Description of
Current Conditions Report

For:

ATOCHEM North America, Inc.
(formerly Pennwalt Corporation)
Wyandotte, Michigan
East Plant

and Appendices

EPA I.D. Number MID 005 363 114
Administrative Consent Order V-W-89R-45

Prepared For:

ATOCHEM North America, Inc.
(formerly Pennwalt Corporation)
Safety and Environmental Service
King of Prussia, Pennsylvania

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SECTION 1

INTRODUCTION

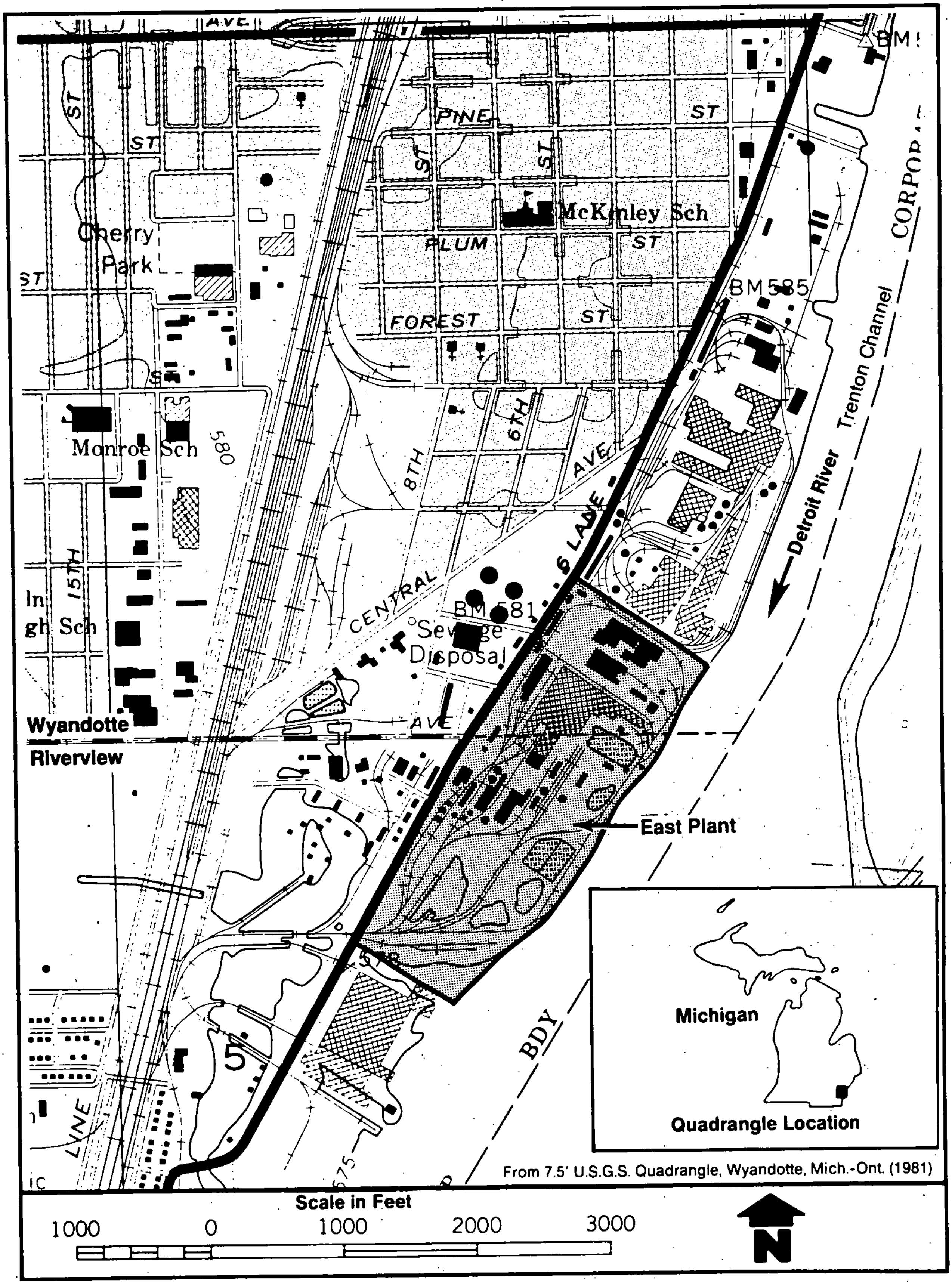
1.1 BACKGROUND

The purpose of this report is to respond to Attachment I, Task I of the final Consent Order (dated 21 September 1989) between the U.S. Environmental Protection Agency (EPA) Region V and Pennwalt Corporation. On 31 December 1989 Pennwalt Corporation underwent a corporate reorganization. Certain affiliate companies were merged into and with Pennwalt Corporation, which is the surviving corporation. The name of Pennwalt Corporation has been changed to Atochem North America, Incorporated. For the sake of simplicity, however, we have used the name Pennwalt Corporation throughout this report. The Consent Order requires Pennwalt to conduct a RCRA Facility Investigation (RFI) to determine the nature and extent of possible releases of hazardous waste or hazardous constituents from regulated units, solid waste management units, or other source areas into soils and possibly surface water and/or groundwater. This report addresses the requirement to prepare a document describing current conditions at Pennwalt's East Plant.

The Pennwalt East Plant is located on approximately 90 acres along the western bank of the Detroit River in Wyandotte, Michigan, as shown in Figure 1-1. It is bounded on the east by the Detroit River, on the south by a decommissioned Firestone facility, on the west by Pennwalt's West Plant and the Wayne County Wastewater Treatment Plant, and on the north by Wyandotte Cement and a decommissioned BASF facility. The general site map, Figure 1-2, provides a general layout of the facility. The northern portion of the facility is located in the town of Wyandotte, and the southern portion in the town of Riverview.

The Pennsylvania Salt Manufacturing Company (which later became Pennwalt Corporation) built the East Plant facility in 1898. The initial manufacturing operations focused on the production of chlorine and caustic soda using the region's extensive subsurface salt deposits as raw material. The facility was in active production from 1898 to December 1985. The East Plant is in the process of being demolished by Pennwalt. Several buildings are no longer standing. These have been indicated on Figure 1-2 by lightly shading their outlines. A portion of the East Plant is currently leased to Pressure Vessel Services, Inc. (PVS) for the manufacture of ferric chloride and the distribution of hydrochloric acid and caustic soda.

Historically, Pennwalt manufactured primarily inorganic chemicals at the East Plant, including caustic soda, chlorine, hydrogen, and ferric chloride. Pennwalt leased part of the East Plant, known as the Halowax area, to the Halowax Corporation of New York and subsequently to Bakelite Corporation, Union Carbide and Carbon Corporation, and Koppers Company, Inc., (now Beazer Materials and Services, Inc.) for the production of chloronaphthalenes and other chlorinated compounds. Other areas of the East Plant were leased to other tenant companies for the manufacture of hydrogenated fish oil and



From 7.5' U.S.G.S. Quadrangle, Wyandotte, Mich.-Ont. (1981)

FIGURE 1-1 PENNWALT EAST PLANT LOCATION MAP

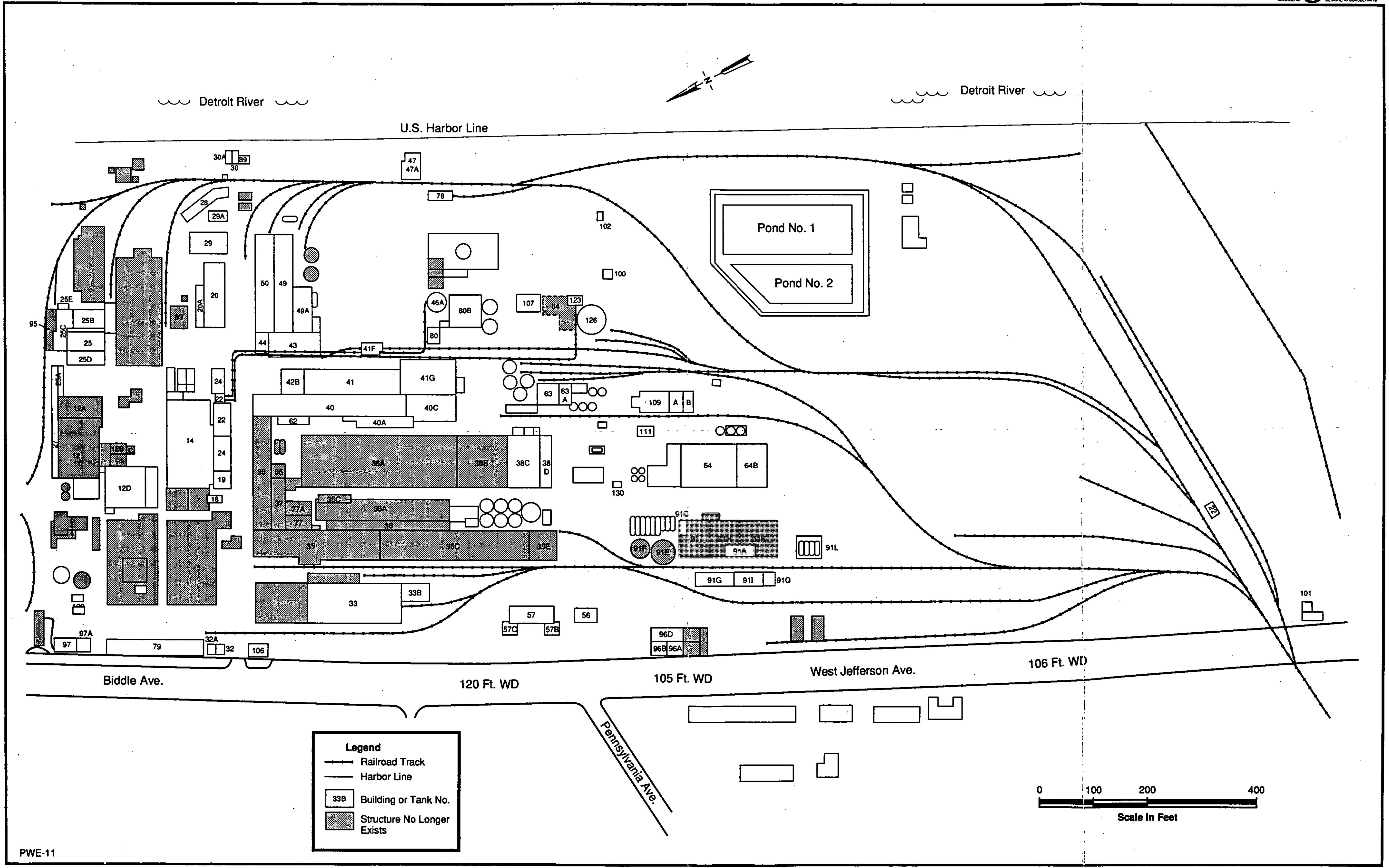


FIGURE 1-2 GENERAL SITE MAP EAST PLANT
PENNWALT CORPORATION

carbon tetrachloride. In summary, past chemical operations at the East Plant included production of ammonia, ammonium chloride, hydrochloric acid, hydrogen peroxide, calcium hypochlorite, carbon tetrachloride, chlorinated benzenes, and chlorinated naphthalenes as well as a gasification plant.

1.2 OBJECTIVE AND SCOPE

The objective of this report is to describe the current conditions at the East Plant facility. This description is a comprehensive review of the available background information and environmental conditions of the East Plant.

The objective has been accomplished through a diligent review of drawings and files maintained by the Wyandotte plant, Corporate Central Engineering and Corporate Safety, Health and Environmental Affairs offices in King of Prussia, Pennsylvania. Specifically, the report contains the following information, as required by Attachment I, Task I of by the Consent Order:

- Maps that summarize the regional location, pertinent boundary features, general East Plant physiography, hydrogeology, and historical use of the facility for treatment, storage, or disposal of solid and hazardous waste.

- A history and description of ownership and operation including former tenant operations; associated solid and hazardous waste generation; treatment, storage and disposal activities. This includes a listing of raw materials used, products, byproducts generated, and locations of production areas.

- A history of spills, summarizing approximate dates, amounts, locations, and response actions of past product or waste spills which involved hazardous constituents or hazardous wastes.

- A summary of past environmental permits requested and/or received, any enforcement actions, and their subsequent responses. This includes a list of the documents and studies prepared with respect to these environmental permits.

- A summary of all potential source areas of contamination. This includes the location, quantity of waste, identification of the waste or constituents, and identification of the additional information required.

- A preliminary assessment and description of the existing degree and extent of contamination. This includes available monitoring data, identification of potential migration pathways, and potential impacts on human health and the environment.

