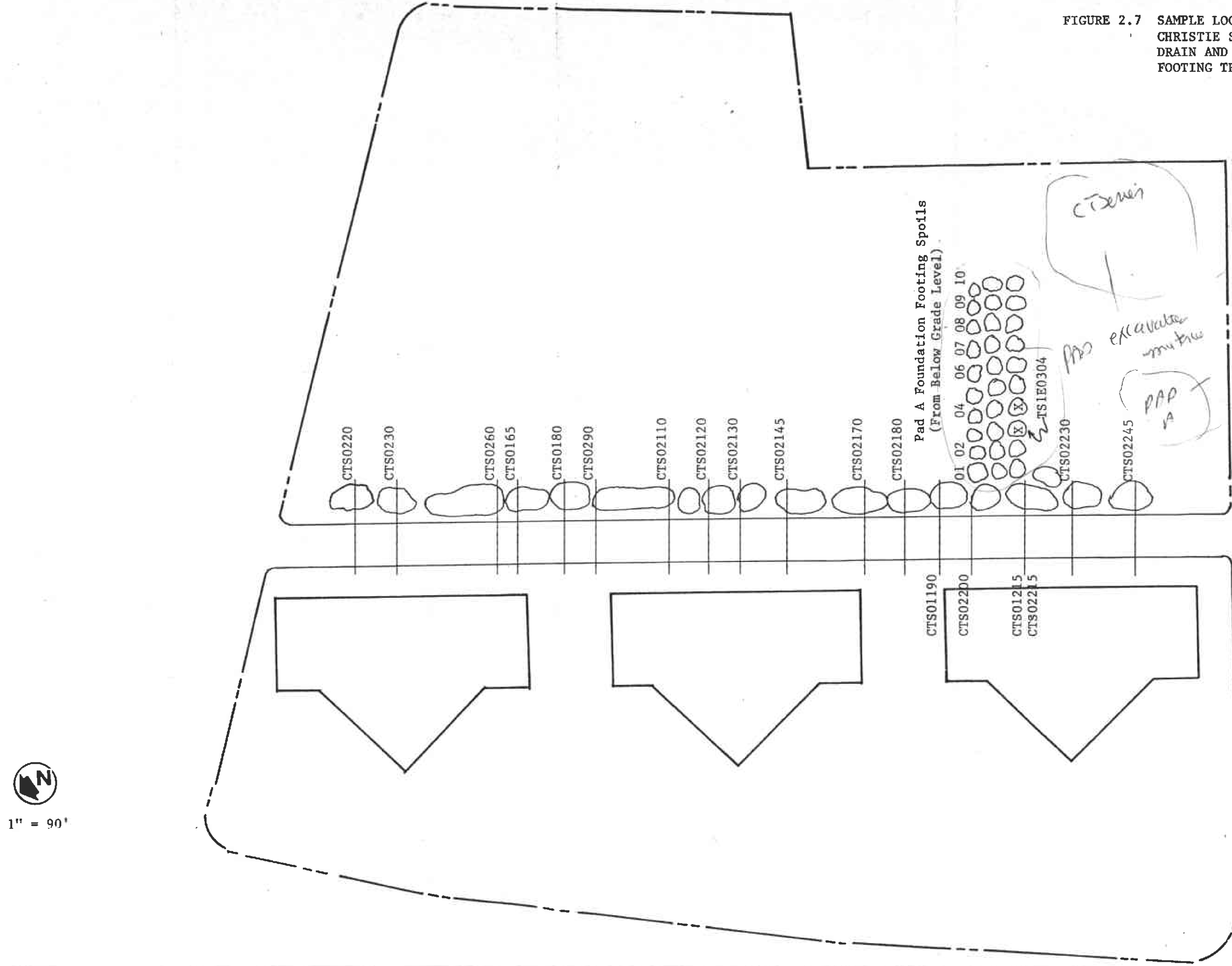


FIGURE 2.7 SAMPLE LOCATIONS OF CHRISTIE STREET STORM DRAIN AND PAD A FOOTING TRENCH SPOILS



3. RESULTS OF CONTAMINANT CHARACTERIZATION

HEAVY METALS ANALYSES. Initial testing at the Bay Center site screened lead, zinc and chromium contamination in preliminary soils borings (1-18). Results are listed in Table 3.1. Site characterization also focused on lead contamination in stockpiled excavated fill from fuel tank removal operations, and in foundation fill material in the Delta and Garrett truck line terminal buildings (see Figure 3.1). These results are listed in Table 3.2. Additional heavy metals analyses recently have been made of the stockpiled foundation fill, tank pit excavation materials, and utility line or foundation footing trench spoils. These recent results are included in Table 3.6 (page 3-11).

Pursuant to site characterization goals stated in the Draft Work Plan, submitted to the Alameda County Health Department, a testing program for a spectrum of priority anticipated heavy metal contaminants was implemented. Samples submitted for heavy metals analysis included three water samples (see Figure 2.1), nine cores (see Figures 2.2 to 2.5), one cuttings sample composite from the drilling of Monitor Well A (see Figure 2.1), and three composite samples from stockpiled surface soils removed during the grading of the Christie Street extension (see Figure 2.6). The 17 metals for which these 16 samples were tested correspond to those listed in Title 22 - California Environmental Health and Safety Code: antimony (Sb), arsenic (As), barium (Ba), beryllium (Be), cadmium (Cd), total chromium (Cr), cobalt (Co), copper (Cu), lead (Pb), mercury (Hg), molybdenum (Mo), nickle (Ni), selenium (Se), silver (Ag), thallium (Tl), vanadium (V) and zinc (Zn). These results are listed in Table 3.3.

Heavy metals concentrations measured were compared with the "Soluble Threshhold Limit Concentrations" (STLC) for water samples and with the "Total Threshhold Limit Concentration" (TTLC) for soils. Note that chromium can occur in toxic quantities as either bivalent, trivalent or hexavalent chromium. Hexavalent chromium is by far the most toxic, requiring only 500(*) mg/kg (TTLC) or 5.0(*) mg/liter (STLC) as compared to 2,500 mg/kg (TTLC) or 560 mg/liter (STLC) for bivalent/trivalent chromium. The heavy metals analysis run was for total chromium, and results indicate negligible quantities, even in a worst case situation which assumes all chromium present is hexavalent. Sample EM5-II(**) (see Table 3.1) was split in half and run separately to ensure accuracy of the testing. Results indicate excellent repeatability.

Metals that were consistently found to be either absent, or only present in minute quantities were then eliminated from future tests. Although zinc was detected at a level above the TTLC in sample EM14-II, the metal is not considered a high priority contaminant by the County Health Department (Miller, 1986). Seven metals are therefore considered a priority for additional testing at the Bay Center site: arsenic (AS), barium (Ba), cadmium (Cd), copper (Cu), lead (Pb), mercury (Hg) and nickle (Ni). Twenty five additional core samples were subsequently submitted for analysis, and results are listed in Table 3.1.

HALOGENATED HYDROCARBONS ANALYSIS (INCLUDING EPA METHODS 9022 AND 608). Of the initial tests run at the Bay Center site, two composite soil samples of exposed Garrett (A1) and Delta (D6) foundation fill were submitted for EPA test Method 608 (organochlorine pesticides). These results are listed in

TABLE 3.1. SOIL MONITORING RESULTS FROM PRELIMINARY AUGER BORINGS AT BAY CENTER, EMERYVILLE

BORING LOG NO. (a)	DEPTH OF PETROLEUM ODOR OR OILY DESCRIPTION	DEPTH OF SAMPLE FOR METALS ANALYSIS	LEAD LEVEL MG/KG	ZINC	CHROMIUM	IRON
1	10'± to 11'	1.5' 4.5' 7.5'	51 170* 66*	55 120 160	34 36 41	- - -
2	10'± to 11'	2.25' 3.75'	4,400** 2,400**	4,800* 1,700	100 7	- -
3		2.25' 3.75'	17 7,000**	77 860	77 72	- -
4	9.5'± to 10.5'	0.75'	5,000**	5,700**	86	-
5	10.5'± to 14.5'	-	-	-	-	-
6	-	-	-	-	-	-
7	10'±	-	-	-	-	-
8	7+.10'	-	-	-	-	-
9	14'±	-	-	-	-	-
10	-	-	-	-	-	-
11	-	-				
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	-	-	-	-	-	-
15	-	1.5' 2.25' 3.75' 4.5'	690* 4,800** 1,100** 1,600**	1,700 2,800* 1,700 2,000	- - - -	140,000 - 21,000 -
16	-	1.5' 2.25' 3.75' 4.5' 7.5'	30,000** 4,000** 10 14 400*	480 1,800 48 26 640	- - - - -	13,000 - 6,700 - 10,000

(CONTINUED)

TABLE 3.1 (CONTINUED). SOIL MONITORING RESULTS FROM PRELIMINARY AUGER BORINGS AT BAY CENTER, EMERYVILLE

BORING LOG NO. (a)	DEPTH OF PETROLEUM ODOR OR OILY DESCRIPTION	DEPTH OF SAMPLE FOR METALS ANALYSIS	LEAD LEVEL MG/KG	ZINC	CHROMIUM	IRON
17	-	0.75'	<5	23	-	15,000
		2.25'	330*	300	-	14,000
		4.5'	3,500**	3,900*	-	70,000
		5.25'	1,800**	2,000	-	-
		7.5'	34	60	-	14,000
		8.25'	78	100	-	-
18	-	0.75'	4,100**	4,200*	-	-
		1.5'	3,800**	5,500**	-	51,000
		3.75'	1,600**	7,800**	-	64,000
		4.5'	2,600**	3,200*	-	-
		7.5'	1,600**	2,600*	-	-
		11.25'	890*	360	-	14,000

* Potentially toxic
** Categorically toxic
\- Information not available

(a) See Figure 2.1

Source: Earth Metrics Incorporated, 1986; ERG, 1986; Geomatrix, 1985.

TABLE 3.2. SOIL MONITORING RESULTS FROM FUEL TANK STOCKPILES, EXPOSED SOIL AREA AND TRENCHES AT BAY CENTER, EMERYVILLE

SAMPLE ID.	CODE DATE	DESCRIPTION	LEAD (MG/KG)
A4	4/18	Exposed soil/planter, east	120
A5	4/18	Stockpile at waste oil tanks	54
A6	4/18	Indigenous soils at fuel island	39
A7	4/18	Pea gravel at fuel island	6
A8	4/18	Overburden at steel tanks	150
A9	4/18	Pea gravel at fuel island	8
D1	4/25	Delta/foundation	2
D2	4/25	Delta/foundation	2
D3	4/25	Delta/foundation	100
D4	4/25	Soil below asphalt, north side delta	None
D5	4/25	Soil below asphalt, below delta foundation	5.5
D8	4/25	Soil below asphalt, next to north fence	None
G1	4/16	Garrett/foundation	None
G2	4/16	Garrett/foundation	None
G3	4/16	Garrett/foundation	None
K1	4/15	Tank pit (western)	51
K3	4/15	Stockpile at southern tanks	970
K4	4/15	Stockpile at southern tanks	530
L2	4/15	Tank pit (eastern)	48
L3	4/15	Stockpile at southern tanks	46
L4	4/15	Stockpile at southern tanks	39
Z1	4/29	Trench around truck scale perimeter	530

Source: Earth Metrics Incorporated, 1986; ERG, 1986.