SECTION 2

PHYSICAL FEATURES

2.1 TOPOGRAPHY AND SURFACE DRAINAGE

Pursuant to the East Plant RFI Scope of Work, a map is to be included that presents the topography and surface drainage on the site. This map is included in Appendix A.

The plant site is essentially flat. As a result, there are no clearly defined surface water drainage and none is defined on the map. The surface impoundments (Ponds 1 and 2) are the only water containment feature onsite. Surface water enters the plant sewer system through catch basins, sumps, and manholes located throughout the site. The sewers discharge to the Detroit River through the plant's NPDES treatment facilities.

As previously indicated, the Wyandotte plant is located near the Trenton Channel of the Detroit River. The plant lies in the 100-year floodplain and is identified by the Federal Emergency Management Agency in their Flood Insurance Rate Maps 2602460001B and 2602400005C to be between the 578.0 to 579.0-foot MSL contours as shown on the topographic map.

2.2 TANKS, BUILDINGS, AND UTILITIES

Pursuant to the East Plan RFI Scope of Work, maps depicting all tanks, buildings, utilities, paved areas, easements, rights-of-way, and other features are presented in this report. Due to the number and bulk of these drawings, they are presented in Appendix B. The following is a list of the drawings provided:

• Tanks and Buildings	Drawing W03-7114B, Plate 1
• Utilities	Drawing W03-7149, Plate 2
Process Sewer	Drawing W03-7100A, Plate 3
Sanitary Sewer	Drawing W03-7104A, Plate 4
Water	Drawing W03-7145, Plate 5
	Drawing W03-7146, Plate 6
Electrical Underground Services	Drawing W03-7101A, Plate 7
	Drawing W03-7102A, Plate 8
• Paved Areas	Drawing W03-7111A, Plate 9
• Easements and Right-of-Way	
PVS, Water and Steam	Plate 10
PVS, Access and Power	Plate 11

2.3 SOLID AND HAZARDOUS WASTE TSDs

The solid and/or hazardous waste treatment storage and disposal facilities (TSDs) requested in the Consent Order are listed in Table 2-1. Their locations are presented in Figure 2-1.

Table 2-1

Solid and Hazardous Waste TSDs

Pennwalt East Plant

SWMU Number[a]	Identification	Description	Active 19 November 1980 Before and/or After
1	Tank 103[b]	50,000 gal tank	Both
2	Tank 104[b]	50,000 gal tank	Both
3	Tank 4	1,100 gal indoor tank	Both
4	Tank 6A	3,000 gal indoor tank	Both
5	Drum storage Containment Pad	40 ft x 60 ft curbed, reinforced concrete pad	After
6	Tank 1	10,000 gal indoor tank	Both
7	Anhydrous Ferric Chloride Container[b]	A metal dumpster box located in a 10-ft x 12-ft indoor area, concrete floor and sump.	Both
8[c]	PCB Storage Area	225 sq ft indoor area	Both
9[c]	Asbestos Storage Area	400 cu ft indoor area	Both
10[c]	Underground Injection Wells	3 Class V underground injection wells	Both
11	NPDES Neutralization Tanks	5 concrete and/or steel tanks	Both
12	NPDES Surface Impoundment (a.k.a. Ponds 1 and 2)	2 surface impoundments; 2 million gal total volume	Both
13	Former Landfill 5 (a.k.a. Burn Area)	Landfill	Before
14	Reject Liquor Tank	100,000 gal. tank rubber lined	Both

Table 2-1

Solid and Hazardous Waste TSDs

Pennwalt East Plant
(continued)

SWMU Number[a]	Identification	Description	Active 19 November 1980 Before and/or After
16	Ferric Chloride Processing Area	Copper recovery pad, 12-ft x 12-ft, reduction tank sludge waste pile	Both
		Anhydrous ferric chloride wastes	Before
17	Halowax Area	Pitch pits, still bottoms	Before
21	Former Lime Sludge Storage/Disposal Area	Waste pile/landfill	
26[d]	Detroit Edison Co. Pond	Surface Impoundment fly ash	After

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[a] As numbered in the Consent Order.
[b] Currently operated by Pressure Vessel Services, Inc. under a lease agreement.
[c] No RFI will be required for this Solid Waste Management Unit (SWMU) as indicated in the Consent Order, Attachment I, Table I, East Plant Scope of Work, pp. 53-56.
[d] Through the record search, this pond was identified as a fly ash settling pond and is included as a SWMU.

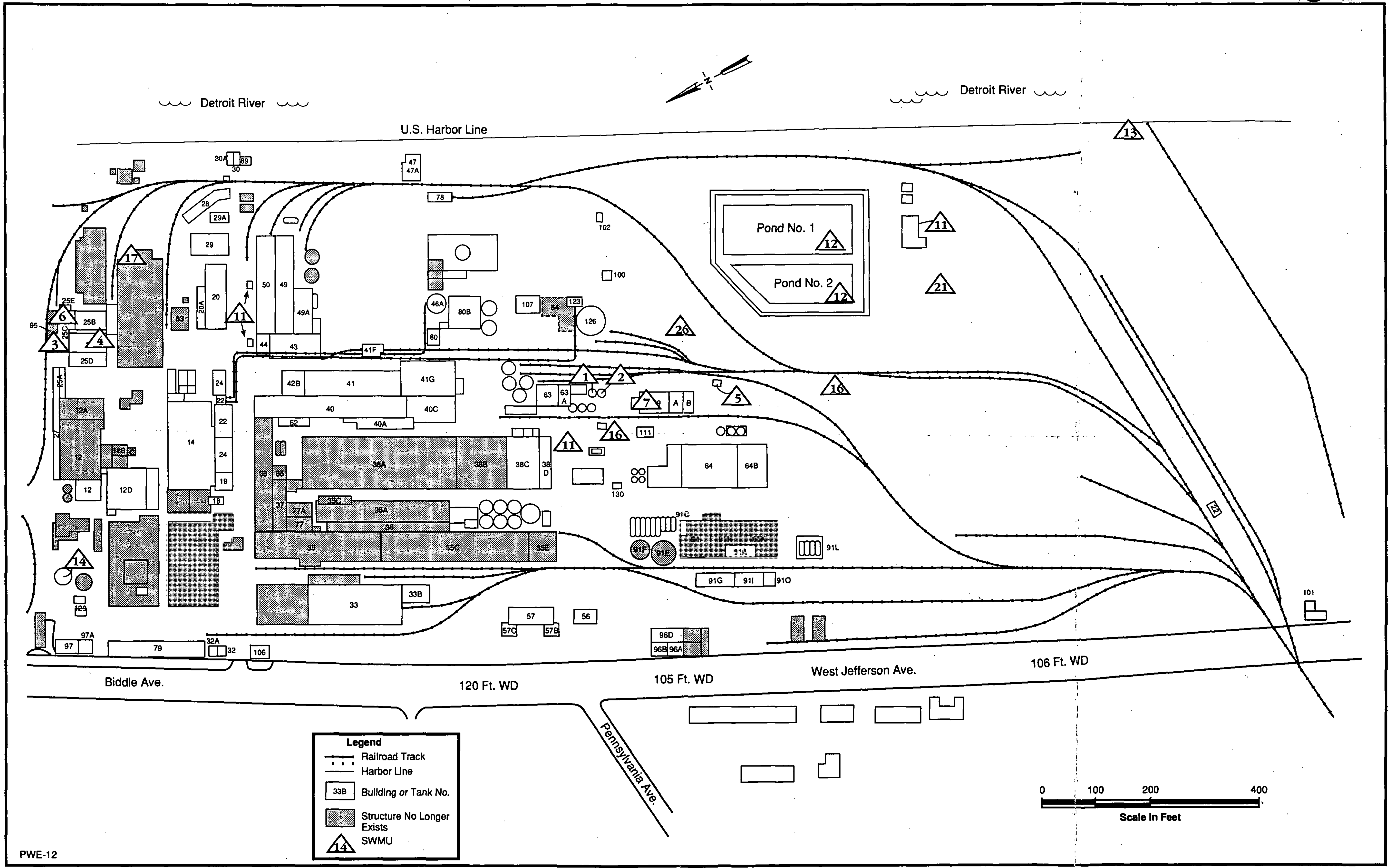


FIGURE 2-1 SOLID AND/OR HAZARDOUS WASTE TSDs, PENNWALT EAST PLANT

2.4 UNDERGROUND TANKS AND PIPING

Review of Pennwalt files and drawings indicates a total of seven underground tanks on the East Plant, none of which was used for hazardous or nonhazardous waste service. There are no details available concerning piping associated with these tanks. The locations of the underground tanks are shown in Figure 2-2. Tank 170 is a 2,000-gallon underground gasoline storage tank located in the northwestern corner of the facility near Building 97. A 1,000-gallon kerosene tank was located near Building 21 along Main Street. Plant personnel recall that this tank was emptied and filled with sand. The third underground tank was a mineral oil tank located at the southern end of Building 38D. Finally, four underground tanks were located in the former Taylor Chemical Area (Buildings 107 and 54) for storage of the raw material carbon disulfide.

The Consent Order requests information regarding underground pipelines in addition to the listing of the underground storage tanks. The only buried process piping consisted of lines from the brine wells to Building 43 and brine sludge lines from Building 49A past Building 78 to Ponds 1 and 2.

2.5 SURROUNDING LAND USE

Surrounding land use information is presented in Figure 2-3. Property usage within the vicinity of the East Plant is primarily industrial. The property along the Detroit River and immediately to the north of the East Plant is Wyandotte Cement and a decommissioned BASF facility which reportedly produced certain organic and inorganic chemicals including ethylene and propylene oxides, chlorine, and caustic soda. To the northwest across Biddle Avenue is the Municipal Wastewater Treatment Plant. Immediately to the west across Biddle Avenue is the Pennwalt West Plant. The area to the south of the East Plant along the Detroit River is a decommissioned Firestone facility which manufactured wheels. To the east of the plant is the Detroit River and the northern tip of Grosse Ile Island, reportedly used for past BASF operations.

To the north and west and within a 1-mile radius of the plant there are four schools. The residential areas within the 1-mile radius are primarily located to the north and northwest of the plant. A small portion of the residential area on Grosse Ile is within the 1-mile radius.

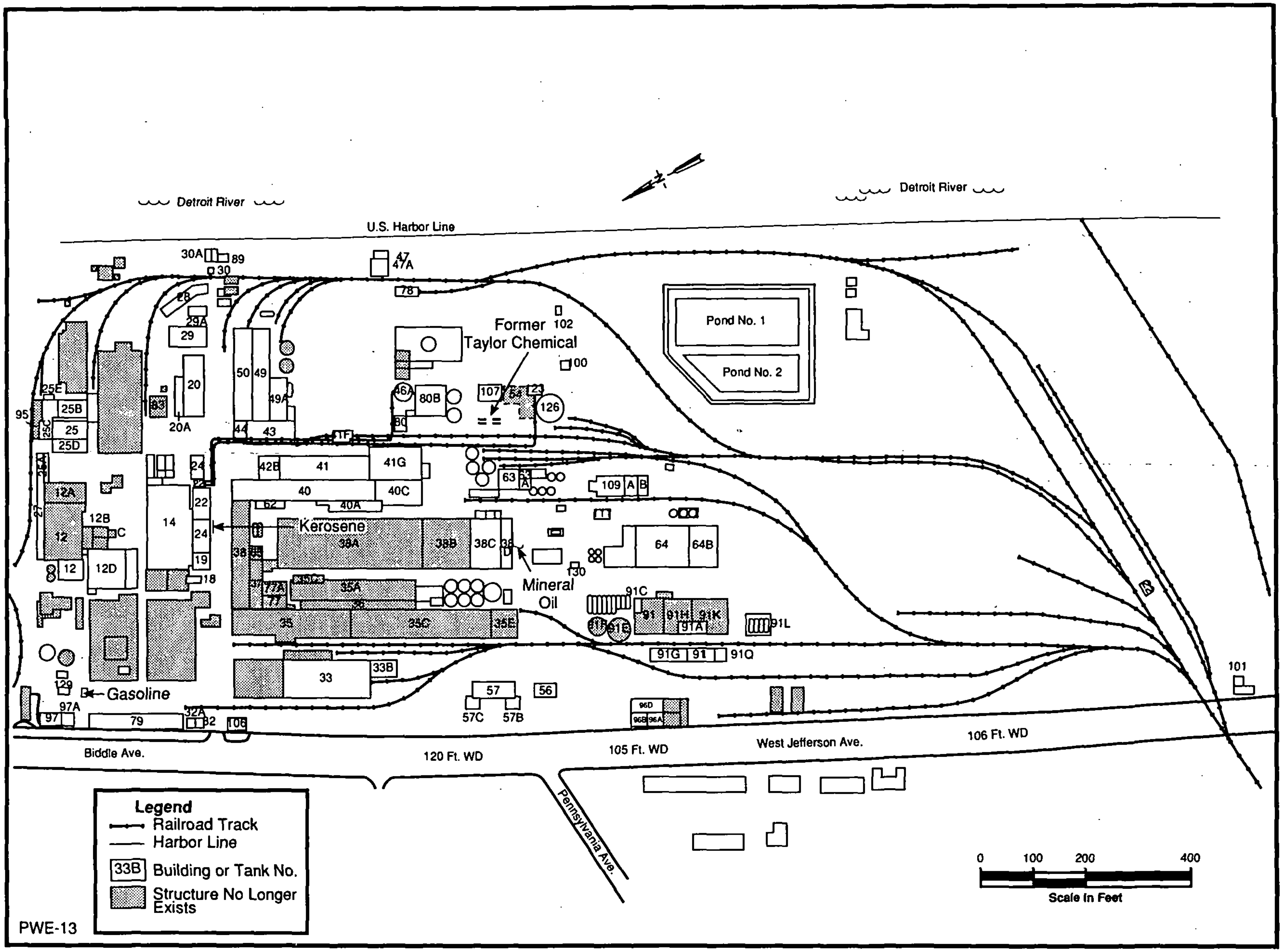
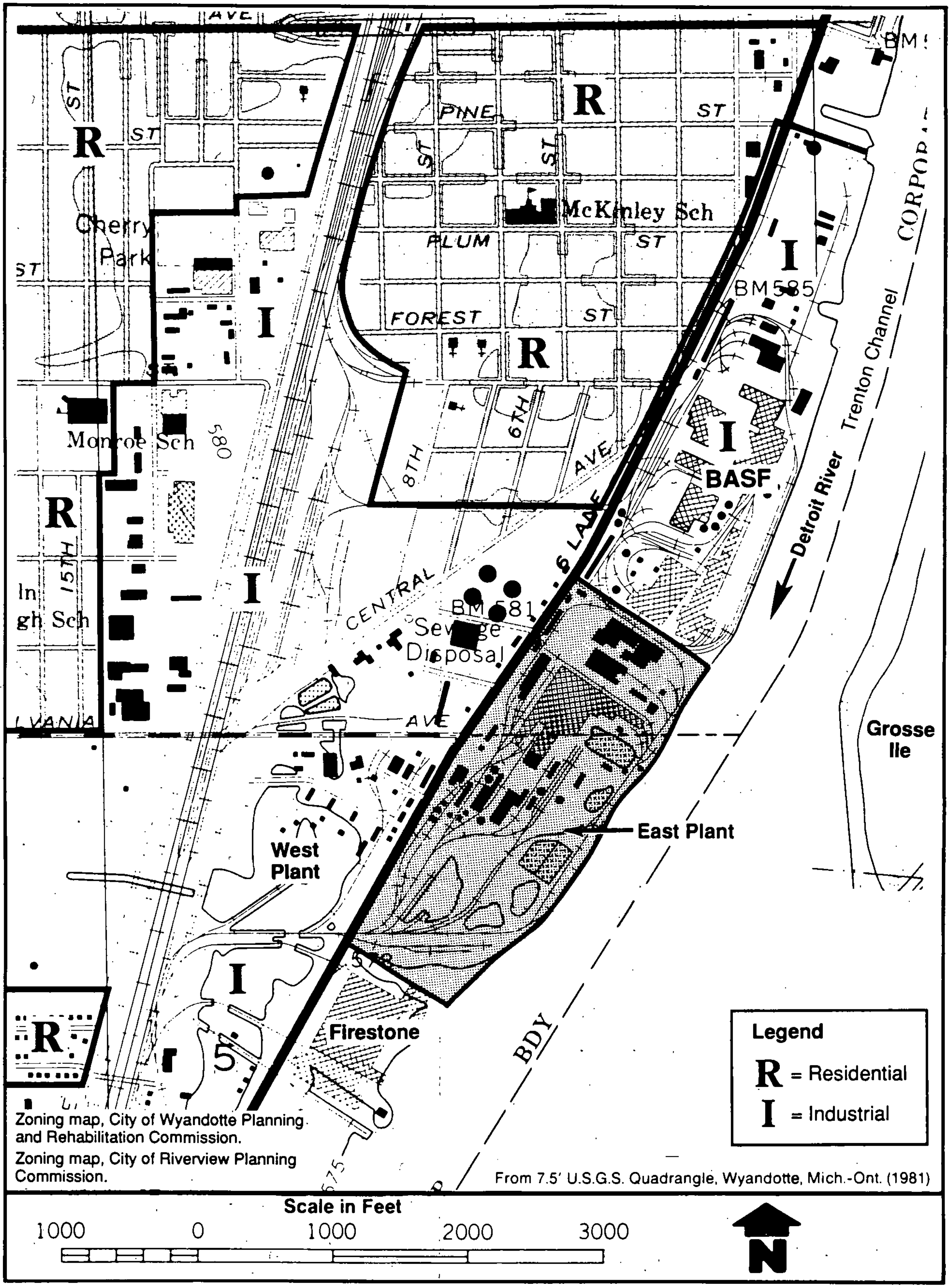


FIGURE 2-2 UNDERGROUND STORAGE TANK LOCATIONS PENNWALT EAST PLANT



Zoning map, City of Wyandotte Planning and Rehabilitation Commission.

Zoning map, City of Riverview Planning Commission.

From 7.5′ U.S.G.S. Quadrangle, Wyandotte, Mich.-Ont. (1981)

FIGURE 2-3 SURROUNDING LAND USE - PENNWALT EAST PLANT

SECTION 3

OWNERSHIP AND LEASES

3.1 PENNWALT

Pennwalt's holdings in the East Plant consist of parts of four parcels (A-W-001, A-W-002, A-W-004, and A-W-006) presently totalling approximately 90 acres, located between West Jefferson Avenue (Biddle Avenue), the Detroit River, south of Wye Street and north of the Firestone properties. Pennwalt originally acquired parcel A-W-001 from the Detroit River Land Company in 1898, parcel A-W-002 from Eureka Iron and Steel Works in 1899, parcel A-W-004 from the Detroit Rock Salt Company in 1937, and parcel A-W-006 from the Village of Riverview in 1937.

3.2 TENANTS

3.2.1 FORMER TENANTS

Pennwalt has leased portions of the East Plant to other parties for various purposes since the 1920s. The locations of the leased areas are shown in Figure 3-1. Table 3-1 outlines these leases in terms of the dates, area leased, and products.

The two major leases involved the Halowax area and the power plant. The Halowax area was used for the production of chlorinated naphthalenes and other chlorinated compounds. The original lessee for this area was the Halowax Corporation of New York. The property was subsequently leased to Bakelite Corporation, Union Carbide and Carbon Corporation, and Koppers Company, Inc. (now Beazer Materials and Services, Inc.). The power plant was a coal-fired unit that produced electricity and steam for the East Plant. Detroit Edison leased and operated the power plant from 1963 to 1986.

3.2.2 CURRENT TENANT

The only current tenant at the Pennwalt East Plant is Pressure Vessel Service, Inc. (PVS). The lease with PVS started on 30 December 1985 and has continued under several extensions. PVS manufactures ferric chloride and distributes inorganic industrial chemicals including hydrochloric acid and caustic soda. The location of the leasehold for the PVS operations is presented on Figure 3-2.

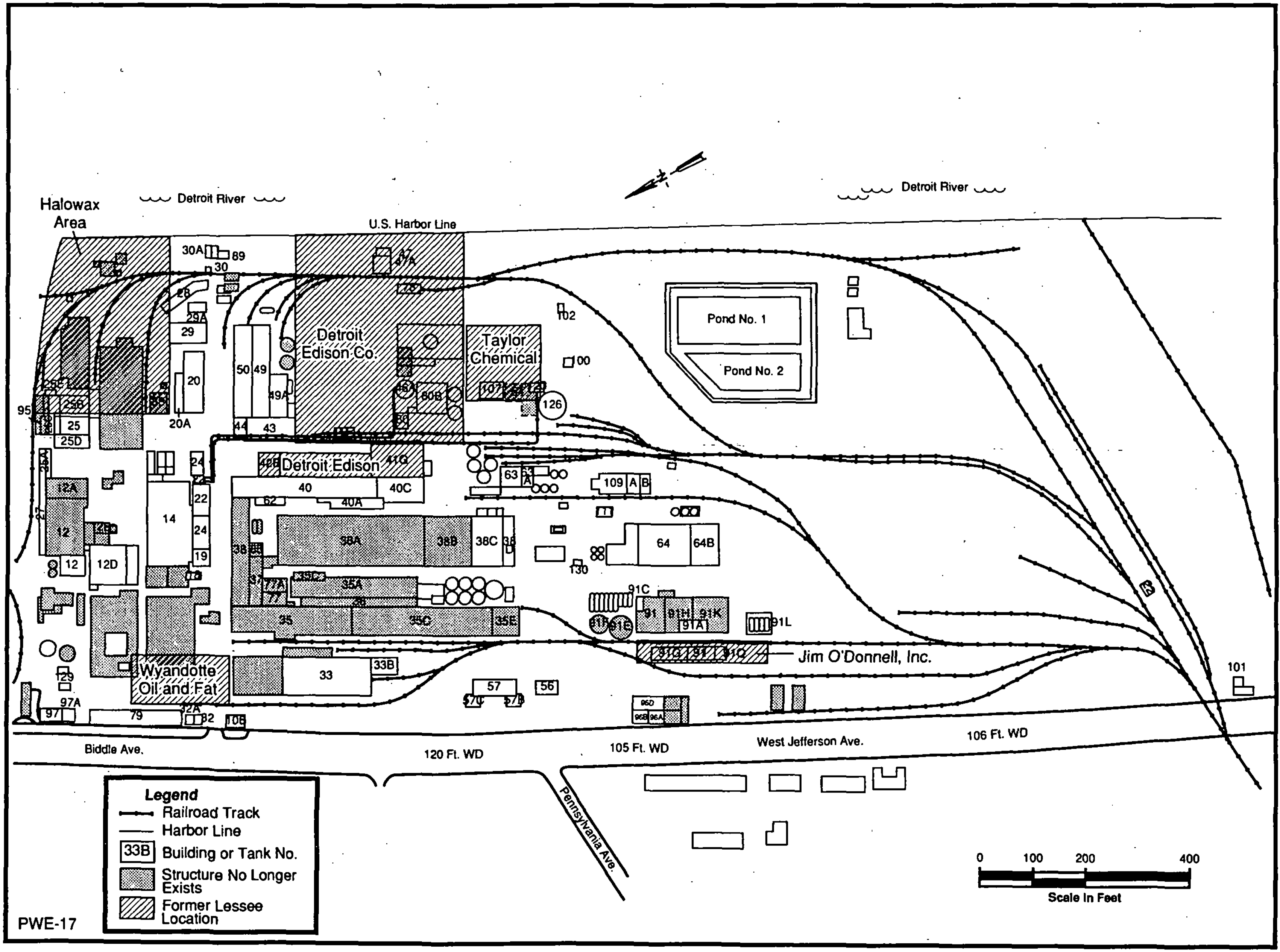


FIGURE 3-1 FORMER LESSEE LOCATIONS PENNWALT EAST PLANT

Table 3-1

East Plant Lessees

Lessee	Dates	Products	Location
Halowax Corporation (had occupied premises	27 July 1928 - 11 August 1939	chlorinated naphthalenes	Halowax Area
Bakelite Corporation (assignee of Halowax lease)	11 August 1939 - ?	chlorinated naphthalenes	Halowax Area
Halowax Products Div. of Union Carbide and Carbon Corporation (lease was extended indefinitely after it expired)	1 February 1944 31 January 1949 1 February 1949 1 January 1952	chlorinated naththalenes, chlorinated benzene, chlorinated paraffins, aroclors, bisphenol-a	Halowax Area
Halowax Products Div. of Union Carbide and Carbon Corporation (lease of railroad tracks, lease was extended indefinitely after it expired)	1 July 1951 1 July 1956	chlorinated naththalenes, chlorinated benzene, chlorinated paraffins, aroclors, bisphenol-a	Halowax Area
Koppers Company, Inc.	1 June 1959 31 March 1969	chlorinated naphthalenes, chloirnated terphenols chlorinated paraffins, epoxy resins, hexachlorobenzene	Halowax Area
Detroit Edison (land only, Edison owned building equipment and has right to abandon, subleased to Pennwalt Chemicals, sublease terminated 31 January 1986)	27 June 1963 31 March 1989	electric power and steam	Building 41
Detroit Edison (about 0.5 acres for additional coal storage, subleased to Pennwalt Chemicals)	31 January 1968 23 October 1973	NA	Coal Storage Area
Wyandotte Southern Railroad (for railroad office building)	1 January 1967 31 December 1986	NA	Building 101
Wyandotte Oil and Fat	1940s - 1950s*	hydrogenated fish oil	Northeast Corner of Plant

Table 3-1

East Plant Lessees
(continued)

Lessee	Dates	Products	Location
Archer-Daniels-Midland (formerly Werner G. Smith Co., formerly Wyandotte Oil and Fat)	? - 1962	hydrogenated fish oil	Northwest Corner of Plant
Jim O'Donnell, Inc. (formerly Wall gases, Inc.; formerly Wall-Colmanoy Corp.; actually terminated in 1986 or 1987)	23 November 1959 31 March 1992	hydrogen in cylinders	Building 91
Taylor Chemical	1940s*	carbon tetrachloride	Building 107, 54

*Unconfirmed, based on recollections by plant personnel.