TABLE 3.3. DRAFT WORK PLAN HEAVY METALS ANALYSIS RESULTS AT BAY CENTER, EMERYVILLE

	Sb	As	Ba	Be	Cd	Cr	Co	Cu
Water-Samples STLC (mg/l)	15	5	100	0.75	1.0	5.0*	80	25
MWA-WS2	<5	<2	0.7	<0.2	<0.5	<0.5	<0.5	<1
MWB-WS2	<0.5	8.0	0.7	<0.02	≤0.05	<0.05	0.2	0.4
W9	<5	19.0	41.0	<0.2	≤0.5	2.4	1.0	5.0
Soil Samples TTLC (mg/kg)	500	500	10,000	75	100	500*	8,000	2,500
EM 5 - II**	10/20	1.0/1.02	178/196	0.5/0.5	0.5/0.6	16/15	9/8	25/24
EM 9 - IV	ND	260	110	<5	<5	≤10	<10	30
EM14 - II	40	4.8	440	0.5	5.0	29	14	300
EM15 - IV	ND	190	160	<5	<5	50	10	20
EM16 - III	20	0.67	113	<0.2	0.4	8	1	260
EM18 - II	20	0.88	300	0.5	0.8	21	15	5
EM21 - III	ND	160	130	<5	<5	40	10	50
EM22 - II	30	0.92	90	0.5	0.5	34	11	15
EM28 - I	20	2.84	280	0.5	2.0	17	10	360
MWA - 3a	20	1.04	520	0.5	1.1	26	8	55
CSE - 1	<100	38	950	<5	24	120	37	750
CSW - 1	<100	34	1,200	<5	33	110	39	770
CSW - 2	<100	55	1,100	<5	36	110	70	1,600
EM 1 - I		<40	300		6			32
EM 3 - II		<40	110		12			100
EM 3 - III		<40	130		5			36
EM 4 - II		<40	180		9			50
EM 4 - III		<40	100		≤5			10
EM 5 - I		<40	120		9			40
EM 9 - IIa		<40	160		≤5			60
EM 9 - IIb		<40	170		≤5			10
EM10 - I		<40	140		10			60
EM10 - II		<40	200		12			60
EM10 - III		<40	210		8			110
EM15 - II		<40	320		9			280
EM15 - III		<40	240		≤5			1,200
EM16 - II		<40	420		10			1,200
EM18 - III		<40	94		≤5			50
EM20 - I		<40	3,100		127			5,600
EM21 - II		50	150		40			1,300
EM21 - IV		<40	190		8			60
EM22 - I		<40	140		≤5			60
EM22 - III		<40	160		≤5			20
EM23 - I		≤40	50		5			70
EM23 - II		<40	10		<5			30
EM24 - I		<40	300		7			70
EM25 - I		<40	480		10			230
EM26 - III		<40	120		5			30

(CONTINUED)

TABLE 3.3 (CONTINUED). DRAFT WORK PLAN HEAVY METALS ANALYSIS RESULTS AT BAY CENTER, EMERYVILLE

	Pb	Hg	Mo	Ni	Se	Ag	Tl	V	Zn
Water Samples STLC (mg/l)	5.0	0.2	350	20	1.0	5.0	7.0	24.0	250.0
MWA-WS2	10.0	<0.01	<5	<1	<0.2	<0.4	<3	<2	14
MWB-WS2	0.2	<0.002	<0.5	0.3	<0.02	<0.04	<0.3	0.2	0.7
W9	40.0	0.15	<5	5.0	<0.02	<0.4	<3	3.0	110.0
Soil Samples TTLC (mg/kg)	1,000	20	3,500	2,000	100	500	700	2,400	5,000
EM 5 - II**	56/60	0.10/ 0.12	<10/ <10	27/26	0.10/ 0.13	0.4/ 0.4	2/2	10/5	76/86
EM 9 - IV	30	ND	<50	<20	ND	<5	<50	≤20	250
EM14 - II	340	0.06	<10	70	0.32	1.0	10	30	6,400
EM15 - IV	<20	ND	<50	40	ND	<5	<50	50	50
EM16 - III	29	0.11	<10	6	0.06	0.4	4	<5	128
EM18 - II	330	0.12	<10	20	0.12	0.4	6	<5	260
EM21 - III	50	ND	<50	4.0	ND	<5	<50	50	130
EM22 - II	5	0.05	<10	29	0.01	0.3	2	10	29
EM28 - I	400	0.23	<10	520	0.10	0.9	2	10	1,100
MWA - 3a	320	0.14	<10	39	0.16	0.6	6	25	940
CSE - 1	6,500	0.5	<100	150	<10	<2	<50	33	1,800
CSW - 1	630	1.2	<100	110	<10	<2	<50	37	1,800
CSW - 2	700	0.5	<100	110	<10	<2	<50	47	2,000
EM 1 - I	80	0.3		60					
EM 3 - II	210	0.8		70					
EM 3 - III	40	<0.2		30					
EM 4 - II	20	≤0.2		40					
EM 4 - III	<20	<0.2		40					
EM 5 - I	97	9.0		30					
EM 9 - IIa	30	0.2		30					
EM 9 - IIb	≤20	<0.2		30					
EM10 - I	190	≤0.2		30					
EM10 - II	50	0.3		50					
EM10 - III	450	0.6		65					
EM15 - II	26,000	≤0.2		70					
EM15 - III	160	<0.2		≤10					
EM16 - II	860	0.2		35					
EM18 - III	30	0.6		30					
EM20 - I	9,300	30.0		260					
EM21 - II	2,100	0.8		150					
EM21 - IV	70	0.3		60					
EM22 - I	20	0.6		30					
EM22 - III	30	0.5		60					
EM23 - I	160	0.2		30					
EM23 - II	<20	≤0.2		20					
EM24 - I	230	<0.2		40					
EM25 - I	620	0.5		90					
EM26 - III	<20	<0.2		50					

Table 3.4. Stockpiled foundation fill (Delta and Garrett) and tank pit excavated soils have not had further characterization analysis for halogenated hydrocarbons.

Pursuant to the goals of the Draft Work Plan, thirty four core samples were subsequently taken from various depths throughout the site and were submitted for TOX (total organic halogens) analysis by means of EPA Method 9022. Seven additional VOA samples were taken from pilot hole cuttings in building pads A and B, and were submitted for TOX. Two composite soil samples, also submitted for TOX analysis, were taken from the stockpiled surface soils graded from the Christie Street extension right-of-way. All TOX analysis results are listed in Table 3.4.

Three core samples taken from the Christie Street extension right-of-way were found to contain chlorine and were resubmitted for pesticides analysis (EPA Method 608). These results have also been listed in Table 3.4.

<u>GC/MS TEST METHOD (EPA 624/625 (8240/8270) AND PESTICIDE SCAN)</u>. Water samples were taken from monitor wells A and B (MWA, MWB) and from hollow stem auger borings in the Christie Street extension (W9, W15). These were submitted for gas chromatograph/mass spectroscopy (GC/MS, including pesticides) analysis, (EPA Methods 8240/8270). One soil composite sample taken from the stockpile of surface soils graded from the Christie Street extension right-of-way was also submitted for GC/MS (624/625, including pesticides) analysis. All GC/MS results are listed in Table 3.5.

<u>ASBESTOS</u>. Testing of asbestos in the soils and fill materials was performed for the Delta building foundation (D7, see Figure 3.1). Results were negative. Further asbestos tests have been limited to personal monitoring of construction workers by an industrial hygienist. As of the date of this report, asbestos has not been identified.

TABLE 3.4. HALOGENATED HYDROCARBONS AND ORGANOCHLORINES RESULTS AT BAY CENTER, EMERYVILLE

HALOGENATED HYDROCARBONS: EPA 9022 (MG/KG)				ORGANOCHLORINE (PESTICIDES AND PCBS) EPA 608 (MG/KG)		
SOILS ID	Cl-	Br-	I-	DDT,DDD,DDE	PCBS	ALL OTHERS
A1	-	-	-	ND	ND	2,4,5-T at 34 ppb
D6	-	-	-	ND	ND	ND
EM 1 - I	<0.5	ND (0.1)	<0.05			
EM 3 - II	<0.5	<0.1	<0.05			
EM 3 - III	<0.05	<0.1	<0.05			
EM 4 - II	0.66	<0.1	<0.05			
EM 4 - III	<0.5	<0.1	<0.05			
EM 5 - I	0.9	<0.1	<0.05			
EM 5 - II	0.76	<0.1	<0.05			
EM 9 - II	<0.05	<0.1	<0.05			
EM 9 - III	<0.05	ND	<0.05			
EM 9 - IV	0.33	<0.1	<0.05			
EM10 - I	0.56	<0.1	<0.05			
EM10 - II	<0.05	ND	<0.05			
EM10 - III	<0.05	ND	<0.05			
EM14 - II	<0.5	<0.1	<0.05			
EM15 - II	14	<0.1	<0.05	ND	ND	ND
EM15 - III	<0.5	ND	ND			
EM15 - IV	<0.25	<0.1	<0.05			
EM16 - II	0.05	ND	ND			
EM16 - III	<0.05	ND	<0.05			
EM18 - II	<0.5	<0.1	<0.05			
EM18 - III	0.87	0.1	0.05			

(CONTINUED)

TABLE 3.4 (CONTINUED). HALOGENATED HYDROCARBONS AND ORGANOCHLORINES RESULTS AT BAY CENTER, EMERYVILLE

		HALOGENATED HYDROCARBONS: EPA 9022 (MG/KG)			ORGANOCHLORINE (PESTICIDES AND PCBS) EPA 608 (MG/KG)		
SOILS	ID	Cl-	Br-	I-	DDT,DDD,DDE	PCBS	ALL OTHERS
EM20	- I	<0.5	<0.1	<0.05			
EM21	- II	1.7	<0.1	<0.05	ND	ND	ND
EM21	- III	<0.25	ND	<0.05			
EM21	- IV	<0.05	<0.1	<0.05			
EM22	- I	7.1	<0.1	ND			
EM22	- II	0.64	<0.1	<0.05			
EM22	- III	1.0	ND	<0.05			
EM23	- I	0.61	ND	ND			
EM23	- II	<0.5	ND	<0.05			
EM24	- I	<0.5	<0.1	<0.05			
EM25	- I	2.7	<0.1	<0.05	ND	0.96	ND
EM26	- I	<0.05	<0.1	<0.05			
EM28	- I	2.0	<0.1	<0.05			
CSW	- 10	4.6	<0.05	ND			
CSE	- 10	4.8	0.06	ND			
PA1		3.0	0.06	ND			
PA2		5.7	0.08	ND			
PA3		1.5	<0.1	<0.05			
PA4		1.5	<0.1	<0.05			
PA5		1.2	<0.1	<0.05			
PB1		5.4	<0.05	ND			
PB2		3.0	<0.05	ND			

TABLE 3.5. GC/MS TEST RESULTS (EPA METHOD 624/625 INCLUDING PESTICIDES) AT BAY CENTER, EMERYVILLE

ANALYTES OBSERVED IN SAMPLES	WATER SAMPLES (MG/L) MWA-WS	MWB-WS	W9	W15	SOIL SAMPLE(MG/KG) CSE1 AND CSE10
Pesticides					
α - BHC	4.4	4.6	0.19	ND	ND
β - BHC		0.12	ND	ND	ND
γ - BHC	0.27	0.048	ND	ND	ND
δ - BHC		0.25	ND	ND	ND
* DDE (0.10 STLC, 1.0 TTLC)	0.29	0.31	0.75	ND	2.7
* DDD (0.10 STLC, 1.0 TTLC)	0.33	0.51	0.42	ND	2.9
* DDT (0.10 STLC, 1.0 TTLC)	0.48	0.15	0.41	ND	4.5
Other Organochlorines					
* PCB-1206 (5.0 STLC, 50 TTLC)	7.2	ND	ND	ND	ND
Volatile Organics					
Benzene	41,000	ND	9	ND	ND
Ethyl benzene	4,200	ND	ND	ND	ND
Toluene	22,000	ND	ND	ND	ND
Acid/Base Neutrals					
Benzo-a-anthracene	63	ND	10	ND	ND
Benzyl-butyl-phthalate	80	ND	ND	ND	ND
Bi-3,2-ethyl-hexyl-phthalate	ND	ND	34	ND	ND
Di-ethyl-phthalate	ND	ND	ND	ND	0.20
Di-n-butyl-phthalate	ND	ND	ND	ND	2.00
Fluoranthene	6	ND	25	ND	ND
Fluorene	33	ND	ND	ND	ND
Napthalene	1,100	ND	12	ND	ND
Phenanthrene (C14H10)	83	ND	22	ND	0.40
Pyrene (C16H10)	8	13	28	ND	ND
Benzo-a-pyrene	ND	ND	15	ND	ND
Benzo-b-fluoranthene	ND	ND	10	ND	ND
Benzo-k-fluoranthene	ND	ND	10	ND	ND
Chrysene (C18H12) (Benzo-a-phenanthrene	ND	ND	14	ND	ND
Indeno-1,2,3-cd-pyrene	ND	ND	15	ND	ND
Aliphatic hydrocarbons C15-C35	ND	ND	ND	ND	400

* Title 22 - California Environmental Health and Safety Code - priority pollutants.

TABLE 3.6. SCREENING TEST RESULTS OF BULK AND SOLUBLE LEAD CONCENTRATIONS IN CHRISTIE STREET STORM DRAIN AND PAD A AND B FOUNDATION FOOTING TRENCH SPOILS AT BAY CENTER, EMERYVILLE

SAMPLE CODE			LEAD	
I.D.	DATE	DESCRIPTION	BULK (MG/KG) TTLC = 1,000	SOLUBLE (MG/L) STLC = 5
CTS0220	8/12/86	Christie Street Storm Drain	10	
CTS0230	8/12/86	Christie Street Storm Drain	1,420	
CTS0260	8/12/86	Christie Street Storm Drain	833	95.9
CTS0165	8/12/86	Christie Street Storm Drain	41	
CTS0180	8/12/86	Christie Street Storm Drain	292	10.1
CTS0290	8/12/86	Christie Street Storm Drain	182	8.8
CTS02110	8/20/86	Christie Street Storm Drain	1,350	
CTS02120	8/20/86	Christie Street Storm Drain	3,100	
CTS02130	8/20/86	Christie Street Storm Drain	2,380	
CTS02145	8/20/86	Christie Street Storm Drain	1,900	
CTS02170	8/20/86	Christie Street Storm Drain	2,600	
CTS02180	8/20/86	Christie Street Storm Drain	1,360	
CTS01190	8/20/86	Christie Street Storm Drain	1,510	
CTS02200	8/20/86	Christie Street Storm Drain	2,060	
CTS01215	8/20/86	Christie Street Storm Drain	438	
CTS02215	8/20/86	Christie Street Storm Drain	831	
CTS02230	8/20/86	Christie Street Storm Drain	797	
CTS02245	8/20/86	Christie Street Storm Drain	1,530	
TS1E0102	8/12/86	Pad A Footing Trench Spoils	15,190	137
TS1E0304	8/12/86	Pad A Footing Trench Spoils	4,230	
TS1E0506	8/12/86	Pad A Footing Trench Spoils	26,040	
TS1E0809	8/12/86	Pad A Footing Trench Spoils	3,870	
PBTWI	8/12/86	Pad B Footing Trench Spoils	149	16.2

Notes:

CTS Christie Street Storm Drain Trench
CTS01,02 Refers to light colored (01) or dark colored (02) spoils
CTS02nnn "nnn" refers to the distance in meters measured south from the 65th Street property line.