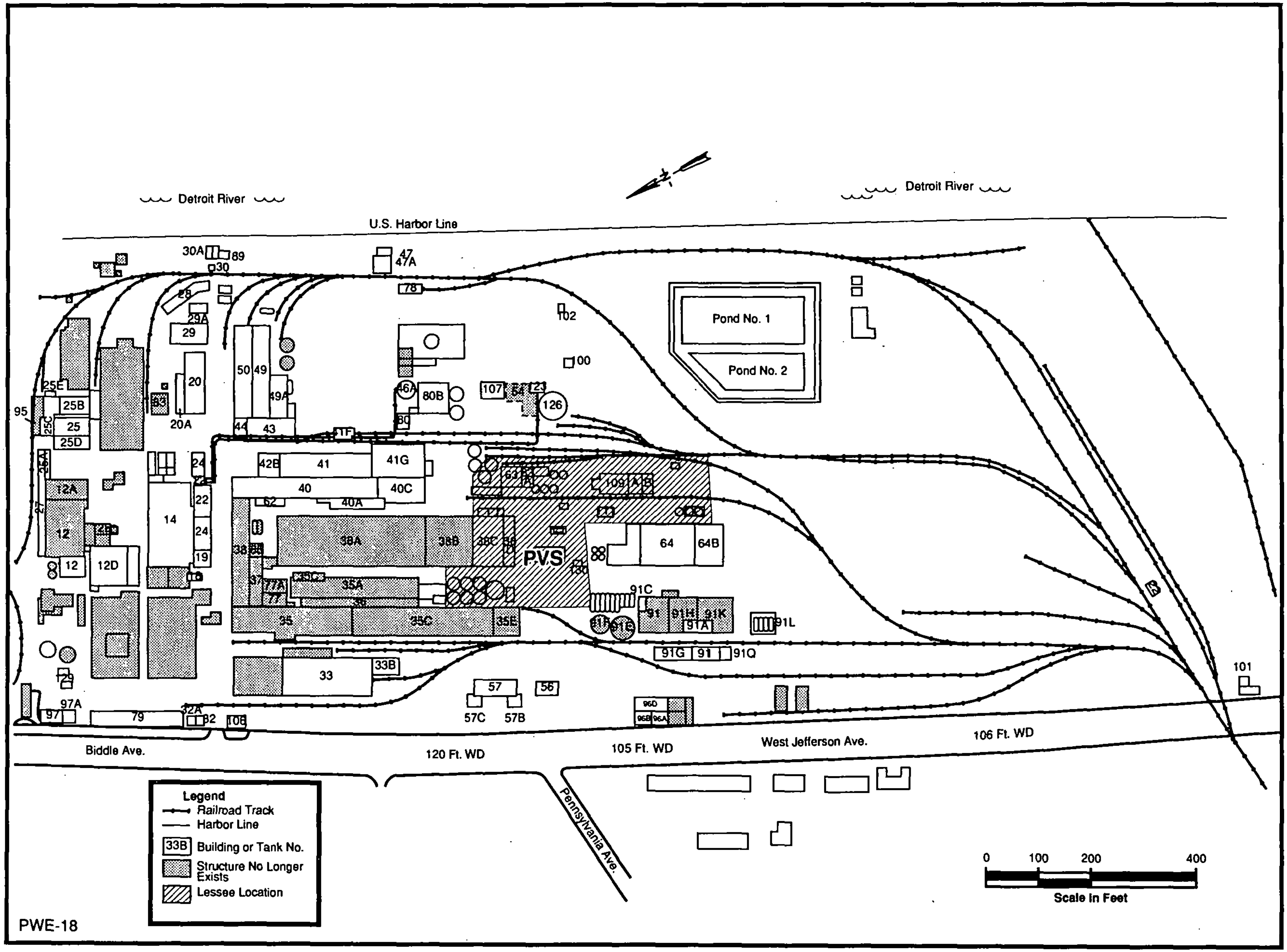


FIGURE 3-2 CURRENT LESSEE LOCATION
PENNWALT EAST PLANT

SECTION 4

PRODUCTION HISTORY

4.1 PENNWALT

4.1.1 INORGANIC CHEMICAL PROCESSES

Historically, Pennwalt manufactured primarily inorganic chemicals at the East Plant. Chemical production focused on the manufacture of chlorine and caustic soda utilizing the region's natural salt deposits. Other, secondary chemical operations included the production of ammonia, ammonium chloride, hydrochloric acid, hydrogen peroxide, anhydrous and liquid ferric chloride, perchloron (calcium hypochlorite), ammonium and potassium persulfate, and orthosilicates. Table 4-1 presents the products, byproduct wastes, raw materials, and locations of the various operations at the East Plant. Plate 1 of Appendix B provides a listing of building numbers their uses and a map of their locations. Pennwalt ceased all chemical manufacturing operations at the East Plant in December 1985.

4.1.1.1 Chlor-Caustic

The chlor-caustic process produced hydrogen, chlorine, and sodium hydroxide (caustic) which were both finished products and intermediates used in the plant's secondary operations. Salt brine used as a raw material for the process was pumped from production wells on Pennwalt property, primarily the Brine Field areas. The brine was heated to 150°F with steam. Caustic and soda ash were then added to remove the calcium and magnesium impurities from solution. The brine was heated further to 190°F and pumped to the cell room where electrolytic cells were used to apply an electrical current to the brine. The current caused the formation of gaseous chlorine and hydrogen which were collected and transferred to other buildings for further purification and processing. The remaining brine solution, called cell liquor, contained salt and caustic. This cell liquor was concentrated to 50 percent using steam operated evaporators. The salt and caustic were separated in centrifuges. The salt was dried and shipped in bulk. The caustic was cooled, and iron was removed. Caustic was then processed through evaporation units to produce 50 and 70 percent solutions and solid flakes. The process byproducts and wastes included salt, brine purification muds, and spent sulfuric acids. When graphite cells were used in the operation, chlorinated hydrocarbons wastes were formed. Asbestos wastes were produced when diaphragm cells were used.

4.1.1.2 Orthosil

The Orthosil process produced sodium orthosilicates to form the base for a product line of heavy duty cleaners. Additives and builders such as polyphosphates and surface active agents were added to form various products. The orthosil process fused anhydrous caustic soda with extremely fine grained silica (140 to 200 mesh) to form a 2 to 1 molar ratio of sodium to silicate as follows:

$$4NaOH + SiO_2 \rightarrow 2NaOH \cdot Na_2SiO_3 + H_2O$$

Table 4-1

Former Manufacturing Operations
Pennwalt East Plant

Process	Product	Raw Material	Location Building Number	Byproducts and Wastes
<u>Inorganic</u>				
Chlor-Caustic	Chlorine Hydrogen Caustic	Brine	35, 36, 37 38, 43, 49	Brine Purification muds, salt, spent sulfuric acid, hydrogen, chlorinated hydrocarbons (graphite cell operations), asbestos (diaphragm cell operations).
Orthosil	Sodium Orthosilicate	Caustic, Silicate Sand	35C, E	Process wash waters containing inert solids and unreacted caustic soda.
Acid	Muriatic Acid	Hydrogen, Chlorine	64, 64B	Acidic wastewater from scrubber units.
Ammonia	Ammonia	Hydrogen, Nitrogen	91, 91H, 91K	Carryover condensate from vapor condensers which could contain trace amounts of ammonia.
Sal Ammoniac	Ammonium Chloride	Ammonium, Chlorine, Hydrogen	64, 64B	Acidic wastewaters from process vessel washouts and vent scrubber units.
Potassium and Ammonium Persulfate	Potassium and Ammonia Persulfate	Ammonia, Potassium Sulfate Sulfuric Acid	13B	Acidic wastewaters from process vessel washouts and vent scrubber units.
Peroxide	Hydrogen Peroxide	Ammonium Persulfate Sulfuric Acid Water	96A, B, D	Acidic wastewater from process vessel washout and vent scrubber units.
Anhydrous Ferric Chloride	Anhydrous Ferric Chloride	Scrap iron Chlorine	109	Furnace plugs.
Liquid Ferric Chloride	Liquid Ferric Chloride	Scrap iron Chlorine Pickle liquor	63	Reduction tank sludge.
Perchloron	Calcium Hypochlorite	Lime Chlorine	12	Reject liquor containing calcium hypochlorite, calcium chloride, sodium chloride, calcium carbonate, and other solids. Also filtrate slurry containing lime and diatomaceous earth.

Table 4-1

Former Manufacturing Operations
Pennwalt East Plant
(continued)

Process	Product	Raw Material	Location Building Number	Byproducts and Wastes
Organic				
Carbon Tetrachloride	Carbon Tetrachloride	Chlorine, Carbon Disulfide	54	Sulfur
Monochlorobenzene	Monochlorobenzene	Chlorine, Benzene	107	Still Bottoms
Chloroform	Chloroform	Acetone, Chlorine	12	Calcium Acetate Calcium Hydroxide

After the reaction was complete, the product was flaked, then ground and screened. Fine particles were recycled or packaged as necessary. The wastes produced in this operation were primarily process wash waters containing inert solids and unreacted caustic soda.

4.1.1.3 Acid

The acid plant or synthetic acid process at Pennwalt's East Plant produced muriatic (hydrochloric) acid. Hydrogen and chlorine produced in the cell room and purified in coolers or scrubbers were burned together to form gaseous hydrogen chloride. This was absorbed in water to make muriatic acid. Acidic wastewaters were produced in the scrubber units for the process.

4.1.1.4 Ammonia

The ammonia plant utilized hydrogen from the chlor-caustic process and nitrogen from the air to produce ammonia. A portion of a circulating gaseous hydrogen and nitrogen stream was catalytically converted to ammonia gas. The ammonia gas was removed from the gas stream using refrigerated condensation units. Both anhydrous and aqueous ammonia were produced. The aqueous form was made by combining the condensed ammonia with condensate from the hydrogen peroxide operation. The waste produced by this process was the carryover condensate from the vapor condensers which could have contained trace amounts of ammonia.

4.1.1.5 Sal Ammoniac (Ammonium Chloride)

The Sal Ammoniac process burned hydrogen in a chlorine atmosphere to form gaseous hydrogen chloride. This vapor was cooled and absorbed by process liquors in a mixing tower. Ammonia vapor and the acid rich process liquors were combined in a reaction vessel to generate ammonium chloride.

The acidic ammonium chloride process liquor flowed to the neutralization tank where additional ammonia was added to control the pH. The liquor was then pumped to a vacuum crystallizer where pressure and temperature were adjusted to remove water and supersaturate the ammonium chloride solution. Supersaturation was lost in the crystallizer allowing growth of the crystals in a suspension container. The crystals were removed from the crystallizer, centrifuged, and dried. The wastes produced by this process were acidic wastewaters from process vessel washouts and vent scrubber units.

4.1.1.6 Potassium and Ammonium Persulfate

Potassium and ammonium persulfate were also produced at Pennwalt's East Plant. Ammonia from the onsite ammonia plant was reacted with sulfuric acid to form ammonium sulfate. This was then combined with sulfuric acid and routed through electrolytic cells to form ammonium persulfate. The ammonium ion was then displaced using potassium sulfate to form potassium persulfate. Acidic wastewaters from process vessel washouts and vent scrubber units were produced by the process.