Refer to Figure 2.7 for sample locations.

Source: Earth Metrics Incorporated, 1986.

4. OBSERVATIONS DURING THE TANK REMOVAL, GRADING AND CONSTRUCTION PROCESS

4.1 WORK SITE MONITORING

The work site is being monitored by the industrial hygienist for several chemicals including airborne particles and gases. Measurements to date have demonstrated that airborne lead and DDT concentrations are below the action levels established by CAL-OSHA. Lead and DDT levels are measured using personal monitors in the breathing zone during soil excavation activities.

During drilling of groundwater monitor wells A and B and, recently, during drilling of pile pilot holes, hydrocarbons levels are being measured using Gastector monitors. Hydrocarbons, reported as methane in parts per million or relative to the lower explosive limit (LEL) of methane, have been detected in the holes at significant levels, up to 100 percent of the LEL. The LEL for methane is approximately 5.4 percent (54,000 ppm), but the Gastector typically is calibrated conservatively by the manufacturer and therefore is valuable as an industrial hygiene tool and screening instrument. A log has been created on which records of Gastector readings are kept by the industrial hygienist.

Speciation of C1 through C6 hydrocarbons was performed of samples drawn from pilot holes in Pad A and Pad B, and also in Monitor Well B. The results indicated the following characteristics:

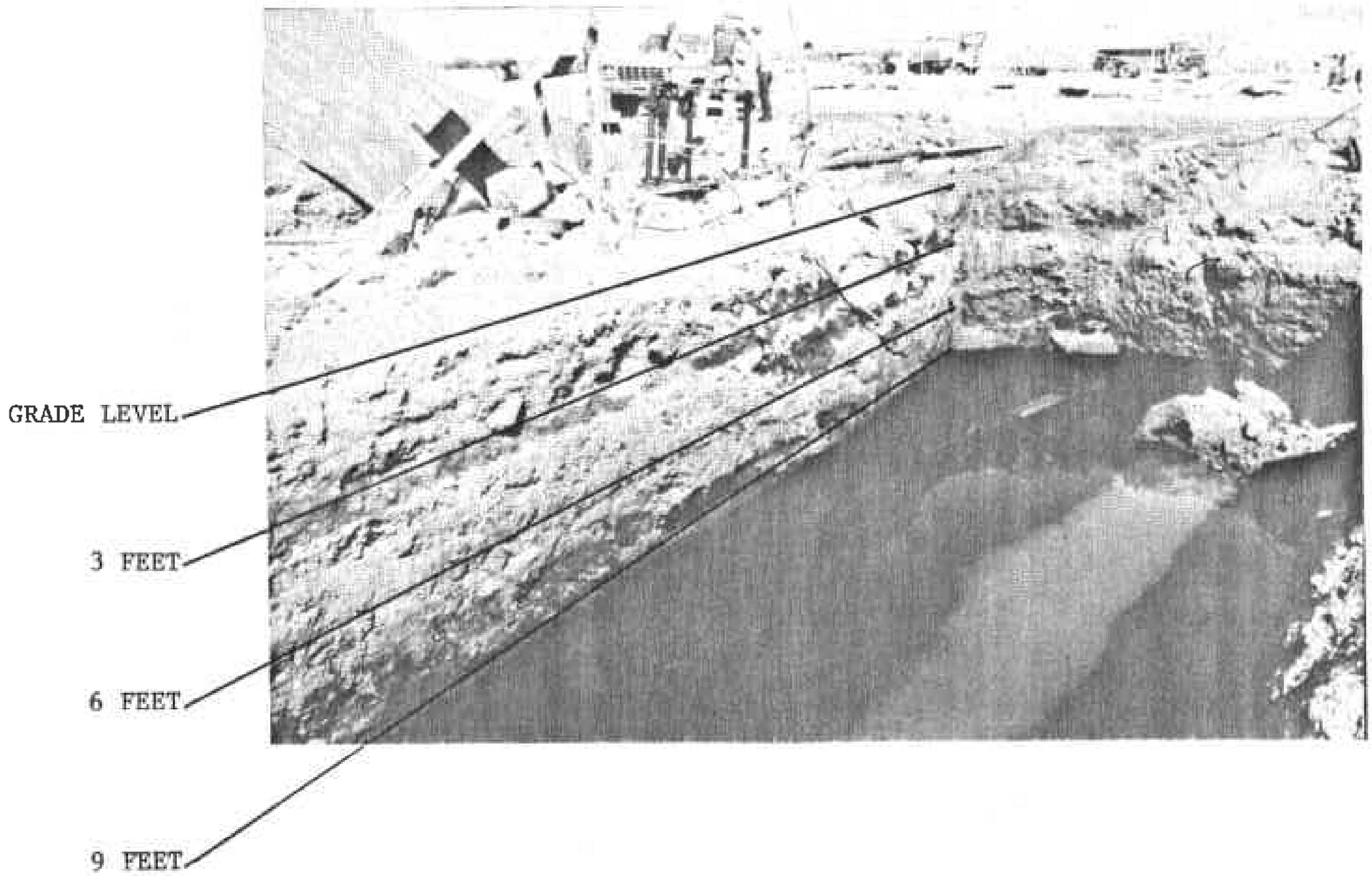
	Pad B	Pad A	MWB
Methane (ppm)	2,700	4,700	4,100
Ethane (ppm)	28	31	ND(10)
Propane (ppm)	5	ND(10)	ND(10)
Butane (ppm)	ND (2)	ND(10)	ND(10)
Pentane (ppm)	ND (5)	N/A	N/A
Hexane (ppm)	ND (10)	N/A	N/A

The total of the above concentrations is at most 0.5 percent or 10 percent of the LEL.

4.2 FIELD OBSERVATIONS

In place soils have been observed to contain distinctive strata which are distinguishable by color, material content, and moisture. Wood, brick, glass, and metal parts have been observed in the several stockpiles on site and in the walls of excavated fuel storage tanks. At various locations and depths petroleum odors have been observed.

Figure 4.1 illustrates fill strata. Figures D-1 and D-2 of Appendix D present soil logs recorded by the geologist during drilling on site. The logs have annotated descriptions of observed soil characteristics and odor relative to depth within the Bay Center site.



earth metrics

FIGURE 4.1 BAY CENTER FILL STRATA IN EXCAVATED TANK PIT 1, SE QUADRANT

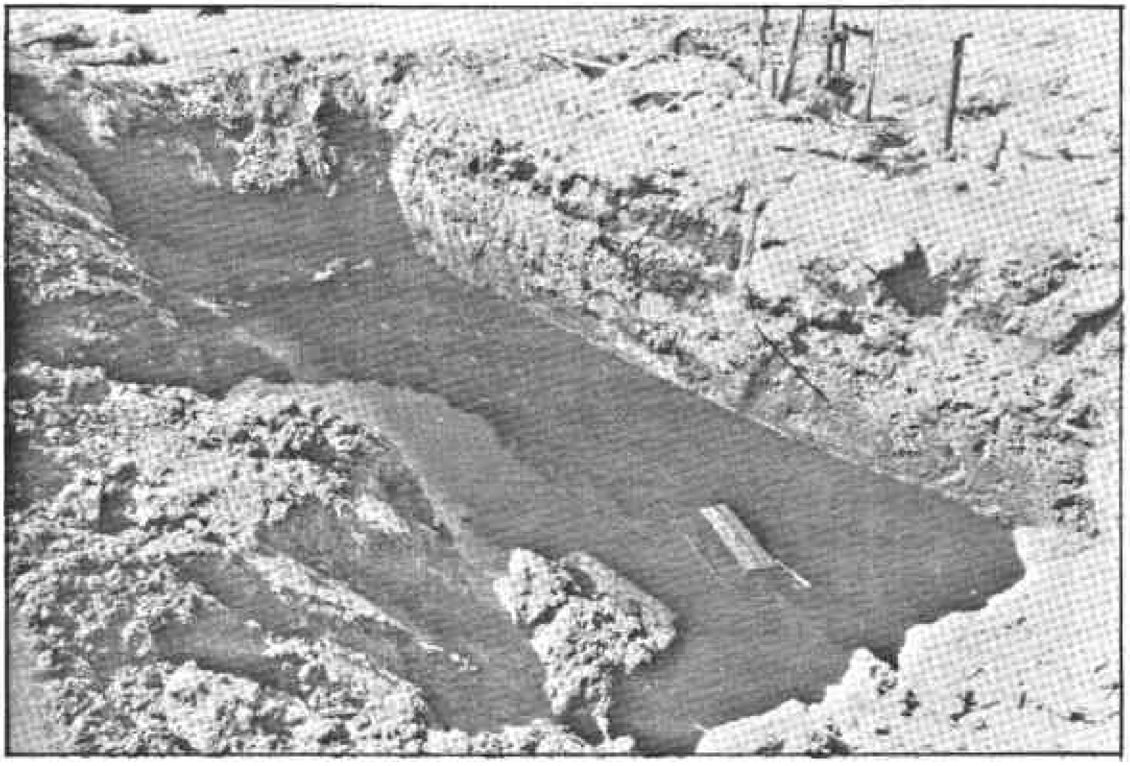


FIGURE 4.2 BAY CENTER FILL STRATA IN EXCAVATED TANK PIT 2, SE QUADRANT

FIGURE 4.3 BAY CENTER FILL STRATA IN EXCAVATED TANK PITS, NE QUADRANT

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 DISCUSSION OF RESULTS

Heavy Metals Contamination. Results indicate that soils at the Bay Center site have widely varying metals levels. Lead concentrations in soils at levels above the total threshold limit (TTLC) of 1,000 ppm were found in several places. Christie Street surface soils contain lead at levels that are over 10,000. A significant portion of these soils have been excavated during the Christie Street grading, and stockpiled on site. Other soils samples found to contain heavy metals at or above TTLCs are not from locations which are being disturbed by any of the construction activities.

Figure 5.1 illustrates lead contamination contours. The contours show areas of the site having lead concentrations between the stated levels. Lead contamination on site is variable with location (horizontal) and depth (vertical). The contours, therefore, are idealized, and generally represent the highest lead levels which could be encountered in the south/central portion of the site. The contours are drawn for soils, not for groundwater.

Water contamination in the vicinity of Monitor Well A is expected, owing to the proximity of Monitor Well A to the underground fuel tank pits. Monitor Well B generally does not contain hazardous levels of lead or most other heavy metals.

Arsenic, detected in two of the three water samples, is relatively common in the groundwater of the bay fringe, which is brackish and unsuitable for drinking. Arsenic may originate from the site fill. Arsenic levels in site fill characteristically are less than 40 ppm, except at EM9, EM15, and EM21 (Stratum III or IV depth), where arsenic ranges from 160 ppm to 260 ppm in the soil.

Water samples from Monitor Well A (MWA-WS) and from a hollow stem auger sample (W9), were found to contain lead at levels of 200 percent (MWA-WS) and 800 percent (W9) of the soluble threshold limit concentration (STLC). Arsenic was found at 160 percent (MWB-WS) and 380 percent (W9) of the STLC. Other heavy metals in water were nondetectable or detected at levels below the STLCs.

Chlorinated Hydrocarbons Contamination. Figure 5.2 illustrates organic chlorine contamination contours. The contours show areas of the site having chlorine concentrations (as elemental chlorine by weight of soil sample) between the stated levels. Actual contamination on site is variable with location (horizontal) and depth (vertical). The contours, therefore, are idealized and generally represent the highest chlorine concentrations (as elemental chlorine by weight of soil sample) which could be encountered.

Detectable levels of organic chlorine in soil samples indicate the presence of one or more pollutants such as DDT, other pesticides, or PCB in the south/ central portion of the site. EPA Method 608 testing confirmed PCB (1260) in sample EM 25-I just below the Total Threshold Limit Concentration (TTLC) of 1.0 ppm (see Table 3.2). EPA Method 608 did not confirm the presence of chlorinated pesticides or PCB pollutants in the other two samples.