4.1.1.7 Hydrogen Peroxide

Hydrogen peroxide was produced at the facility by combining ammonium persulfate, sulfuric acid and water. This mixture was put through electrolytic cells to yield a weak peroxide. This was then distilled to a 30 percent hydrogen peroxide solution. As in the two preceding processes, acidic wastewaters from process vessel washouts and vent scrubber units were produced by the process.

4.1.1.8 Anhydrous Ferric Chloride

Anhydrous ferric chloride was made by combining gaseous chlorine with specially selected scrap iron. The raw materials were combined in a water-cooled vertical tower. Scrap iron was charged intermittently from above and pre-heated chlorine gas was fed continually from the bottom. The reaction was exothermic and the reactor temperature was controlled to yield an exit temperature of between 400° and 600°C.

Vaporized ferric chloride and excess chlorine gas exited out the top of the reactor to a sublimation chamber. Here, the reaction gas cooled and ferric chloride condensed as solid crystals. The excess chlorine and ferric chloride exited the sublimation chamber as gasses and were scrubbed with a ferrous chloride solution. This formed an aqueous ferric chloride solution thereby maximizing use of the raw materials. The unreacted metal (furnace plug) at the bottom of the tower was periodically removed and was the primary waste from the process.

4.1.1.9 Liquid Ferric Chloride

Liquid ferric chloride was produced by reacting scrap iron material with spent pickle liquor from the steel finishing industry in reduction tanks. The liquor is then circulated counter-currently through a chlorine tower to achieve the desired concentration. The reduction tank sludge was the primary waste produced in this process.

4.1.1.10 Perchloron

Perchloron was produced by reacting lime (calcium hydroxide) with chlorine. The resulting calcium hypochlorite was filtered, centrifuged, dried, ground, and packaged as Perchloron. Byproduct streams were a reject liquor stream containing 1 to 3 percent available chlorine plus salt and lime from the centrifuging of the mother liquor; and a slurry of lime, diatomaceous earth, and residual chlorine from the filtering step.

4.1.2 ORGANIC CHEMICAL PROCESSES

4.1.2.1 Carbon Tetrachloride

In the 1930s, Pennwalt (then Pennsylvania Salt Manufacturing Co.) and the J.T. Baker Chemical Company, in a joint venture, purchased the Taylor Chemical Company of Penn Yan, NY, to manufacture carbon tetrachloride. For carbon tetrachloride production they acquired a process abroad and built a plant within the East Plant. It was located at former Building 54, which was near Building 107.

This was a two-step process. First, carbon disulfide was treated with chlorine in the presence of iron in a lead-lined still with a reflux condenser and heating coils:

$$CS_2 + 3\ Cl_2 \xrightarrow{Fe} SsCl_2 + CCl_4$$

These products were separated by distillation and the sulfur monochloride was treated with carbon disulfide to produce more carbon tetrachloride:

$$CS_2 + 2S_2\ Cl_2 \rightarrow CCl_4 + 6S$$

The primary byproduct/waste from this process was elemental sulfur which was reused.

4.1.2.2 Monochlorobenzene

Monochlorobenzene was produced by Pennwalt in former Buildings 107 and 54. Review of Pennwalt files indicate production of monochlorobenzene was discontinued by 1948.

Monochlorobenzene was produced by the addition of chlorine gas to liquid benzene in a chlorination reactor. The chlorinated product was then neutralized with soda ash. This crude product was then crystallized at controlled temperatures, filtered and centrifuged. Steam distillation was then used to purify it. The solidified product was ground and screened to yield a finished product with a grain size of approximately 2 to 4 mm. The record search found little information concerning the byproducts or wastes produced. However, still bottoms could have been produced in the distillation step.

4.1.2.3 Chloroform

Chloroform was produced during the 1930s and 1940s in the liquid bleach plant, Building 12. Chloroform was produced by reacting acetone and calcium hypochlorite. Calcium acetate and calcium hydroxide were produced as byproducts.

4.1.3 OTHER PROCESSES

4.1.3.1 COAL GASIFICATION

No records were found that document the coal gasification plant operation on the East Plant. Drawings indicate it was located near the present Building 107. Operations were from 1900 to the 1920s.

Coal gasification processes changed significantly over the years that the industry operated. The specific process utilized by Pennwalt could not be determined from the available records. However, an overview of the basic process would include the following three general operations:

- Distillation, where the coal was heated to drive off the organic carbon-based materials. Sometimes steam was used to heat the coal.

- Condensation, where the coal gas was cooled to remove the tar fraction.

- Purification, where the gas was washed and/or contacted with iron oxide chips to remove toxic materials from the gas.

In addition to these three basic processes, enrichment processes such as carburition were utilized in some cases. In carburition petroleum distillates were mixed with the hot coal gases and cracked in a brick chamber. Other, later, enrichment processes utilized catalysts to modify the chemical makeup of the gas constituents.

The coal or water gases produced were a mixture of hydrogen, methane, carbon monoxide, nitrogen and carbon dioxide. Trace quantities of cyanide and sulfuric compounds were also present. Tar was a typical byproduct of coal gasification. Reportedly, the coal tar was used in making asphalt for the plant pavement. No description of this process was found in the record search. Typical wastes produced by gasification processes include ash, slag, clinkers, cooling waste waters, and spent iron oxide.

4.2 TENANTS

4.2.1 FORMER TENANT PROCESSES

4.2.1.1 Chlorinated Hydrocarbons (Halowax)

As described in subsection 3.2.1, the Halowax area has been leased by several companies for the production of chlorinated hydrocarbons including: chlorinated naphtalenes, chlorinated benzene, chlorinated paraffins, chlorinated ter phenol, Aroclors, bisphenol-a, and epoxy resins. The Halowax area operations were conducted and controlled by the tenants, utilizing chlorine purchased from Pennwalt. Other raw materials were produced offsite. The following paragraphs are based on information provided by Beazer Materials and Union Carbide in response to a 104(e) request by EPA, dated 24 August 1989 and 6 September 1989, respectively. Process information is detailed on Table 4-2.

In the chlorinated naphthalene production process, naphthalene was placed in a reactor (kettle), a catalyst (ferric chloride) may have been added and dry chlorine gas was bubbled through it to achieve the proper degree of chlorination. The chlorinated naphthalene was then neutralized with lime or soda ash. It was then put through a distillation process to purify it.

Chlorinated benzene production involved benzene chlorination on a toll conversion basis. The chlorinated benzene (predominantly hexachlorobenzene) was cooled in pans and placed in drums as a solid. The chlorinated benzene products did not require neutralization or distillation.

The ter phenol and paraffin chlorination was accomplished in a reaction system similar to chlorinated naphthalene production. However, as with chlorinated benzenes, chlorinated paraffins did not require neutralization or distillation. Filtration was used for final product polishing.

Table 4-2

Former East Plant Tenant Processes

Lessee	Products	Byproducts*	Raw Materials*	Location	Solid or Hazardous Waste Generated*
Halowax Corporation (had occupied premises)	chlorinated naphthalenes	NI	NI	Halowax Area	NI
Bakelite Corporation (assignee of Halowax lease, acquired by Union Carbide and Carbon Corp., 1959)	chlorinated naphthalenes	NI	NI	Halowax Area	NI
Halowax Products Div. of Union Carbide and Carbon Corporation (lease was extended indefinitely after it expired)	chlorinated naththalenes, chlorinated benzene, chlorinated paraffins, Arochlors, bisphenol-a	Hydrochloric acid	naphthalene, chlorine, lime, benzene, paraffins, diphenyl oxide still bottoms	Halowax Area	still bottoms (pitch)
Koppers Company, Inc.	chlorinated naphthalenes, chlorinated ter phenols, chlorinated paraffins, epoxy resins, hexachlorobenzene	hydrochloric acid, pitch (still residue)	naphthalene, ter phenol, paraffin, chlorine, soda ash, dichlorobenzene, lime, ortho cresol, epichlorohydrin, toluene	Halowax Area	still bottoms (pitch), salt precipitate
Detroit Edison (land only, Edison owns building equipment and has right to abandon, subleased to Pennsalt Chemicals, sublease terminated 31 Janary 1986)	electric power and steam	None	coal	Bldg. 40, 41	bottom and fly ash
Archer-Daniels-Midland (formerly Werner G. Smith Co., formerly Wyandotte Oil and Fat)	hydrogenated fish oil	None	hydrogen, fish oil	NE corner of plant	NI
Jim O-Donnell, Inc. (formerly Wall gases, Inc.; formerly Wall-Colmanoy Corp; actually terminated in 1986 or 1987)	hydrogen in cylinders	N/A	N/A	Bldg. 91	NI
Taylor Chemical	carbon tetrachloride	sulfur	carbon disulfide	Bldg. 107	NI

*NI = No information was found during the records search. NA = Not applicable.

Aroclor production consisted of melting still bottoms from Dow Chemical's diphenyl oxide process followed by chlorination, neutralization and distillation.

Epoxy resin production involved placing ortho cresol and epichlorohydrin in a reactor with a calalyst.

No process description for bisphenol-a was found in the record search.

4.2.1.2 Coal Power Plant

Detroit Edison leased from Pennwalt and operated a coal-fired power plant on the East Plant between 1963 and 1986. The plant supplied power and steam for the East Plant. Coal was used to fire boilers and produce steam. The steam was used to drive turbines which generated the electricity and was also used in various plant manufacturing. The main wastes produced by this type of plant are fly ash and bottom ash. It was reported that these wastes were removed from the East Plant to Detroit Edison's offsite ash disposal landfill. Detroit Edison also operated a wastewater treatment system, including a settling pond for removal of entrained fly ash. The settling pond was cleaned and filled with clay material from the pond banks before Detroit Edison vacated the site.

4.2.1.3 Hydrogenated Fish Oil

Wyandotte Oil and Fat (later W.G. Smith Co., later Archer-Daniels-Midland) produced hydrogenated fish oil at the East Plant. Hydrogenation of oils and fats hardens them and reduces their natural odors. Hydrogen from the chlor-caustic process was blown or bubbled through the oil in the presence of a catalyst, probably nickel based, until the oils were saturated with hydrogen.

4.2.1.4 Hydrogen

Jim O'Donnell, Inc., (formerly Wall Gases, Inc.; formerly Wall-Colmonoy, Corp.) bought hydrogen from Pennwalt's chlor-caustic process and compressed it into cylinders for sale. There was no chemical reaction process involved.

4.2.2 CURRENT TENANT PROCESS (FERRIC CHLORIDE)

Pressure Vessel Service, Inc. (PVS) is the only current lessee operating on the East Plant facility. PVS produces ferric chloride using the same process as described in Subsection 4.1.1 PVS also distributes hydrochloric acid and caustic soda.

SECTION 5

SPILL HISTORY

As requested in the Consent Order, Table 5-1 presents a list collected from a review of Pennwalt plant and corporate files of past product and waste spills of hazardous wastes or hazardous constituents. This table includes identification of the material spilled, the approximate amount spilled, the location of the spill, and a description of the response action. The record review found only spill incident records which date back to November 1979. No spill documentation exists prior to November 1979. Also, no former tenant spill information is available.

In Table 5-1, the material spilled and spill location are coded by number. A key to the code numbers is presented in Table 5-2. The spill incident reports are provided in Appendix C.

Table 5-1

Spill History, Pennwalt East Plant

Date	Material	Quantity (gal)	Location	Receptor	Cause	Response Action*
12-Apr-79	5	est. 5		Ground	Transformer leak	Fluid analyzed <50 ppm PCB, starter replaced
16-Jun-80	1	50	1	Floor drains to Outfall 002 neutralization facility	Tank leak	Tank serviced
17-Jul-84	2	15	2	Pavement	Drum leak	Neutralized with soda ash, drummed, disposed
20-Oct-83	2	1,000	3	Drain to Outfall 003 neutralization facility	Drain plug leak	Facility inspected, penalty $2,500
25-Apr-80	2	200	3	Ground to Outfall 003 neutralization facility	Spill	Liquid picked up by vac-truck, curb repaired
05-Jan-86	2	2,300 lbs	4	To Outfall 005 neutralization facility	Tank overflow	Neutralized with dilute caustic soda
25-Jul-83	2	1,000 lbs	4	Cooling water to Outfall 003 neutralization facility	Chamber leak	Furnace shut down, repaired, penalty $2,000
24-Jun-83	2	1,200	4	Floor drain to Outfall 003 neutralization facility	Sump pump failed	Pumps repaired
30-Apr-81	2	50	4	Floor, ground to Outfall 003 neutralization facility	Pump leak	Spare pump activated
28-May-80	2	300	4	Floor, ground to Outfall 003 neutralization facility	Tank overflow	Neutralized with soda ash, pump and curb replaced, $2,000 penalty
06-Apr-82	2	50	5	Roadway to sewer to Outfall 003 neutralization facility	Truck spill	Loading personnel cautioned
07-Oct-81	3	150	6	Ground	Truck leak	Absorbed and disposed in landfill

Table 5-1

Spill History, Pennwalt East Plant
(continued)

Date	Material	Quantity (gal)	Location	Receptor	Cause	Response Action*
20-Aug-81	4	150	6	Ground, drain to Outfall 003 neutralization facility	Spilled during loading	Absorbed in Speedy Dry, disposed
14-Sep-80	2	600	7	Ground	Pipe leak	Neutralized with soda ash, vacuumed by truck, pipe replaced
21-Mar-80	2	40	8	Floor, settling ponds to Outfall 005 neutralization facility	Pipe leak	Replaced floor drain plug
17-Nov-88	2		9	Ground, drain to Outfall 003 neutralization facilities	Pipe leak	Liquid pumped to tank car, affected soils removed
01-Apr-87	5		10	Floor, drain trap	Transformer	Adsorbed and disposed at approved facility

Table 5-2

Key to Spill Codes

<u>Material Code</u>

1	Waste H_2SO_4
2	$FeCl_3$, $FeCl_2$ - lead, hazardous constituent
3	Hydraulic Oil
4	Reduction Tank Sludge
5	PCB

<u>Location Code</u>

1	Building 25-D, Chlorine Liquefaction
2	East of Building 56 - Control Lab
3	Copper Recovery Slab
4	Building 109
5	Neutralization Station for Outfall 003
6	West of Reduction Tank
7	Building 63A, Southwestern Corner
8	Building 63A, Pumphouse
9	Anhydrous Ferric Scrubber Tank Dike
10	Building 43

SECTION 6

PERMITS AND ENFORCEMENT ACTIONS

6.1 PERMITS

Pennwalt applied for and received various environmental permits for operations at the East Plant. The permits fall into three general categories; water, air and solid/hazardous waste permits. The laws and regulations under which these permits were issued were enacted/promulgated in the late 1960s (water), the 1970s (air), and the early 1980s (solid and hazardous waste). Therefore, there were no permits prior to 1960.

6.1.1 WATER

Pennwalt was issued a National Pollutant Discharge Elimination System Permit (NPDES Permit No. MI0002381) to discharge treated process waters and cooling waters from the East and West Plants. Plant effluent was discharged to the Wye Street storm sewer, the Detroit River and Monguagon Creek, a tributary of the Detroit River. The permit specified the discharge limitations and monitoring requirements for outfalls 001, 002, 003, 005 and 006 (West Plant). The NPDES permit required monitoring at the outfalls and the water intake for flow, pH, chlorides, oil and grease, temperature, total suspended solids, ammonia, copper, lead, iron, and residual chlorine. The NPDES permit was revised to address the East Plant shutdown in 1985 and was reissued on 19 September 1986, covering only West Plant operations. As a result of the reissued permit, Outfall 006 was renamed Outfall 001.

Pennwalt operated permitted waste injection wells. These were permitted as Underground Injection Wells by the State of Michigan Geologic Survey Division of Mineral Resources. Their permit numbers are listed in Table 6-1. Disposal wells 004, 006, and 015 were included as part of the 1975 NPDES permit.

These wells are considered Class V wells by EPA and were permitted by rule under the Underground Injection Control Program (40 CFR 144). The wells were used to inject nonhazardous materials from East Plant settling ponds, including calcium and magnesium salts from the past brine purification process. The materials were injected into a salt formation cavity 1,200 to 1,300 feet below ground surface. Wells 004, 006, and 015 were injection wells while 016 and 018 produced the brine used to slurry the nonhazardous solids for injection. All five wells penetrate the same salt formation. These wells have been on standby status since 1986.

6.1.2 AIR

The Wayne County Department of Health, Air Pollution Control Division has been delegated the authority to issue Certificates of Operation for emission

Table 6-1

Permitted Waste Injection Wells

Well Number	Permit Number
004	49-736-882
006	48-736-882
015	47-736-882
016	153-746-782
018	171-756-782

certificates were reissued each year for many individual sources. Appendix D provides a listing of the process sources and their certificate numbers for each year.

6.1.3 SOLID/HAZARDOUS WASTE

Pennwalt (EPA I.D. Number MID005 363 114) submitted Part A of its RCRA permit application on 13 November 1980. Revisions to this were submitted on 13 August 1982 and 3 October 1984. Pennwalt submitted the Part B of its RCRA permit application on 1 April 1985. These applications covered Pennwalt's hazardous waste operations for both the East and West Plants. The hazardous waste management units on the East Plant, which were listed in the application, included:

- Tank 1 for accumulation of alkaline waste from chlorine scrubbing tower effluent, for less than 90 days.
- Tanks 4 and 6A for storage of waste sulfuric acid.
- Tanks 103 and 104 for storage of spent pickle liquor (later the material was defined as a recycleable material and not a hazardous waste by definition).
- Container storage pad.

The Part B permit application was revised in October 1985 and May 1986. These revisions address the East Plant shutdown. All waste management units on the East Plant were removed from the application. On 16 April 1987, Pennwalt withdrew the remainder of its Part B application.

In regard to the waste management units in the East Plant, after the plant shut down in 1985, the following actions were taken:

- Tank 1 was closed. Since this tank held wastes for less then 90 days no formal closure plan was required. The tank was emptied and cleaned in December 1985. This work was done in compliance with 40 CFR 265.197.
- A closure plan in compliance with 40 CFR 265.115 was prepared (12 December 1985) for Tanks 4 and 6A. It was approved by EPA (9 June 1986). The tanks had been closed in accordance with the plan in December 1985. This was certified by a Professional Engineer (23 June 1986) and EPA was notified (27 June 1986) as requested.
- Tanks 103 and 104 are currently being used by the lessee (PVS) for storage of spent pickle liquor. Spent pickle liquor is used as a recyclable raw material, which excludes its classification as a hazardous waste.
- A separate closure plan was prepared for the container storage pad. This was approved by EPA (19 August 1986) and the unit was closed on 27 March 1986. Closure, in accordance with the approved plan was certified by a Professional Engineer (27 August 1986) and EPA was notified (28 August 1986).

6.2 ENFORCEMENT ACTIONS

In addition to the permits issued to Pennwalt by the regulatory agencies, several enforcement actions were also issued. For the purposes of this report, an Enforcement Action is an administrative order that includes notification of permit non-compliance, a request for response action within a specific schedule, and possible penalties. The majority of enforcement actions issued to Pennwalt pertained to its NPDES permit. The NPDES permit had been modified by Final Order No. 1931 in October 1977, which modified the schedule of compliance contained in the original permit. The enforcement actions issued with regard to the NPDES permit are listed chronologically as follows:

- MDNR WRC, Final Order of Abatement No. 1931, October 1977. Modified the schedule of compliance with the original effluent limitations and required Pennwalt to develop and implement a program to achieve compliance with the Best Practicable Control Technology (BPCT) effluent guidelines. It also required a payment of $150,000 for liquidated damages in respect to past excursions. Pennwalt installed upgraded pH control facilities for BPCT and paid the liquidated damages, as required.

- MDNR WRC, Final Order of Abatement No. 1994 , 19 February 1981. Required payment of $180,000 in liquidated damages and implementation of a Pollution Incident Plan (PIP) for secondary containment and spill prevention facilities. Pennwalt installed extensive PIP facilities and paid liquidated damages, as required.

- State of Michigan v. Pennwalt, Circuit Court for City of Ingham, MI, C.A. 86-57673-CE. Alleged NPDES permit excursion. Consent Decree 18 November 1986. Pennwalt paid $100,000 in damages. That portion of the penalty associated with the East Plant involved past excursions, since the East Plant had ceased operations in December 1985.

As indicated in Section 5, some spills of various materials and amounts occurred at the East Plant. For those spills that reached the Detroit River through the process sewer outfalls and were reportable quantities, the U.S. Coast Guard became involved. The following is a list of the reportable quantity spills which involved the U.S. Coast Guard enforcement actions:

- U.S. Coast Guard Notice of Violation; Case No. 09-1073/83, 18 November 1983. An alleged 12,000-gallon caustic soda discharge, on 27 June 1983. Electric storm blew fuses on primary circuit; after short period the fuses on the alternate power supply blew. Power was out for approximately 1 hour. Part of the sodium hydroxide was neutralized by the outfall treatment facilities. A penalty assessment of $1,750 was made on 7 March 1984. This was later reduced to $1,000 and paid on 28 March 1984.

- U.S. Coast Guard Notice of Violation; Case No. 09-1093/83, 18 November 1983. An alleged oil discharge on 26 July 1983. A penalty assessment of $2,000 was made on 24 February 1984 which was paid on 28 March 1984.
- U.S. Coast Guard Notice of Violation; Case No. 09-1092/83, 18 November 1983. An alleged cell liquor (18,000 to 20,000-gallon) discharge on 31 August 1983 due to power outage. A penalty assessment of $5,000 was made on 3 April 1984 which was paid on 30 April 1984.
- U.S. Coast Guard Notice of Violation; Case No. 09-1119/83, 13 January 1984. An estimated 400 pounds of ferric chloride was released on 20 October 1983 due to a leaking chain plug on the copper recovery pad. Penalty assessment of $2,500 was paid on 28 March 1984.
- U.S. Coast Guard Notice of Violation. Caustic soda release on 7 August 1985. Pennwalt paid $5,000 penalty.
- U.S. Coast Guard Notice of Violation, Case No. 5D/003/86; 2 June 1986, Citation No. MV 86001334. Alleged ferric/ferrous chloride discharge on 5 January 1986. Spill caused by Pennwalt lessee, Pressure Vessel Service, Inc. (PVS). The Coast Guard found PVS liable.

SECTION 7

NATURE AND EXTENT OF CONTAMINATION

Pursuant to the East Plant RFI Scope of Work, a description of the existing information concerning the nature and extent of potential contamination is presented herein. This information is to include a summary of possible source areas, identifying the location of the area, type and quantities of solid and hazardous wastes, and any additional data requirements. These areas, as specified in Attachment I, Task I of the Consent Order, are listed in Table 7-1. The locations of these areas are presented in Figure 7-1.

The units identified in Table 7-1 are characterized individually in the following subsections according to the format described in the Consent Order (Attachment 1, Task I). As also requested in the Consent Order, data previously collected to assess the presence of contamination are summarized with the appropriate source description. Pursuant to the Consent Order, additional information requirements concerning the nature and extent of contamination pertaining to these units will be detailed in the RFI Work Plan. The primary sources of reference used to develop the Section 7 information were the July 1987 EPA Visual Site Investigation (VSI) Report and the report entitled "Environmental Study, Pennwalt East Plant, Wyandotte, Michigan," WESTON, January 1987, referred to herein as the WESTON Study. A copy of the WESTON Study is included As Appendix E to provide a complete compilation of the environmental assessment conducted at the site.

7.1 TANKS 103 AND 104 (SWMUs 1 and 2)

SWMU Characterization:

- Location: South of liquid ferric chloride plant (Building 63B).
- Dimensions: 50,000 gallons each.
- Description: Aboveground, rubber-lined steel tanks with collection sumps. Used to store spent pickle liquor.
- Waste Managed: None.
- Hazardous Constituent: Hexavalent chromium and lead.

Contamination Assessment: This unit was not included in either the Scope of Work of the WESTON study or the VSI report.

7.2 TANK 4 (SWMU 3)

SWMU Characterization:

- Location: Within chlorine liquefaction plant along Wye Street, indoors in Building 25C.