FIGURE 5.1
LEAD SUMMARY

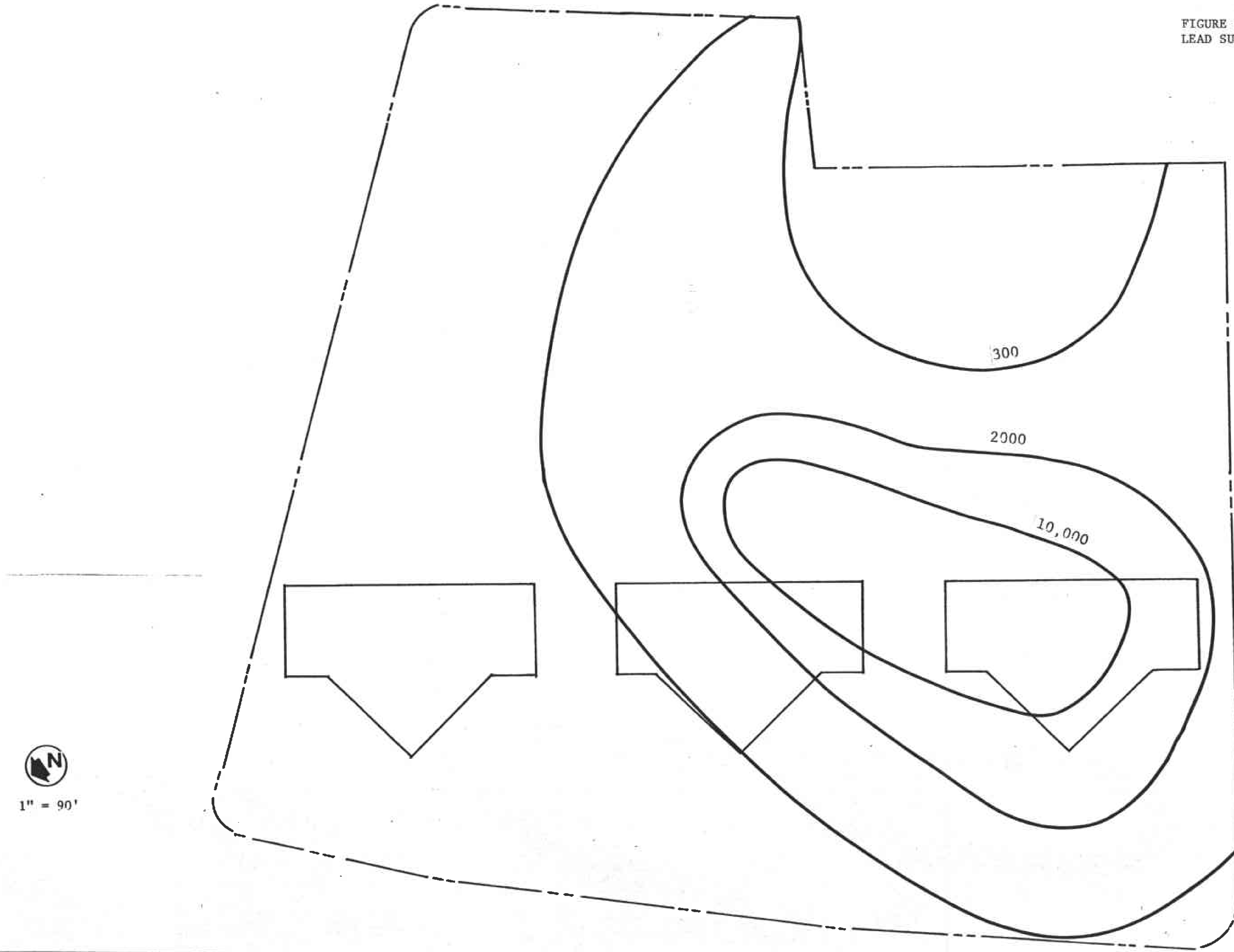
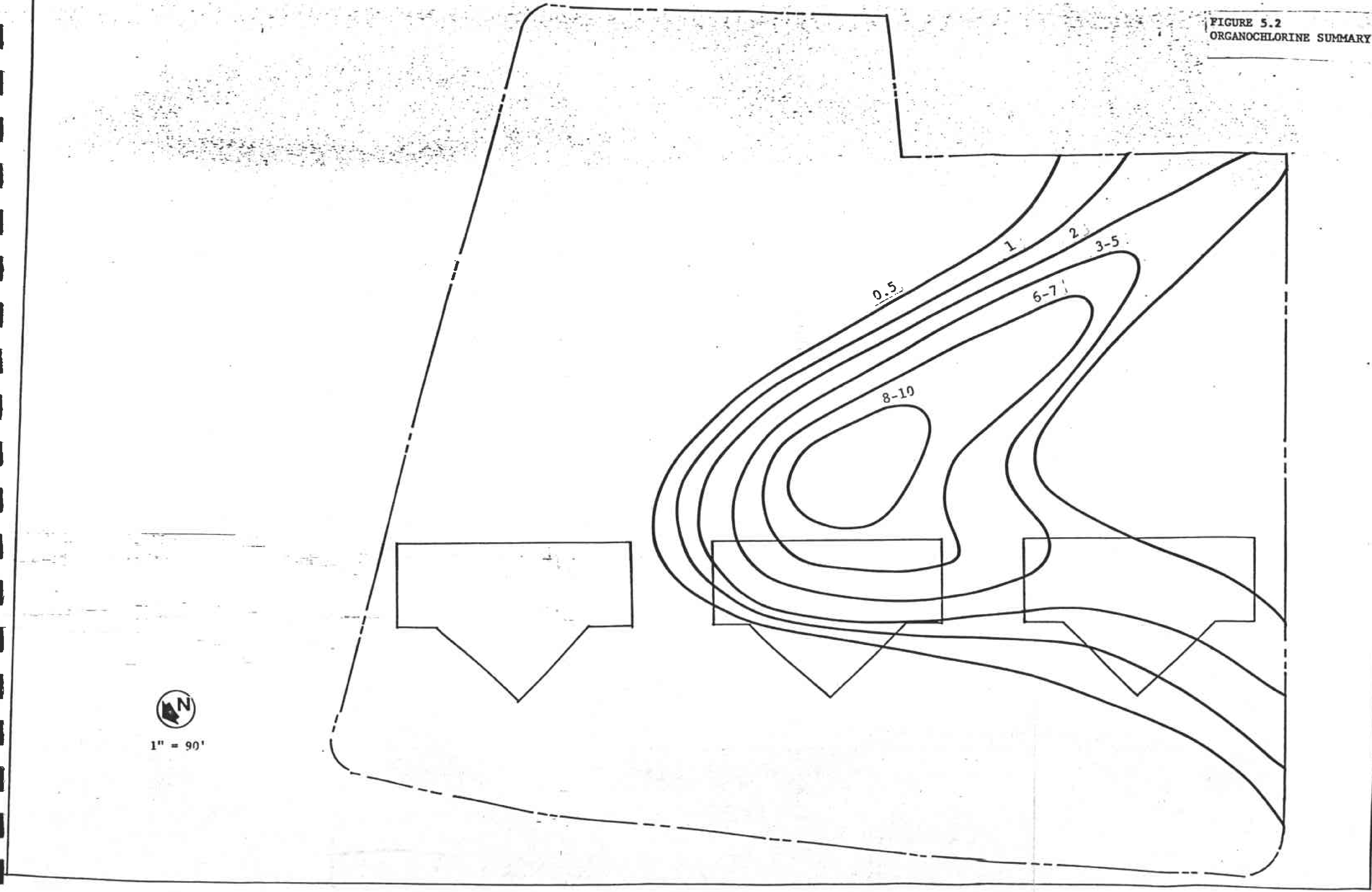


FIGURE 5.2
ORGANOCHLORINE SUMMARY



EPA Method 624/625 results for the composite soil sample taken from the Christie Street grading stockpile indicate presence of the pesticides DDT, DDD and DDE at levels above the TTLC. The DDT, DDD, DDE total concentration in the Christie Street grading stockpile is 10.1 ppm (4.5 + 2.9 + 2.7). The corresponding gross organic chlorine concentration is approximately 4.6 ppm to 4.8 ppm (as elemental chlorine by weight), as determined by EPA Method 9022. Therefore, based upon the considerations addressed in Section 2, it is concluded that all organic chlorine in the Christie Street grading stockpile is accountable as the DDT, DDD, DDE pesticide group. This conclusion can be extrapolated to the characterization of other fill material generally in the site and specifically in the Christie Street alignment.

If one assumes that most of the organic chlorine present on site is in the form of the DDT, DDD, DDE group, then the Figure 5.2 contours represent one half of the DDT, DDD, DDE group concentration contours (i.e., DDT, DDD, DDE concentration x 0.5). It is noted that EPA Method 608 did not confirm the presence of any chlorinated pesticides or PCBs in soil samples EM15-II and EM21-II, which samples are from the Christie Street alignment and, according to EPA Method 9022, contain 1.7 ppm to 7.1 ppm organic chlorine. Also, EPA Method 608 did confirm the presence of PCB (1260) in soil sample EM25-I. Interpretation of Figure 5.2 as one half of the DDT, DDD, DDE group concentration contours, therefore, may tend to overestimate the actual presence of DDT, DDD, and DDE.

Volatile Organics. Results indicate hydrocarbons contamination of groundwater generally in the northeastern quadrant of the Bay Center site and a small area around the former Delta truck terminal. Volatiles confirmed in water sample MWA-WS include benzene, ethyl benzene and toluene. The extent of groundwater contamination and groundwater contaminant characterization are the subjects of a forthcoming report by Aqua Science Engineers.

5.2 RECOMMENDED ABATEMENT ACTION

Table 5.1 presents an assessment of existing Bay Center site contamination or hazard conditions and general response actions. This assessment is general in scope and includes potential conditions which may have been demonstrated sufficiently by the characterization study and work site monitoring, or other tests reported herein, to be nonapplicable or to require no remedial action owing to the insignificance of the hazard. Ultimately, selection of remedial action requirements is the responsibility of Alameda County. The following discussion represents Earth Metrics interpretations of the available data and alternatives, and recommendations for remedial action.

Soils Contamination. Based upon the soils contamination characterization, the preferred abatement action is generally to encapsulate soils in place, wherever practical and wherever volatile organic concentrations are not an issue. Encapsulation in place is the lowest-cost, technologically feasible, effective action for in place soils.

Remedial actions and related costs for abating excavated contaminated soils which have been displaced by foundation footings, utility lines, or for structural capability reasons, are described below:

TABLE 5.1. ASSESSMENT OF EXISTING CONDITIONS AT BAY CENTER AND GENERAL RESPONSE ACTIONS

Site Problems or Potential Problems:

1. Potential Hazardous Particulates Released to Atmosphere

2. Volatilization of Hydrocarbons into Air (e.g., Benzene)

3. Soil Contamination (Hydrocarbons, Pb, DDT)

* 4. Groundwater Contamination

5. Potential Off-Site Gas Migration

6. Potential Runoff Contamination

General Response Actions (In Addition to No Action)

1. Air Pollution Control (e.g., Watering/Encapsulation)

2. Air Pollution Control (e.g., Benzene Measurement)

3. Temporary Storage, Encapsulation On Site, In-Situ Treatment (e.g., Soils Aeration to Remove Hydrocarbons), or Excavation and Removal

* 4. In-Site Treatment, Direct Waste Treatment, Temporary Storage

5. Off-Site Gas Migration Control

6. Surface Water Controls (e.g., Site Encapsulation and Stormwater Collection)

* Denoted responsibility of Aqua Science Engineers.

Source: Earth Metrics Incorporated, 1986.

ON SITE ENCAPSULATION OF EXCAVATED SOILS. On site encapsulation consists of backfilling a portion of excavated soils back into trenches or pits left from underground storage tank removal. Backfilled materials would be compacted and then encapsulated with asphalt or clean fill. Excess soils, after backfilling, are estimated to range from 3,000 to 5,000 cubic yards, depending upon structural suitability. Excess soils could be either i) disposed off site in an appropriate landfill or ii) grade spread over the northeast quadrant of the site and encapsulated.

Off site disposal of excess soils which cannot be backfilled into trenches or pits is estimated to cost $455,700 (3,000 cubic yards) to $771,500 (5,000 cubic yards). The latter cost estimate includes the cost of importing 2,000 cubic yards of clean replacement fill.

Spreading and compacting 3,000 to 5,000 cubic yards on the northeast quadrant of the site would cost on the order of $50,000. If the spread area is 4.65 acres, then the maximum elevation change relative to no action would be 0.4 to 0.66 feet, assuming uniform spreading. With sifting or sorting, and compaction, the actual elevation change could be substantially lower. Encapsulation and three feet of clean fill would cost $135,000 (estimate based on uniform coverage of entire 4.65 acres). The total worst case cost of spreading and encapsulating, therefore, would be $185,000.

This above cost represents a worst case. Non uniform spreading, as in earth berms, and/or asphalt encapsulation, would greatly reduce this cost to $100,000 or less.

OFFSITE DISPOSAL OF ALL EXCAVATED SOILS. Over 7,500 cubic yards of excavated soils will be generated by project construction. At this time, several thousand cubic yards have been placed in interim storage stockpiles on site. The minimum off site disposal cost is estimated to be $1.2 million (including test costs) for 7,500 cubic yards. This cost does not include the cost of importing clean replacement fill for backfilling. If 4,500 cubic yards of clean replacement fill are imported to the site, the added cost would be $30,000 which does not significantly affect the above $1.2 million estimate.

This minimum cost would result if 25 percent of the stockpiled material could be disposed at a Class II landfill (e.g., the Richmond landfill), the remaining 75 percent being disposed at a Class I landfill. The above percentage is based upon lead (Pb) test results for the existing stockpiled material (i.e., Christie Street storm drain trench, Pad A foundation footings, and Christie Street grade cut).

Encapsulation in place is the preferred alternative in view of the following factors:

- Lead levels are widely varying, so definition and isolation of contaminated soils is not practical. Effectiveness of excavation and removal from the site could not be assured.

- Contaminants such as DDT and lead will tend to remain fixed in the site soil and not migrate off site. Once encapsulated these contaminants also will not become airborne as windblown dust.

- Site design is generally consistent with thorough encapsulation except for small area landscaping.

- Project is an office use, so future land use changes entailing soil disturbance or activities entailing casual soil contact are improbable.

- Other alternatives (e.g., excavation and removal from the site) would not provide significant health or environmental benefit, relative to encapsulation in place, yet would be substantially more costly.

Off site disposal of all excavated soils would not provide a significant incremental benefit relative to no action or relative to soils encapsulation on site, yet would cost significantly more than both options ($1.2 million versus $0 to $100,000). The majority of lead contamination on the site and in the general vicinity would remain, despite off site disposal of 7,500 cubic yards of excavated soils. Encapsulation on site, therefore, is recommended subject to appropriate engineering design and control of potential contamination intrusion into building systems.

The recommended abatement actions do not apply to soils or water contaminated with hydrocarbons, particularly in the context of the underground storage tank pits. Abatement of the soils or water contaminated with hydrocarbons is the subject of a separate contaminant characterization report.

Benzene. At the request of the Alameda County Health Department, Earth Metrics Incorporated measured the concentration of benzene in air upwind and downwind of the aeration field for the soil excavated from around the underground fuel tanks. Benzene is present in gasoline at concentrations between 1 and 2 percent and is a suspected carcinogenic substance. The excavated soil which was found to have elevated concentrations of petroleum compounds was spread out over a 97,000 ft2 area (6 to 12 inches deep) in the northwest corner of the Bay Center site.

MEASUREMENT PROTOCOL. We used large charcoal sorbent tubes (400 mg/200 mg) to collect hydrocarbons for subsequent thermal desorbtion and separation and quantification by gas chromatography with a flame ionization detector. Two simultaneous 2 1/2 hour samples (140 liters) were taken on August 15, 1986 between the hours of 14:00 and 16:30. The excavated contaminated soil had been spread for aeration on the previous day. One sample was taken 10 feet downwind of the aeration field and the other sample was taken 400 feet upwind by the construction trailers. The sky was 80 percent clear, temperature 70 degrees Fahrenheit, and the wind was from the west at 5 to 10 mph.

RESULTS. The concentrations of benzene in air both upwind and downwind of the aeration field were measured to be less than the detection limit of 5 ppbv. Thus we conclude that there is negligible benzene being released from the aeration field. Typical outdoor urban concentrations range from 1 to 5 ppbv. The recommended eight hour exposure level (ACGIH) is 1,000 ppbv. Remedial action, therefore, is not required.

APPENDICES

A. EPA Method 9022

B. Hygiene and Safety Plan

C. California Title 22 Excerpts and EPA Priority Pollutants

D. Water Monitor Well Logs

SW-846 To: Rob Flay

METHOD 9022

TOTAL ORGANIC HALIDES (TOX) BY NEUTRON ACTIVATION ANALYSIS

1.0 Scope and Application

1.1 Method 9022 determines Total Organic Halides (TOX) in drinking, ground, and river waters, and in wastewater treatment plant effluents. The method uses a carbon adsorption procedure identical to that of Method 9020 (TOX analysis using a microcoulometric-titration detector), irradiation by neutron bombardment, then detection using a gamma-ray detector. The reliable limits of detection are 5 ppb for chlorine and 1 ppb for iodine and bromine.

1.2 Method 9022 detects all organic halides containing chlorine, bromine, iodine, and fluorine that are adsorbed by granular activated carbon under the conditions of the method. Each halogen can be quantitated independently.

1.3 Method 9022 is restricted to use by, or under the supervision of, analysts experienced in the operation of neutron activation analysis and familiar with spectral interferences.

1.4 This method may be used in place of Method 9020 and has the advantage of determining the individual concentrations of the halogens chlorine, bromine, and iodine in addition to TOX.

2.0 Summary of Method

2.1 A sample of water that has been protected against the loss of volatiles by the elimination of headspace in the sampling container, and that is free of undissolved solids, is passed through a column containing 40 mg of granulated activated carbon (GAC). The column is washed to remove any trapped inorganic halides. The GAC sample is exposed to thermal neutron bombardment creating a radioactive isotope. Gamma-ray emission, which is unique to each halogen, is counted. The area of the resulting peaks is directly proportional to the concentration of the halogens.

3.0 Interferences

3.1 Method interferences may be caused by contaminants, reagents, glassware, and other sample processing hardware. All these materials must be routinely demonstrated to be free from interferences under the conditions of the analysis by running method blanks.

3.1.1 Glassware must be scrupulously cleaned. Clean all glassware as soon as possible after use by treating with chromate cleaning solution.

This should be followed by detergent washing in hot water. Rinse with tap water and distilled water, drain dry, and heat in a muffle furnace at 400° C for 15 to 30 min. Volumetric ware should not be heated in a muffle furnace. Glassware should be sealed and stored in a clean environment after drying and cooling to prevent any accumulation of dust or other contaminants.

3.1.2 The use of high purity reagents and gases helps to minimize interference problems.

3.2 Purity of the activated carbon must be verified before use. Only carbon samples that register less than 2000 ng/40 mg should be used. The stock of activated carbon should be stored in its granular form in a glass container with a Teflon seal. Exposure to the air must be minimized, especially during and after milling and sieving the activated carbon. No more than a two-week supply should be prepared in advance. Protect carbon at all times from all sources of halogenated organic vapors. Store prepared carbon and packed columns in glass containers with Teflon seals.

3.3 It is possible that other radioisotopes, stray radiation, counting geometries, and counting-equipment materials can affect gamma counting. It is essential that the data interpretation be performed by an analyst experienced at detecting these interferences.

4.0 Apparatus and Materials

4.1 Adsorption system

4.1.1 Dohrmann adsorption module (AD-2), or equivalent, pressurized, sample and nitrate-wash reservoirs.

4.1.2 Adsorption columns: Pyrex, 5-cm-long x 6-mm-O.D. x 2-mm-I.D.

4.1.3 Granular activated carbon (GAC): Filtrasorb-400, Calgon-APC or equivalent, ground or milled, and screened to a 100/200 mesh range. Upon combustion of 40 mg of GAC, the apparent-halide background should be 2000 ng Cl^- equivalent or less.

4.1.4 Cerafelt (available from Johns-Manville), or equivalent: Form this material into plugs using a 2-mm-I.D. stainless-steel borer with ejection rod (available from Dohrmann) to hold 40 mg of GAC in the adsorption columns. CAUTION: Do not touch this material with your fingers.

4.1.5 Column holders (available from Dohrmann).

4.1.6 Volumetric flasks: 100-ml, 50-ml. A general schematic of the adsorption system is shown in Figure 1.

7.0 Procedure

7.1 Sample preparation

7.1.1 Special care should be taken in handling the sample in order to minimize the loss of volatile organohalides. The adsorption procedure should be performed simultaneously on the front and back columns.

7.1.2 Reduce residual chlorine by adding sulfite (1 ml of 0.1 M per liter of sample). Sulfite should be added at the time of sampling if the analysis is meant to determine the TOX concentration at the time of sampling. It should be recognized that TOX may increase on storage of the sample. Samples should be stored at 4° C without headspace.

7.1.3 Adjust the pH of the sample to approximately 2 with concentrated HNO_3 just prior to adding the sample to the reservoir.

7.2 Calibration

7.2.1 Check the adsorption efficiency of each newly-prepared batch of carbon by analyzing 100 ml of the adsorption-efficiency standard, in duplicate, along with duplicates of the blank standard. The net recovery should be within 5% of the standard value.

7.2.2 Nitrate-wash blanks (method blanks): Establish the repeatability of the method background each day by first analyzing several nitrate-wash blanks. Monitor this background by spacing nitrate-wash blanks between each group of eight analysis determinations. The nitrate-wash blank values are obtained on single columns packed with 40 mg of activated carbon. Wash with the nitrate solution as instructed for sample analysis, and then analyze the carbon.

7.2.3 Prior to each day's operation, the instrument is calibrated using radioactive standards (e.g., cobalt-60 and radium-226 sources). The instrument is calibrated such that gamma rays from the standards fall within plus or minus one channel of their true energies. A 100-sec blank is then counted to verify that no stray radioactive sources are within sensing distance of the detector. As data are obtained throughout the day peak locations in the standards are monitored to ensure there is no electronic drift of the instrument. If drift is noted, the system is recalibrated.

7.3 Adsorption procedure

7.3.1 Connect two columns in series, each containing 40 mg of 100/200-mesh activated carbon.

7.3.2 Fill the sample reservoir, and pass a metered amount of sample through the activated-carbon columns at a rate of approximately

3 ml/min. NOTE: 100 ml of sample is the preferred volume for concentrations of TOX between 5 and 500 µg/l; 50 ml for 501 to 1000 g/l, and 25 ml for 1001 to 2000 g/l.

7.3.3 Wash the columns-in-series with at least 2 ml of the 5000-mg/l nitrate solution at a rate of approximately 2 ml/min to displace inorganic chloride ions.

7.4 Activation

7.4.1 After the quartz collection tube with the GAC is removed from the extraction unit, the GAC and cerafelt pads are extruded using the packing rod into a prewashed plastic container (e.g., 1/5-dram polyethylene snap-cap vial). The vial is prewashed to remove inorganic and organic chorine by soaking in distilled water followed by storage in a glass jar containing 50% v/v acetone and hexane. Just prior to extrusion the vial is removed by forceps and air-dried to remove residual water, acetone, and hexane. The vial is snapped shut, the hinge removed with a scalpel blade, the cap heat-sealed to the vial with an electric soldering gun reserved for that purpose, and a single-digit number placed on the vial with a Marks-A-Lot (or equivalent) marker pen.

7.4.2 Samples plus a similar vial containing 25 µg Cl, 2.5 µg Br and 2.5 µg I standards are then introduced into the reactor, generally by placing them together in a 5-dram polyethylene vial and inserting them into a pneumatic-tube transfer "rabbit" for neutron irradiation. Irradiation would be for a 15-min period at a thermal neutron flux of 5×10^{12} neutrons/cm^2/sec. After returning from the reactor the rabbit is allowed to "cool" for 20 min to allow short-lived radioisotopes (primarily Al) present in the GAC to decay away.

7.5 Detection

7.5.1 Analysis is performed using lithium drifted germanium Ge(Li) gamma ray detector with an amplifier and a 4096-channel memory unit for data storage. The analyses can be performed either manually, with the operator changing samples and transferring the data to magnetic tape, or automatically, with both functions performed by an automatic sample changer.

7.5.2 Analysis begins by counting the standard and samples for a suitable time period (e.g., 200 sec "live" time for the standards and samples). The operator records the time intervals between samples and the "dead" time of each sample in a logbook for later use in calculating halogen concentrations in each sample.

7.6 Calculations

7.6.1 Chlorine, bromine, and iodine can be analyzed within a 200-sec counting period taking place 20 to 40 min after irradiation.

7.6.2 Chlorine is analyzed using the 1642-KeV gamma ray produced by 37.1-min ^{38}Cl. Bromine is analyzed using the 616-KeV gamma ray from 17.7-min ^{80}Br, while iodine is analyzed using the 442-KeV gamma ray produced by 25-min ^{128}I.

7.6.3 The calculation used for quantitation is:

$$\text{ppm halogen} = \frac{\text{cts unk.}}{\text{cts std.}} \times \frac{\text{counting time std.}}{\text{counting time unk.}} \times \frac{\mu\text{g in std.}}{\text{sample vol.}} \times e^{\lambda t}$$

where

cts unk. = the integrated area of the appropriate gamma-ray peak in the unknown with background subtracted and the total multiplied by 1 + [(% dead time unknown − % dead time std.)/200]. The latter correction is usually less than 4% and corrects for pile-up errors.

cts std. = the integrated area of the appropriate gamma-ray peak in the standard with background subtracted.

counting time std. = the "live" counting time in seconds of the standard.

counting time unk. = the "live" counting time in seconds of the unknown.

µg in std. = the number of micrograms of the stable element in question in the standard (25 for Cl, 2.5 for Br and I).

sample vol. = the volume of sample passed through the GAC column, in milliliters.