Table 7-1

Solid Waste Management Units and Other Source Areas Pennwalt East Plant

SWMU Number[a]	Identification	Description
1	Tank 103[b]	50,000 gal tank
2	Tank 104[b]	50,000 gal tank
3	Tank 4	1,100 gal indoor tank
4	Tank 6A	3,000 gal indoor tank
5	Drum storage Containment Pad	40 ft x 60 ft curbed, reinforced concrete pad
6	Tank 1	10,000 gal indoor tank
7	Anhydrous Ferric Chloride Container[b]	A metal dumpster box located in a 10 ft x 12 ft indoor area, concrete floor and sump
8[c]	PCB Storage Area	225 sq ft indoor area
9[c]	Asbestos Storage Area	400 cu ft indoor area
10[c]	Underground Injection Wells	3 Class V underground injection wells
11	NPDES Neutralization Tanks	5 concrete and/or steel tanks
12	NPDES Surface Impoundment (a.k.a. Ponds 1 and 2)	2 surface impoundments; 2 million gal total volume
13	Former Landfill 5 (a.k.a. Burn Area)	Landfill
14	Reject Liquor Tank	100,000 gal. tank rubber lined

Table 7-1

Solid Waste Management Units
and Other Source Areas
Pennwalt East Plant
(continued)

SWMU Number[a]	Identification	Description
15	Former Coal Pile Storage and/or Runoff Area	Coal pile and runoff areas
16	Ferric Chloride Processing Area[b]	12 ft x 12 ft copper recovery pad and former waste pile
17	Halowax	Area associated with former Halowax operations including former pitch pits
18	Former Ammonium Chloride Plant	Buildings 64 and 64B
19	Former Synthetic HCl Plant	Buildings 64 and 64B
20	Buildings 35A and 38A	Area between where Buildings 35A and 38A were formerly located
21	Former Lime Sludge Storage/Disposal Area	Waste pile/landfill
22	Former Mond Gas Area	Building 107 area
23	Former Taylor Chemical Area	Building 107 area
24	Wyandotte Oil and Flat Plant	Buildings 71A, 71 and 16
25	Monitor Well 12	Near Building 79

Table 7-1

Solid Waste Management Units and Other Source Areas Pennwalt East Plant (continued)

SWMU Number[a]	Identification	Description
26[d]	Detroit Edison Co. Pond	Surface impoundment, fly ash

[a] As numbered in the Consent Order.

[b] Currently operated by Pressure Vessel Services, Inc. (PVS) under a lease agreement.

[c] No RFI will be required for this SWMU as indicated in the Consent Order, Attachment I, Table I, East Plant Scope of Work, pp. 53-56.

[d] Through the record search this pond was identified as a fly ash settling pond and is included as a SWMU.

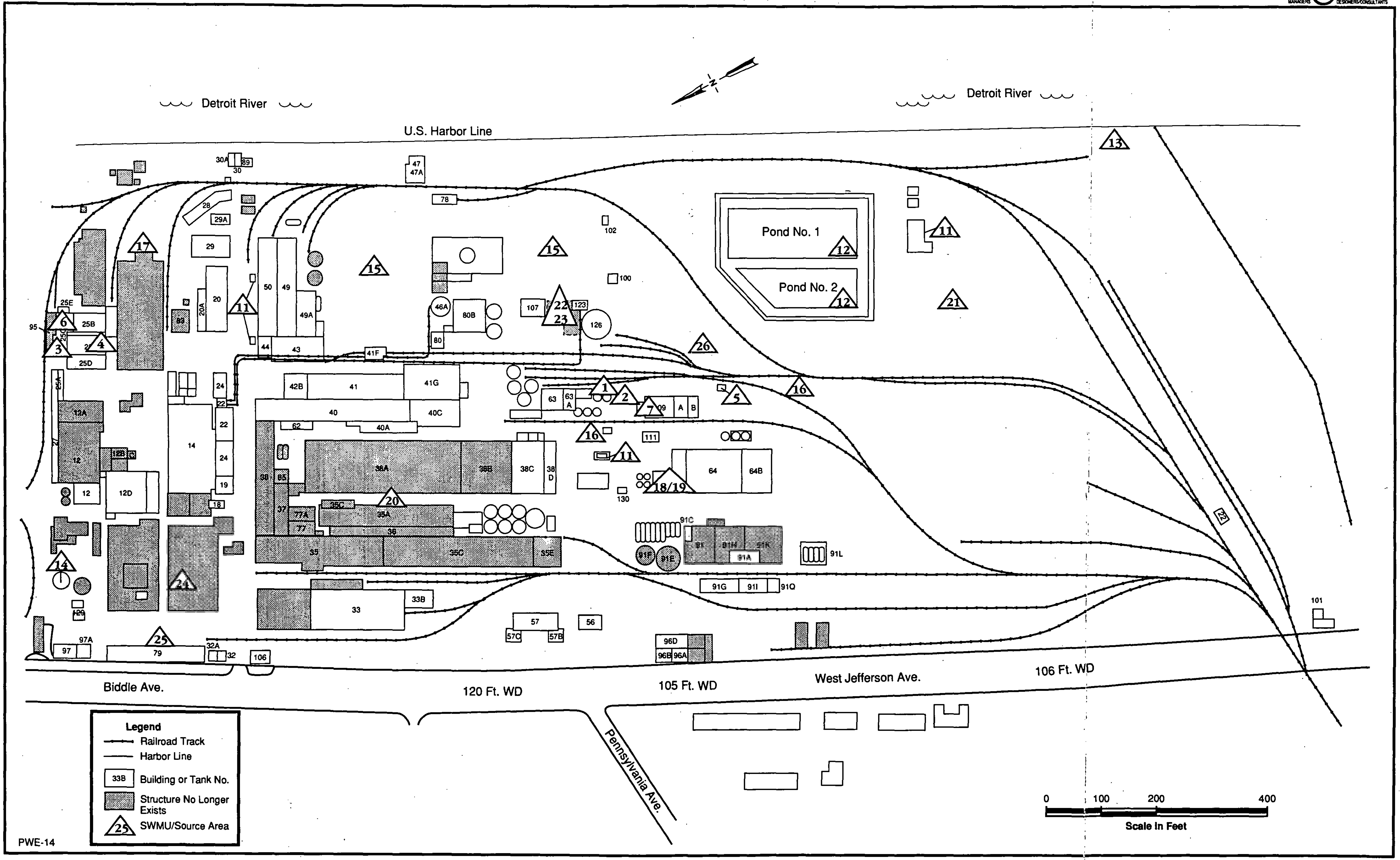


FIGURE 7-1 SOLID WASTE MANAGEMENT UNIT LOCATIONS AND OTHER SOURCE AREAS PENNWALT EAST PLANT

- Dimensions: 1,100 gallons.
- Description: Steel tank surrounded by concrete walls with a reinforced concrete bottom diked area and collection sump.
- Waste Managed: Waste sulfuric acid (H_2SO_4) hazardous due to corrosivity. The waste characterization as presented in Pennwalt's 3004(u) response is shown in Table 7-2.
- Hazardous Constituent: None.

Contamination Assessment:

- As detailed in the EPA VSI report, there are "no obvious signs of releases around the tank."
- Under the requirements of 40 CFR 265.115, the closure plan for the tank was approved by the EPA on 9 June 1986. Closure was completed on 23 December 1985. Closure was certified by a Professional Engineer (23 June 1986) and EPA was notified (27 June 1986).
- This unit was not included in the Scope of Work of the WESTON study.

7.3 TANK 6A (SWMU 4)

SWMU Characterization:

- Location: Within chlorine liquefaction plant along Wye Street, indoors in Building 25C.
- Dimension: 3,000 gallons.
- Description: Aboveground steel tank surrounded by concrete walls within a concrete bottom diked area with collection sump; empty.
- Waste Managed: Waste sulfuric acid (H_2SO_4), hazardous due to corrosivity. The waste characterization as presented in Pennwalt's 3004(u) response is shown in Table 7-2.
- Hazardous Constituent: None.

Contamination Assessment:

- As detailed in the EPI VSI report, there are no obvious signs of releases from the unit.
- Under the requirements of 40 CFR 265.115, the closure plan for the tank was approved by EPA on 9 June 1986. Closure was completed 23 December 1985. Closure was certified by a Professional Engineer (23 June 1986) and EPA was notified (27 June 1986).

Table 7-2

Waste Characterization - Tanks 4 and 6A*

a. Chemical Composition (by weight)

H_2SO_4 - 90-95 percent
$Fe_2(SO_4)_3$ - 0.1-2.0 percent
Carbon - trace
Cl_2 - <200 ppm
H_2O - 5-10 percent

b. Physical State

Liquid with finely divided suspended solids

c. Combustion Temperature

Not applicable

d. Specific Gravity

Approximately 1.7

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*Section 3004(u) certification questionaire response submitted to EPA 29 May 1985.

- This unit was not included in the scope of work for the WESTON study.

7.4 DRUM STORAGE CONTAINMENT PAD (SWMU 5)

SWMU Characterization:

- Location: South of the anhydrous ferric chloride plant (Building 109).
- Dimension: 40 feet by 60 feet.
- Description: Staging area for containerized solids from ferric chloride operations, 6-inch reinforced concrete pad, curbed, currently used for nonhazardous material staging, by the lessee, PVS, Inc.
- Waste Managed: Anhydrous ferric chloride waste; characteristic hazardous waste due to corrosivity and EP Toxicity for lead.
- Hazardous Constituents: Lead.

Contaminant Assessment:

- In accordance with 40 CFR 265.115, closure of the containment pad was approved by EPA on 19 August 1986. Closure was completed on 27 March 1986. Closure was certified by a Professional Engineer (27 August 1986) and EPA was notified (28 August 1986).
- This unit was not included in the Scope of Work for the WESTON study.

7.5 TANK 1 (SWMU 6)

SWMU Characterization:

- Location: Within chlorine liquefaction plant (Building 25) along Wye Street, indoors in Building 25C.
- Dimension: 10,000 gallons.
- Description: Storage tank (less than 90-day) on a 1.5-foot-thick concrete pad with concrete walls; has been cleaned, is empty.
- Waste Managed: Spent scrubber solution, hazardous due to corrosivity.
- Hazardous Constituents: None.

Contamination Assessment:

- As detailed in the EPA VSI report, this unit was described as "a clean and empty tank in good condition. No obvious signs of releases were noted."

- This unit was not part of the Scope of Work for the WESTON study.

7.6 ANHYDROUS FERRIC CHLORIDE CONTAINER (SWMU 7)

SWMU Characterization:

- Location: Anhydrous ferric chloride plant, inside Building 109.
- Dimension: 10 feet by 12 feet area.
- Description: Steel dumpster, located indoors on concrete floor with collection sump. Currently used by lessee, PVS, Inc.
- Waste Managed: Furnace residue (plugs), hazardous due to corrosivity when wet; EP Toxicity for lead.
- Hazardous Constituents: Lead.

Contamination Assessment: This unit was not included in the Scope of Work for the WESTON study.

7.7 NPDES NEUTRALIZATION TANKS (SWMU 11)

SWMU Characterization:

- Location: Two stations are associated with Outfall 002 effluent flume, one tank with Outfall 003, and two aboveground tanks with Outfall 005.
- Dimensions: 40,000 gallons (total) - Outfall 003; 14,000 gallons (total) - Outfall 005. Outfall 002 had no tanks; neutralization took place at two locations within the outfall flume.
- Description: Outfall 002 facilities received the truck garage drainage, storm drainage, hydrostatic test water from chlorine tank testing, cooling water from the cell room, and chlorine liquifaction and wastewater from the caustic evaporator process. These waters went through primary pH adjustment with carbon dioxide and then a second pH adjustment with either sulfuric acid or cell liquor (caustic), as appropriate. This outfall is currently plugged and inactive.

  Outfall 003 facilities received storm drainage, non-contact cooling water from the anhydrous ferric chloride process, cooling water from the cell rooms, and wastewaters from the liquid caustic storage and loading areas and the muriatic acid area. These waters were neutralized with either sulfuric acid or cell liquor (caustic), as appropriate. This outfall is currently operated by the lessee, PVS, Inc.

  Outfall 005 facilities received wastewaters from the brine purification, caustic concentration, and cell room process areas.

These wastewaters were neutralized and pumped to the surface impoundments (Ponds 1 and 2) where solids settled out. The water was then pumped through pH neutralization facilities where carbon dioxide was used to lower the pH. This outfall is no longer active.

- Waste Managed: Wastewaters from East Plant operations, characteristic hazardous waste due to corrosivity.
- Hazardous Constituents: None.

Contaminant Assessment:

- No visible signs of contamination associated with any of the tanks were observed during the EPA VSI.
- This unit was not a part of the Scope of Work for the WESTON study.

7.8 NPDES SURFACE IMPOUNDMENTS (SWMU 12)

SWMU Characterization:

- Location: Southeastern part of East Plant, along Detroit River.
- Dimensions: 2-million gallon capacity.
- Description: Clay-lined earthen dike ponds. Contain approximately 1.5 feet of water and 1.5 feet of sediment.
- Waste Managed: Non-hazardous wastes from brine purification.
- Hazardous Constituents: None.

Contaminant Assessment:

- The pond's surface water and sediment samples presented in Pennwalt's 3004(u) response were tested and characterized as not ignitable, corrosive, reactive or EP toxic. EP toxicity results are shown in Table 7-3.
- As detailed in the EPA VSI report, wastewater in the ponds "was reddish-brown in color with the bottom portion consisting of a hard white precipitate. The surrounding terrain was gravel covered and grassy."
- Potential impact to groundwater in the ponds was evaluated in the WESTON Study. In the study, groundwater samples were collected and analyzed from MW-7, which is located between the impoundment and the Detroit River.
- Groundwater sampling results from WESTON Study are presented in Table 7-4. This study indicated that polynuclear aromatic hydrocarbons (PAHs) and volatile compounds in the groundwater were not associated with the impoundments, see discussion in Subsection 7.9.