$e^{\lambda t}$ = The decay correction to bring all statistics back to t = 0. $\lambda = 0.693/t_{1/2}$ where $t_{1/2}$ = the half-life, in minutes.

t = the time interval in minutes from the end of the count of the standard until the end of the count of the sample.

7.6.4 No further calculations are necessary as long as the final sample is counted within 40 min after the end of irradiation. If samples are counted after 40 min, the addition to the 616-KeV peak of ^{80}Br from the 619-KeV peak from ^{82}Br becomes large enough that a correction factor must be applied. In practice all counting should be completed in less than 40 min after irradiation.

8.0 Quality Control

8.1 All quality control data should be maintained and available for easy reference or inspection.

8.2 Before performing any analyses, the analyst must demonstrate the ability to generate acceptable accuracy and precision with this procedure by analyzing appropriate quality-control check samples.

8.3 The laboratory must develop and maintain a statement of method accuracy for their laboratory. The laboratory should update the accuracy statement regularly as new recovery measurements are made.

8.4 Employ a minimum of one blank per sample batch to determine if contamination is occurring.

8.5 Run check standard after approximately every 15 samples.

8.6 Run one duplicate sample for every 10 samples. A duplicate sample is a sample brought through the whole sample preparation process.

8.7 It is recommended that the laboratory adopt additional quality-assurance practices for use with this method. The specific practices that would be most productive will depend upon the needs of the laboratory and the nature of the samples. Field duplicates may be analyzed to monitor the precision of the sampling technique. Whenever possible, the laboratory should perform analysis of standard reference materials and participate in relevant performance-evaluation studies.

8.8 Quality control for the analysis phase is very straightforward since the instrument is a noncontact analyzer. That is, only the radiation emitted from the sample - not the sample itself - should touch the analyzer. Since contamination of the system is not usually a problem (unless a sample spills on it), the most serious quality-control issues deal with uniform neutron flux, counting geometry, and spectral interpretation. The amount of radioactivity induced in a sample is directly proportional to the neutron flux it is exposed to. Since this flux can vary depending on how the sample is positioned in relation to the reactor core during irradiation, it is essential that a known standard be irradiated with every sample batch to act as a flux monitor. Care must also be taken to ensure that the standard and all samples associated with the standard are counted at the same distance from the detector.

July 31, 1986

TO: Earthmetrics, Inc.
859 Cowan Road
Burlingame, CA 94010

RE: Bay Center Project
Emeryville, CA
D85/146

Gentlemen:

DEVCON CONSTRUCTION INCORPORATED
General Building Contractors

Please find enclosed copies of the following documents containing important job safety and work rules pertaining to the above referenced project:

1. Hygiene and Safety Plan for the Bay Center site prepared by TMA.

2. Hygiene and Safety Plan Addendum dated July 1, 1986.

3. First Notice of Worksite Monitoring Results for Worker Hygiene and Safety Program dated July 10, 1986.

4. Hygienist Notice letter dated July 28, 1986.

555 Los Coches Street
Milpitas, California 95035
Phone (408) 942-8200
Lic. #399163

As you may already know, this jobsite was formerly used by the City of Emeryville as a municipal dump site. For the protection of all individuals working at the site a comprehensive testing program has been conducted to determine the existence of any harmful materials. As a result of this program, it has been determined that the hazard potential of this site is relatively low. However, because of certain substances such as lead and methane gas have been found to exist at the site, it is necessary that the safety procedures and guidelines contained in the above Hygiene and Safety Plan and Notices be strictly adhered to.

The following is a summary of the major specific rules at this jobsite:

1. All workers are required to wash their hands before eating and at the end of each work day.

2. No smoking, eating, or drinking is allowed in the immediate work area. An area at the site has been designated for an eating area.

3. All abrasions and cuts must be cleaned thoroughly and bandaged before continuing work. Sterile water, hydrogen peroxide, and first aid supplies are available in the Contractor's trailer.

4. A certified Industrial Hygienist will be on site to monitor all drilling operations and deep excavations. Should any odorous or strange materials be encountered during excavation, this should immediately be brought to the attention of Devcon's Project Superintendent and the Industrial Hygienist.

5. All excavated materials are to be temporarily stockpiled and tested before they are backfilled or removed from the site. No spoils should be disposed of without prior approval from Devcon.

These regulations may be added to or modified as conditions change at the site. Subcontractors will be immediately notified of any changes in the Safety Plan which affects their work.

It is the responsibility of each Subcontractor to read the Hygiene and Safety Plan and the Addendums and Notices issued in connection therewith and to inform his employees regarding these work rules. Any worker who fails to comply with the Hygiene and Safety Plan or other jobsite work rules and regulations will be asked to leave the jobsite immediately.

Please confirm that you have received and read the enclosed documents and informed your employees who will be involved on this job of the work rules and that you have distributed copies of this material to the employees who will be involved at this jobsite by signing, dating, and returning the enclosed duplicate of this letter. A return envelope is enclosed for your convenience.

You should also advise your employees that the Owner and the Industrial Hygienist have arrangeed for before and after blood lead tests to be available, at the Owner's expense, for workers at this jobsite if desired.

The following is a list of the names and telephone numbers of the Owner, Devcon's Project Manager, the Hygienist, and other Contractors who are responsible for the Hygiene and Safety Plan and monitoring and testing for the presence of toxic materials:

OWNER:

Bay Center Associates
c/o The Martin Company
4256 Hacienda Drive, Suite #101
Pleasanton, CA 94566

Walter T. Kaczmarek
(415) 463-3773

GENERAL CONTRACTOR:

Devcon Construction, Inc.
555 Los Coches
Milpitas, CA 95035

Mark Johnson, Project Manager
(408) 942-8200 x251

INDUSTRIAL HYGIENIST:

Thermo Analytical, Inc.
2030 Wright Avenue
Richmond, CA 94808-0040

Harry Gee, Project Manager
(415) 235-2633

INDUSTRIAL HYGIENIST (Continued)

Emergency Contact: (After Working Hours)
TMA/ERG
1400 - 53rd Street
Emeryville, CA 94608

Brian Hunt, Project Manager
(415) 652-2300

Lisa Polos, Project Manager
(415) 524-1923

CONTAMINATION CONSULTANT:

1. EarthMetrics, Inc.
   859 Cowan Road
   Burlingame, CA 94010

   Marc Papineau
   (415) 697-7103

2. Aqua Science Engineers, Inc.
   P. O. Box 535
   San Ramon, CA 94583

   Terry Carter/Bill Rusk
   (415) 820-9391

EMERGENCY MEDICAL CARE:
Readi Care California Industrial Medical Clinic
5901 Christie Street
Emeryville, CA 94608

(415) 652-5800

We appreciate your cooperation in implementing this Worker Safety and Hygiene Plan. Should you have any questions in this regard, please do not hesitate to call.

Very truly yours,

Mark E. Johnson
Project Manager

ACKNOWLEDGMENT:

I hereby acknowledge receipt of the following:

1. Hygiene and Safety Plan for the Bay Center Site prepared by TMA, Inc.

2. Hygiene and Safety Plan Addendum dated July 1, 1986.

3. First Notice of Worksite Monitoring Results for Worker Hygiene and Safety Program dated July 10, 1986.

4. Hygienist Notice letter dated July 28, 1986.

I hereby acknowledge that I have read the above documents and disseminated the information to all employees who will be involved in working on the project, and I have given each a copy of the above information.

____

For: ____________________________________

____

Date: ____________________________________

HYGIENE AND SAFETY PLAN
BAY CENTER SITE, EMERYVILLE

INTRODUCTION

This Hygiene and Safety Plan has been prepared for use during the soil Excavation Phase of the construction project for The Martin Company Bay Center Site in Emeryville. The Plan represents an effort of the sub contractor, Thermo Analytical, Inc. (EAL). The Plan describes the procedures to be implemented to protect the health and safety of the employees performing the work.

In general, preliminary investigations have indicated that the hazard potential at the site is low and primarily associated with potential contact with lead containing dust. Personal and area air samples for lead and organic vapors will be collected during the different construction processes and locations to insure safe working conditions. Personal air samples will be collected during excavation of a "worst case" area to determine whether or not respirators are necessary.

The purpose of the Plan is to provide construction personnel with adequate protection against possible contamination in the area of Emeryville, California, located in the northeast quadrant of 64th Street/Lacoste Street.

The types of exposure hazards that may potentially be encountered during this investigation are: lead dust and organic vapor exposures. The safety plan will address these two types of hazards.

The prime contractor will assign an Industrial Hygienist to implement the Plan. The Industrial Hygienist is trained in appropriate industrial hygiene and safety information. Training includes, but is not limited to: safety awareness and response, use of respiratory protection equipment, qualitative fit testing of respiratory protection equipment, explosive conditions and lower explosive limits, confined space entry, eye and head protection, skin protection, and use of impervious clothing. Before work at the site begins, the Industrial Hygienist will review the Hygiene and Safety Plan to become acquainted with the Draft Work Plan and contingency emergency response, requisite for safe work at the site. The Industrial Hygienist will remain on-site during soil excavation activities in order to assess changing exposure conditions and to initiate emergency response plans, if required.

MEDICAL INFORMATION

The preliminary investigation of probable airborne lead levels indicates that levels are not expected to exceed the 30 microgram per cubic meter 8 hour time weighted average, 30 days per year, CAL/OSHA "action level." However, the owner and Industrial Hygienist have agreed that, as a precaution, before and after blood lead tests will be made available to affected workers, if desired, at the owners expense.

In the event that unusual circumstances arise during the performance of field work, the Industrial Hygienist will interview involved employees at the site to determine whether any exposure may have occurred and if the employees are experiencing any symptoms which may be related to contaminant exposure. If the employees indicate any adverse effects or, in the judgement of the Industrial Hygienist, such adverse effects are apparent or probable, the Industrial Hygienist will require each of the involved employees to be evaluated by competent medical personnel. Such evaluation will be noted in the Industrial Hygienist's daily log. Emergency care will be provided.

EDUCATION AND TRAINING PROGRAM

Each employee involved in the plan will be trained in the necessary hygiene and safety precautions. The safety requirements for this type of work are largely dependent upon the professional judgement of the Industrial Hygienist. Two different types of potential hazards are associated with the plan. These are: potential lead exposure and potential exposure to unknown hazardous wastes that are associated with the disposal sites within the general Emeryville area. An Industrial Hygienist, trained in conducting this type of field work, will be responsible for instructing each of the affected construction personnel in the appropriate health and safety measures for corresponding job functions.

All personnel involved in excavation of contaminated soil will be trained in the following aspects:

- Health Hazards - All personnel will be made aware of the possible health related problems associated with unmitigated exposure to lead.
- All employees who will wear personal protective equipment will be instructed in the use, care and fitting of personal protective equipment and of the necessity for wearing the equipment, its effectiveness and limitation.
- The Industrial Hygienist will also be responsible for training affected construction personnel concerning the necessity for protection from the adverse effects of hazards associated with contaminated areas. Affected personnel will be advised of the potential hazards and precautions which are to be taken in the event such materials are encountered.
- Proper hygiene, which will include use of wash facilities as appropriate.

The Industrial Hygienist will be responsible for training construction personnel. Personnel will be advised of the notification procedures which are to be followed in the event that odorous or strange appearing materials are encountered.

The Industrial Hygienist will be on-site to oversee all operations and to ensure that proper hygiene and safety measures are being maintained. Construction workers will be required to report any unexpected or irregular occurrences which may be encountered during the field work to the Industrial Hygienist. Such occurrence include, for example, unearthing of drums, pockets of darkened or wet soil, and odors.

In this former landfill site, the fill materials are generally below the surface of the existing asphalt soil. If the activities at the site cause considerable disturbance, the Industrial Hygienist will adjust procedures and protection levels accordingly, making notes of any such changes in the daily log. This procedure will provide continued safety to all personnel on-site.

Since the identities and extent of potential chemical contamination other than lead are not well known, avoidance procedures, monitoring, and personal protection will be required. Added safety precautions will be taken for the inherent hazards of groundwater monitor well drilling and of other drilling procedures.

Specific Hazards and Risks

There is a potential hazard associated with lead-containing dust inhaled during subsurface soil excavation. The greatest risk of inhalation will occur with those activities which disturb surface soil in contaminated area causing causing airborne dust. There are secondary exposure routes of skin absorption and ingestion. Skin absorption will be reduced or eliminated by the use of gloves and coveralls.

Site Entry Procedures

Eating, drinking, smoking and any other practice which increases the probability of hand-to-mouth transfer is prohibited in the work zones. All field personnel will be instructed to thoroughly wash their hands and face upon leaving the work area. The Industrial Hygienist will be responsible for designating a wash area at each work site.

A first aid kit, eye wash kit, 20 pound ABC fire extinguisher, stretcher and blanket, and potable water will be available at the work site.

Levels of Protection

The site will be considered a Zone D work area. Level D Personal Protection will be required. This designation is based upon the existing knowledge that airborne concentrations of lead are expected to be below the present premisible exposure limit (PEL) of 50 microgram/cubic meter of air time-weight average established by CAL/OSHA. The Zone D designation will exist at all operations. Zone D safe guards will include:

- Where necessary, air purifying respirators approved by NIOSH for toxic dusts, and mists.
- Coveralls and gloves and, where necessary, chemical-resistant Tyvek-type clothing, or equivalent.

- Rubber boots with steel toes, or equivalent.
- Hard hat.

All drilling activities will start at Level D protection (Level D protection is described in the U.S. EPA Standard Operating Safety Guides, November 1984) with continuous organic vapor monitoring. Disposable latex gloves, hard hat, and eye protection will be used to minimize injury from engine-driven drilling equipment and to minimize illnesses from skin contact of chemicals. The ground around drilling activities will be wetted to prevent entrainment of airborne dust.

The level of protection will be upgrades to Level C if the drilling encounters irregular materials or, if organic vapor levels exceed 0.5 ppm above background levels continuously for more than five minutes. Personal protective equipment at Level C will include, at a minimum, the following:

- Double cartridge respirator for organic vapors
- Escape masks
- Underwear - cotton
- Coveralls - chemical resistant
- Apron - PVC, butyl rubber, or other material impervious to chemicals
- Gloves - PVC, butyl rubber, or other material impervious to chemicals
- Safety boots - neoprene or other material imprevious to chemicals
- Boots - chemical resistant, steel toes and shank
- Hard hat with face shield
- Safety glasses when face shield not used

CONTAMINATION REDUCTION

All disposable protective clothing will be put into plastic bags, sealed, and provided with a label describing the contents before field personnel leave the sampling area. The plastic bags will be retained on-site until chemical analyses are performed on the field samples. Disposable cothing shall not be re-used from day to day.

PERSONAL MONITORING

Lead Monitoring

Air samples will be taken in the breathing zone for peak exposures during digging and soil handling operations and long-term exposures in high activity operations. All samples will be taken as personal samples worn by the individuals.

Site perimeter samples will be taken in a similar fashion, except that the samples will be collected as fixed source area samples. The monitors will be set at approximately 5-feet above the ground at the site boundary. These samples will be analyzed by NIOSH Method P & CAm 173.

Organic Vapor Monitoring

The Industrial Hygienist will monitor for ambient levels of organic vapors using a Century Organic Vapor Analyzer (GC/FID). The Industrial Hygienist will be notified if organic vapor levels exceed ambient levels. Drilling will cease, equipment will be shut down, and personnel will withdraw from the area if any of the following conditions occur:

- The organic vapor concentrations in the operator's breathing zone exceeds 5 ppm
- The organic vapor concentration 2-feet above the bore hole exceeds 5,000 ppm or 50% of the lower explosive limit

The Industrial Hygienist will determine when personnel may return to the work area.

In the event low levels of organic vapors are detected, personnel will wear appropiate respirators until construction activities at the location are completed and the Industrial Hygienist determines that respirators are not needed. The Industrial Hytienist will attempt to identify the nature and source of the vapors. If industrial debris is apparent in the boring, drilling at the locations will be terminated.

CONTINGENCY PLAN

The Industrial Hygienist designated by the contractor will be present at sampling sites during all drilling and environmental sampling operations. The

Industrial Hygienist will be knowledgeable of expected contaminants, hazards, and risks, and will be responsible for coordinating emergency responses. It will also be the responsibility of the Industrial Hygienist to inform and train the work party members before the work begins at each site. Training will include information on the risks that may be encountered, and techniques to minimize exposures from these hazardous materials. The Industrial Hygienist will also implement the safety plan, hold safety meetings with employees, evaluate employees understanding of risks and preventive measures, inform all employees of designated escape routes and locations of all emergency medical aid.

Before site work begins, the Industrial Hygienist will notify emergency response personnel who may be called upon to respond to emergency situations if they occur, and will brief them on the nature of anticipated hazard and potential emergency scenarios. The groups to be notified will include local clinics and/or hospitals, and fire personnel. The name of the clinics and/or hospitals which have been designated to serve construction personnel shall be posted on-site and made available to construction personnel.

The Industrial Hygienist's primary responsibility in the event of an accident will be evacuation, first aid, and decontamination of injured team members. The Industrial Hygienist will determine safe evacuation areas and begin first aid, and decontamination of injured team members. Injured parties will be taken through decontamination procedures, if possible. However, the procedure will be omitted when it may aggravate or cause more harm to the injured party. A qualified member of the work team will accompany the injured party to the medical facility to advise on matters concerning contamination. A specific evacuation route will be selected based on traffic congestion at the time of the emergency.

Emergency Procedures

In the event of a medical emergency, the injured party will be taken through decontamination procedures, if necessary and possible. However, the procedure will be omitted when it may aggravate or cause more harm to the injured party. A qualified member of the work team will accompany the injured party to the medical facility to advise on matters concerning potential contamination.

RECORD KEEPING

The Industrial Hygienist will maintain a record of all health and safety related matters in a daily log. Air monitoring data and any unusual field data will be recorded in the daily log. In addition, the Industrial Hygienist will maintain pertinent medical records of all field personnel, safety and health documentation, contingency plans, and communications and contracts on-site. These records will be available to all employees upon request.

HYGIENE AND SAFETY PLAN
ADDENDUM

This addendum has been prepared to respond to several questions about hygiene practices and to provide additional background information about the site's history and testing program. The addendum also explains certain terms used in the Hygiene and Safety Plan.

SITE HISTORY. Originally, the construction site was part of the San Francisco Bay. During the period 1935 to 1955 several bay sites, including this site, were filled by the City of Emeryville Public Works Department. The fill consisted of a variety of materials including soil, rock, building debris, and refuse items such as bottles, batteries, wood and wire.

The whole site was covered with asphalt sometime in the late 1950s, and two truck terminal buildings were built. The first was Delta Truck and the second was Garrett Freight lines.

TEST PROGRAM. Samples of the site beneath the asphalt cap were collected by a geotechnical firm retained by the owners as early as March 1985. Additional samples of surface and subsurface materials have been collected and analyzed during January 1986 to June 1986. The test program has identified the following materials:

* A variety of metals (including lead, zinc, and iron) throughout the site.
* A low level herbicide (weed killer) just beneath the asphalt cap.
* A low level of elemental chlorine which may originate from a variety of sources such as battery acid.

Test results have not indicated the presence of toxic pesticides or herbicides, aldrin, PCBs, DDT or harmful hydrocarbon vapors. The test program is continuing, so that additional tests of subsurface material will continue to demonstrate the presence or absence of potential hazards. The continuing test program will address both subsurface soils and airborne particles.

Test results have demonstrated the presence of lead in excess of the State of California Department of Health Services (DOHS) criterion level of 1,000 ppm. Airborne lead levels have been measured to be far below the CAL/OSHA permissible exposure limit. Avoidance of contact with and/or ingestion of soil containing lead, therefore, is an important objective of the Hygiene and Safety Plan.

HYGIENE AND SAFETY PLAN. The following information is provided to amplify and clarify several questions about the plan:

1. What are the objectives of the plan?

   Answer. The plan is designed to minimize worker contact with lead to an acceptable level and to monitor construction site conditions.

2. Will wash facilities be provided?

Answer. Yes, by The Martin Company (Owner) and DEVCON (General Contractor). These are operative now.

3. What is a "worst case" area?

Answer. The hazard potential is low throughout the site.

Tests four feet below the surface along the Christie Street alignment demonstrated the absence of volatile organics and permissible levels of airborne lead. Tests were performed by the Industrial Hygienist and scientists before street construction began.

Based upon these tests, it was determined by the Industrial Hygienist that respirators are not necessary. Work site monitoring will continue, so that new test results will be available as work progresses.

4. What is "emergency response" or "contingency planning"?

Answer. Past tests cannot predict unexpected, unknown events. Therefore, the Hygiene and Safety Plan includes measures for proper response to unexpected conditions (e.g., encountering any material of unusual appearance) and work-related accidents.

5. What about work site presence by the Industrial Hygienist?

Answer. The Industrial Hygienist will be present during sampling of airborne dust levels and during drilling operations. Presence of the Industrial Hygienist after initial grading, trenching, or other underground activity will be at the discretion of the Industrial Hygienist. At all times, the Industrial Hygienist will be available on call from either of two offices in Emeryville and Richmond, California.

6. Will "adjusted" procedures be given in writing?

Answer. Generally, procedures in the Hygiene and Safety Plan and Addendum will not be adjusted. Procedures will be subject to the interpretation of the Industrial Hygienist, who may decide upon such matters as appropriate levels of protection, appropriate times of his work place monitoring, and environmental sampling (e.g., sampling for airborne lead levels).

7. What is the basis of the procedures?

Answer. Again, the Hygiene and Safety Plan and Addendum have been prepared by the Industrial Hygienist. The plan is in compliance with CAL/OSHA requirements and was prepared with due regard for known or potential conditions at the site.

8. Are blood tests to be given to each employee?

<u>Answer</u>. No. Blood tests are being offerred to each employee, if desired, at the owner's expense. However, the tests are optional and are not required based upon the CAL/OSHA regulations.

9. Who will provide, distribute, and collect disposable protective clothing?

<u>Answer</u>. This clothing will be provided by The Martin Company and distributed on the work site by DEVCON. DEVCON will also provide a disposal receptacle.

10. What is the contingency measure if groundwater is encountered?

<u>Answer</u>. If groundwater is encountered, work should be stopped in the immediate vicinity by those workers who would otherwise contact the groundwater. The Industrial Hygienist will be called to sample the water and test it on a "fast turnaround" basis, before the water is discharged to the storm drain system.

11. Who is the "prime contractor" mentioned in the Hygiene and Safety Plan?

<u>Answer</u>. "Prime Contractor" here refers to the firm of Earth Metrics Incorporated, which has been retained by The Martin Company. Earth Metrics Incorporated is under contract to The Martin Company to perform tests of subsurface and excavated soils, in the context of a hazardous materials characterization study for the County of Alameda. The county has received a copy of this Hygiene and Safety Plan.

Thermo Analytical, Inc. is the subcontractor to Earth Metrics Incorporated, which has been retained by Earth Metrics Incorporated to prepare the Hygiene and Safety Plan and provide the services of an Industrial Hygienist. Thermo Analytical, Inc. has offices in Richmond and Emeryville, California.

____ ____________________________________

Certified Industrial Hygienist
THERMO ANALYTICAL

Date

RECEIVED
JUL 11 1986
DEVCON

FIRST NOTICE OF WORKSITE MONITORING RESULTS FOR WORKER HYGIENE AND SAFETY PROGRAM AT BAY CENTER, EMERYVILLE

This notice is the first of a series of reports on the continuing worksite monitoring program that has been implemented by the Prime Contractor (Earth Metrics Incorporated). The monitoring program addresses airborne particles, volatile organic vapors, excavated materials, and in place, subsurface soil in selected work zones.

SUMMARY. Continuing monitoring has demonstrated that the hazard potential throughout the site is low, primarily associated with potential skin contact with regulated materials. The initial investigation demonstrated the presence of lead in soil, in excess of the State of California Department of Health Services (DOHS) criterion level of 1,000 parts per million (ppm). Continuing investigation has demonstrated the presence of the pesticide DDT in soil excavated from the Christie Street extension and, potentially, in drilling spoils from the pilot piles in future building Pad A and Pad B. Detected DDT is in excess of the DOHS criterion level of one ppm.

The Industrial Hygienist has been notified of the above test result on July 8, 1986. He indicates that i) the hazard potential is low and ii) hygiene measures currently in effect are appropriate for minimizing potential skin contact. He also indicates that airborne dust in affected work zones will be tested for DDT in addition to lead. This monitoring revision is the only necessary amendment to the Hygiene and Safety Plan at this time.

PESTICIDE AND PCB TEST RESULTS. Approximately 2000 cubic yards of soil were excavated and stockpiled to make the 64th Street grade for the Christie Street extension. Minor amounts of drilling spoils were stockpiled next to indicator piles driven beneath Pad A and Pad B.

The Christie Street stockpiled material was tested for a variety of contaminants. DDT was confirmed in the Christie Street excavated material at the level of 4.5 ppm. PCBs and a variety of other toxic substances were confirmed to be absent.

The Christie Street stockpiles have been isolated on the eastern portion of the Bay Center site and tarped. Potential for worker contact with DDT in this material, therefore, has been minimized.

Drilling spoils have been kept in small stockpiles adjacent to the indicator piles for testing. Drilling spoils are being moved to the eastern portion of the site, stockpiled in one area, and tarped, to minimize the risk of chance contact.

Approximately fourteen (14) samples of the soil remaining beneath the Christie Street alignment have been collected and submitted to a laboratory for testing. Partial test results indicate very low potential for DDT in the north section of the alignment, DDT concentrations being below the DOHS criterion level of one ppm. Remaining test results will address the potential for DDT in the south section of the alignment. These remaining results are due from the laboratory on July 11, 1986.

AIRBORNE PARTICLE AND VAPOR TEST RESULTS. Airborne lead and volatile organic vapors have been monitored in selected work zones during June 1986. Selected work zones included the Christie Street alignment, Pad A, and Pad B.

Lead concentrations in selected work zones have ranged from nondetectable to 12.5 micrograms per cubic meter, well below the CAL/OSHA permissible exposure limit of 50 micrograms per cubic meter. Volatile organic vapors have been less than 0.02 ppm, also below the CAL/OSHA permissible exposure limit.

OTHER TEST RESULTS. Miscellaneous hydrocarbons were detected in the soil excavated from the Christie Street alignment and in groundwater encountered beneath the alignment. Hydrocarbons included gasoline (less than two ppm) in the groundwater, a polynucleated aromatic hydrocarbon (400 ppb), and miscellaneous aliphatic hydrocarbons (400 ppm combined) in the soil.

Presence of the above substances has been reported to the Industrial Hygienist. Special precautions are not advised.

This notice will be posted in the DEVCON trailer at the Bay Center, Emeryville work site. Any questions about this notice should be directed to Mr. Marc Papineau at (415) 697-7103 or c/o Earth Metrics Incorporated, 859 Cowan Road, Burlingame, California 94010.

Marc Papineau

EARTH METRICS INCORPORATED

7-10-86

DATE

TMA
Thermo Analytical Inc.

TMA/ERG
1400 West 53rd Street
Suite 460
Emeryville, CA 94608-2946
(415) 652-2300

TO: Bob Russey
Site Superintendent
Bay Center, Emeryville

FROM: Brian Hunt
Industrial Hygienist

DATE: July 28, 1986

Please notify your subcontractors that sterile water, hydrogen peroxide, and first aid supplies are available in the contractor's trailer. All abrasions and cuts ~~should~~ must be cleaned thoroughly and bandaged before continuing work. Also, since high concentrations of methane are of concern in this work area, please refrain from smoking on the worksite.

cc: Mark Papineau
Earthmetrics
859 Cowan Road
Burlingame, California 94010

$$\text{Calculated oral or dermal } LD_{50} = \frac{100}{\sum_{x=1}^{n} \frac{\%Ax}{T_{Ax}}}$$

where %Ax is the weight percent of each component in the waste mixture and T_{Ax} is the acute oral or dermal LD_{50} or the acute oral LD_{LO} of each component.

NOTE: Authority cited: Sections 208, 25141 and 25150, Health and Safety Code. Reference: Section 25141, Health and Safety Code.

HISTORY:
1. Editorial correction filed 10-5-84; designated effective 10-27-84 (Register 84, No. 41).

66699. Persistent and Bioaccumulative Toxic Substance.

(a) Any waste is a hazardous waste which contains a substance listed in subsections (b) or (c) of this section:

(1) at a concentration in milligrams per liter as determined pursuant to Section 66700 which exceeds its listed soluble threshold limit concentration, or

(2) at a concentration in milligrams per kilogram in the waste which exceeds its listed total threshold limit concentration.

(b) List of Inorganic Persistent and Bioaccumulative Toxic Substances and Their Soluble Threshold Limit Concentration (STLC) and Total Threshold Limit Concentration (TTLC) Values.

METALS

Substance	*STLC* *mg/l*	*TTLC* *Wet-Weight mg/kg*
Antimony and/or antimony compounds	15	500
Arsenic and/or arsenic compounds	5.0	500
Asbestos	—	1.0 (as percent) PLM
Barium and/or barium compounds (excluding barite)	100	10,000††
Beryllium and/or beryllium compounds	0.75	75
Cadmium and/or cadmium compounds	1.0	100
Chromium (VI) compounds	5	500
Chromium and/or chromium (III) compounds	560	2,500
Cobalt and/or cobalt compounds	80	8,000
Copper and/or copper compounds	25	2,500
Fluoride salts	180	18,000
Lead and/or lead compounds	5.0	1,000
Mercury and/or mercury compounds	0.2	20
Molybdenum and/or molybdenum compounds	350	3,500
Nickel and/or nickel compounds	20	2,000
Selenium and/or selenium compounds	1.0	100
Silver and/or silver compounds	5	500
Thallium and/or thallium compounds	7.0	700
Vanadium and/or vanadium compounds	24	2,400
Zinc and/or zinc compounds	250	5,000

* STLC and TTLC values are calculated on the concentrations of the elements, not the compounds.

† In the case of asbestos and elemental metals, applies only if they are in a friable, powdered or finely divided state. Asbestos includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite.

†† Excluding barium sulfate.

(c) List of Organic Persistent and Bioaccumulative Toxic Substances and Their Soluble Threshold Limit Concentration (STLC) and Total Threshold Limit Concentration (TTLC) Values.

Substance	*STLC* *mg/l*	*TTLC Wet Weight mg/kg*
Aldrin	0.14	1.4
Chlordan	0.25	2.5
DDT, DDE, DDD	0.1	1.0
2,4-Dichlorophenoxyacetic acid	10	100
Dieldrin	0.8	8.0
Dioxin (2,3,7,8-TCDD)	0.001	0.01
Endrin	0.02	0.2
Heptachlor	0.47	4.7
Kepone	2.1	21
Lead compounds, organic	–	13
Lindane	0.4	4.0
Methoxychlor	10	100
Mirex	2.1	21
Pentachlorophenol	1.7	17
Polychlorinated biphenyls (PCBs)	5.0	50
Toxaphene	0.5	5
Trichloroethylene	204	2,040
2,4,5-Trichlorophenoxypropionic acid	1.0	10

NOTE: Authority cited: Sections 208, 25141 and 25150, Health and Safety Code. Reference: Section 25141, Health and Safety Code.

HISTORY:

1. Editorial correction filed 10-5-84; designated effective 10-27-84 (Register 84, No. 41).

66700. Waste Extraction Test (WET).

(a) The WET described in this section shall be used to determine the amount of extractable substance in a waste or other material as set forth in Section 66699(a).

(b) Except as provided in Section 66700(d), the WET shall be carried out if the total concentration in the waste, or other material, of any substance listed in Section 66699 equals or exceeds the STLC value, but does not exceed the TTLC value, given for that substance. The total concentrations of substances listed in Section 66699 shall be determined by analysis of samples of wastes, or other materials, which have been prepared, or meet the conditions, for analysis as set forth in subsections (c) and (d) of this section. Methods used for analysis for total concentrations of substances listed in Section 66699 shall be those given in the following documents or alternate methods that have been approved by the Department pursuant to Section 66310(e):

(1) For metal elements and their compounds, the waste shall be digested according to the indicated methods described in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, 2nd edition, U.S. Environmental Protection Agency, 1982:

NOV 12 1980

PRIORITY POLLUTANT ANALYSIS

ENVIRONMENTAL RESEARCH GROUP, INC.

VOLATILES (PURGE & TRAP)

acrolein*
acrylonitrile*
benzene
bromomethane
bromodichloromethane
bromoform
carbon tetrachloride
chlorobenzene
chloroethane
2-chloroethylvinyl ether
chloroform
chloromethane
dibromochloromethane
1,1-dichloroethane
1,2-dichloroethane
1,1-dichloroethene
trans-1,2-dichloroethene
1,2-dichloropropane
cis-1,3-dichloropropene
trans-1,3-dichloropropene
ethylbenzene
methylene chloride
1,1,2,2-tetrachloroethane
tetrachloroethene
1,1,1-trichloroethane
1,1,2-trichloroethane
trichloroethene
trichlorofluoromethane
toluene
vinyl chloride

ACID EXTRACTABLES

2-chlorophenol
2-nitrophenol
phenol
2,4-dimethylphenol
2,4-dichlorophenol
2,4,6-trichlorophenol
4-chloro-3-methylphenol
2,4-dinitrophenol
2-methyl-4,6-dinitrophenol
pentachlorophenol
4-nitrophenol

BASE/NEUTRAL EXTRACTABLES

acenaphthene
acenaphthylene
anthracene
benzo(a)anthracene
benzo(b)fluoranthene
benzo(k)fluoranthene
benzo(a)pyrene
benzo(g,h,i)perylene
benzidine
bis(2-chloroethyl)ether
bis(2-chloroethoxy)methane
bis(2-ethylhexyl)phthalate
bis(2-chloroisopropyl)ether
4-bromophenyl phenyl ether
butyl benzyl phthalate
2-chloronaphthalene
4-chlorophenyl phenyl ether
chrysene
dibenzo(a,h)anthracene
di-n-butylphthalate
1,3-dichlorobenzene
1,4-dichlorobenzene
1,2-dichlorobenzene
3,3'-dichlorobenzidine
diethylphthalate
dimethylphthalate
2,4-dinitrotoluene
2,6-dinitrotoluene
dioctylphthalate
1,2-diphenylhydrazine
fluoranthene
fluorene
hexachlorobenzene
hexachlorobutadiene
hexachloroethane
hexachlorocyclopentadiene
indeno(1,2,3-cd)pyrene
isophorone
naphthalene
nitrobenzene
n-nitrosodimethyl amine
n-nitrosodi-n-propylamine
n-nitrosodiphenylamine
phenanthrene
pyrene
2,3,7,8-tetrachlorodibenzo-p-dioxin
1,2,4-trichlorobenzene

PESTICIDES (G.C.)

aldrin
a-BHC
b-BHC
d-BHC
g-BHC
chlordane
4,4'-DDD
4,4'-DDE
4,4'-DDT
dieldrin
endosulfan I
endosulfan II
endosulfan sulfate
endrin
endrin aldehyde
heptachlor
heptachlor epoxide
toxaphene
PCB 1016
PCB 1221
PCB 1232
PCB 1242
PCB 1248
PCB 1254
PCB 1260

METALS & OTHER COMPOUNDS

antimony
arsenic
beryllium
cadmium
chromium
copper
lead
mercury
nickel
selenium
silver
thallium
zinc
asbestos
cyanide
total phenolics

Analyses are performed according to the Proposed Rules in the Dec. 3, 1979 Federal Register, and meet monitoring requirements of NPDES.

A priority pollutant analysis includes all four fractions. The Volatile, Base/Neutral, and Acid Fractions are done by GC/MS. The Pesticides are done by G.C. PCBs, which are part of the pesticide fraction, can be confirmed by GC/MS on special request. Metals are run by A.A., Asbestos by T.E.M. and Cyanide colorimetrically.

*Done by direct injection.

ENVIRONMENTAL RESEARCH GROUP, INC.

EARTH METRICS INCORPORATED
BAY CENTER PROJECT
MONITOR WELL A

Drilled 7/3/86

Geologist: D.B. McCullar
Driller: Dave Schultz (Aqua. Science Engineers)

Depth (feet)	Unit	Description
0–3	I	Dark greenish brown clayey silt and sand with abundant fragments of brick, concrete, etc. Samples taken: MWA-1a Amberglass, soil composite MWA-1b VOA, soil composite
3–6	[X] 2c II	Dark brown to black clayey silt, sand, assorted rubble, wires, bricks, concrete, ceramic tiles, ceramic insulators, etc. Samples taken: MWA-2a Amberglass, soil composite MWA-2b VOA, soil composite MWA-2c Brass Tube, core (3.0 - 3.5)
6–9	[X] 3c III water level (330 PM)	STRONG ODOR OF GASOLINE Black, silty to sandy clay, and clay, with weathered glass, slight petroleum odor. Samples taken: MWA-3a Amberglass, soil composite MWA-3b VOA, soil composite MWA-3c Brass tube, core (6.0 - 6.5)
9–12	[X] 4c IV	Runny, watery, silty clay, very dark gray w/brown oily streaks, petroleum odor. Samples taken: MWA-4a Amberglass, soil composite MWA-4b VOA, soil composite MWA-4c Brass tube, core (10.0 - 10.5) (strong gasoline odor)
12–15	V	Black clay, slightly silty, soft, malleable, slight petroleum odor. Samples taken: MWA-5a Amberglass, soil composite MWA-5b VOA, soil composite

TD 15'

EARTH METRICS INCORPORATED
BAY CENTER PROJECT
<u>MONITOR WELL B</u>

Drilled 7/3/86

Geologist: D.B. McCullar
Driller: Dave Schultz (Aqua. Science Engineers)

Depth (feet)		
0 – 3	I	Greenish gray clayey silt to black clay, slight organic odor. Samples taken: MWB-1a Amberglass, soil composite MWB-1b VOA, soil composite
3 – 6	[X] II	Black sandy clay, with wood, brick, glass, assorted rubble, wet, slight organic odor, some greenish gray clay. Samples taken: MWB-2a Amber glass, soil composite MWB-2b VOA, soil composite MWB-2c Brass tube, core (4.0 - 4.5)
6 – 9	(water level 10:40 A.M.) III	Black, gravelly, very wet, clay and silt with abundant gravel, probably cement rubble, some tile pieces, cement chunks, etc., some wood. Samples taken: MWB-3a Amber glass, soil composite MWB-3b VOA, soil composite
9 – 12	IV	Wet, black clay, some minor rock or cement fragments, organic odor. Samples taken: MWB-4a Amberglass, soil composite MWB-4b VOA, soil composite
12 – 15	V	Wet, charcoal gray to green clayey silt. Samples taken: MWB-5a Amber glass, soil composite MWB-5b VOA, soil composite

TD 15'