Table 7-3

Results of EP Toxicity Analysis, Surface Impoundment Samples (in ppm)
Pennwalt East Plant

Sample	Arsenic	Barium	Cadmium	Chromium	Cyanide	Lead	Mercury	Selenium	Silver	Copper	Zinc
Pond 1											
Influent	0.004	0.99	ND	0.026	ND	0.032	0.0003	ND	ND	0.084	0.037
Liquid	ND	0.38	ND	0.024	ND	0.036	0.005	ND	0.006	0.079	0.036
Sludge	<0.001	<0.2	<0.003	0.029	<0.4	0.024	<0.0002	0.002	ND	0.6	0.61
Pond 2											
Sludge	ND	0.03	ND	0.008	<0.4	ND	<0.0002	0.002	ND	0.015	<0.005

Note: ND = None detectable.

Table 7-4

Groundwater Sampling Results
Monitor Well 7

Detected Inorganic Compound	Concentration (ug/L)	
	May 1986	September 1986
Aluminum	6.9	1.1
Arsenic	0.19	0.044
Beryllium	0.01	0.021
Calcium	23	56.9
Cobalt	0.12	ND
Copper	0.03	ND
Iron	0.007	ND
Magnesium	0.2	4.68
Manganese	ND	1.41
Mercury	0.07	0.044
Nickel	0.16	ND
Potassium	123	106
Selenium	0.1	ND
Silver	ND	0.144
Sodium	36,900	23,200
Thallium	ND	2.1
Vanadium	0.35	ND
Zinc	ND	0.023

Detected Organic Compound	Concentration (ug/L)	
Phenol	150J	18
2-Methylphenol	ND	9J
4-Methylphenol	200J	28
2,4-Dimethylphenol	250J	28
Naphthalene	100J	6J
2-Methylnaphthalene	450J	4J
Acenaphthylene	150J	5J
Acenaphthene	100J	3J
Dibenzofuran	150J	5J
Fluorene	350J	9J
Phenanthrene	1,100	34
Anthracene	400J	12J
di-n-Butyl Phthalate	ND	3J
Fluoranthene	1,400	37

Table 7-4

Groundwater Sampling Results
Monitor Well 7
(continued)

Detected Organic Compound	Concentration (ug/L)	
	May 1986	September 1986
Pyrene	700	28
Benzo(a)Anthracene	550	18
bis(2-Ethylhexyl)Pthalate	ND	10J
Chrysene	400J	13J
Benzo(b)Fluoranthene	500	22
Benzo(a)Pyrene	250J	12J
Indeno(1,2,3-cd)Pyrene	50J	9J
Dibenz(a,h)Anthracene	150J	3J
Benzo (g,h,i) perylene	150J	
Methylene Chloride	6J	NA
Acetone	42	NA
2-Butanone	11	NA

Notes: ND = Not detected.
NA = Not analyzed.
J = Below quantification limit.

7.9 LANDFILL 5 (Former Burn Area - SWMU 13)

SWMU Characterization:

- Location: Along Detroit River, south of impoundments.
- Dimension: Approximately 600-foot by 400-foot area.
- Description: Burn area which was closed in the mid-1970s.
- Wastes Managed: Refuse, construction and demolition rubble, chlorine cell parts, wastes from manufacture of orthosilicate and calcium hypochlorite, phenol-containing waste oil burned, temporary storage of drummed caustic waste.
- Hazardous Constituents: Polyaromatic hydrocarbons (PAHs), phenols, volatile compounds, PCBs.

Contamination Assessment:

- This area was identified in the WESTON Study as an area of concern based on a soil analysis that detected semivolatiles, volatiles, and PCBs (Aroclor 1260, 260 mg/kg) in test pit sample TP-28. Visual observations during the study were used to develop a map of the burn area to show the relative horizontal extent of contamination (Figure 7-2). Analyses of soil samples collected from borings drilled to 20 feet below ground surface in this area define the horizontal and vertical extent of contamination as summarized in the following:
  - Semivolatiles 0 to 50 ppm (predominantly PAHs).
  - Volatiles 0 to 370 ppb (predominantly acetone).
  - Pesticides/PCBs 0 to less than 2 ppm with concentrations generally decreasing with depth.
- During the WESTON Study, groundwater samples were collected from MW-5, located at the southern edge of the defined soil contamination (Figure 7-2). Results of these analyses are presented in Table 7-5.
- Analytical results of the groundwater sample collected from MW-7, located on the northern border of the burn area are presented in Table 7-4, Subsection 7.8.

7.10 REJECT LIQUOR TANK (SWMU 14)

SWMU Characterization:

- Location: Northern portion of the East Plant, near Wye Street.
- Dimension: 100,000 gallons.
- Description: Aboveground steel with rubber lining located on a 3-foot concrete foundation, previously used by Pennwalt, presently used by PVS to store hydrochloric acid.

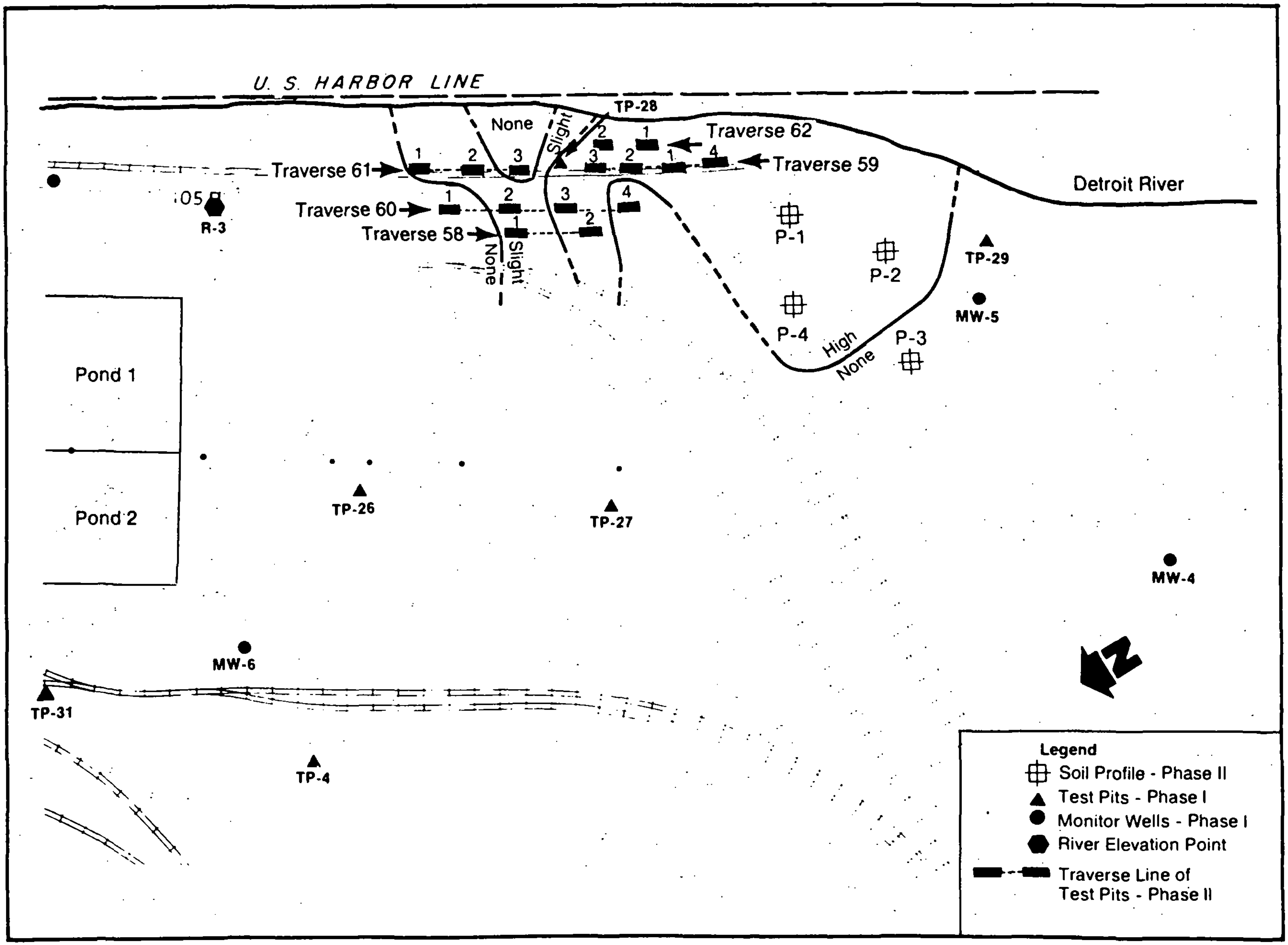


FIGURE 7-2 VISUAL EXTENT OF ORGANIC-CONTAMINATED SOILS (BASED ON PHASE II TEST PIT SCREENING)

Table 7-5

Groundwater Sampling Results
Monitor Well 5 (May 1986)

Detected Organic Compounds	Concentration (ug/L)
Phenanthrene	3J
Fluoranthene	7J
Pyrene	3J
Benzo(a)Anthracene	3J
bis(2-Ethylhexyl)Phthalate	3J
Chrysene	3J
Benzo(b)Fluoranthene	3J
Benzo(a)Pyrene	2J
Methylene Chloride	6J
Aroclor - 1260	0.4J

Detected Inorganic Parameters	Concentration (mg/L)
Aluminum	14.3
Calcium	369
Cadmium	0.004
Iron	1.4
Potassium	29
Magnesium	55
Manganese	1.59
Sodium	11,500
Zinc	0.01
Chloride	8,730
Ammonia (as Nitrogen)	0.76
Total Dissolved Solids	18,100

Note: J = Below quantification limit.

- Wastes Managed: Formerly used to store reject liquor containing 1 to 3 percent calcium hypochlorite from the perchloron process.
- Hazardous Constituents: Hexavalent chromium and lead.

Contaminant Assessment:

- As detailed in the EPA VSI report, this unit was described as "in good condition with no signs of staining on the surface." The surrounding area was noted to "consist of slightly reddish-brown, stained, nonvegetated spots" and other areas which "consist of various types of weeds and grasses."
- This area was not included in the Scope of Work in the WESTON study.

7.11 FORMER COAL PILE STORAGE AND/OR RUNOFF AREAS (AREA 15)

Area Characterization:

- Location: Area to the west, south, and north of sandblasting building (Building 78).
- Dimension: Presently approximately 2 acres, in 1951 as much as 9 to 10 acres.
- Description: Coal pile removed, aboveground surface.
- Wastes Management: None.
- Hazardous Constituents: PAHs, heavy metals.

Contaminant Assessment: As specified in the EPA VSI, the area was characterized as a combination of vegetated and nonvegetated spots. No signs of stressed vegetation were noted.

The WESTON study included an evaluation to determine if PAH levels at the plant could be attributed to the coal stroage piles and related processes. The report concluded that the coal storage piles were probably only one of several facilities and practices which may have contributed PAHs (known constituents of coal) to site soils and groundwater.

As shown in the report, upper soil samples from TP-21, TP-12, and TP-28 contained the highest concentrations of individual PAH compounds with concentrations exceeding 10 ppm. TP-21 is the only one of these samples located within the coal storage area. Samples from TP-20, TP-22, and TP-24, also located within the storage area, contained concentrations of individual PAH compounds at less than 10 ppm.

Analytical results of groundwater samples from MW-7, located south of the storage area, are presented in Table 7-2. Low PAH concentrations detected in the sample were partially attributed to the coal pile in the WESTON study.

7.12 FERRIC CHLORIDE PROCESSING AREA (AREA 16)

Area Characterization:

- Location: Process area is Building 63 and SWMUs are to the south and west.
- Dimension: 200-foot by 100-foot area.
- Description: Process area for ferric chloride includes two SWMUs: a 12-foot by 12-foot by 1-foot concrete recovery pad that is currently used by PVS; and a 50-foot by 150-foot waste pile no longer existing. Both units were used to contain sludge from iron solution tanks in the ferric chloride process and cores from the anhydrous ferric chloride furnaces. The copper pad is currently used for this purpose by PVS.
- Wastes Managed: Iron and steel scrap, furnace cores, sludge from iron solution tanks, sludge from the reduction tanks.
- Hazardous Constituents: Chromium, lead.

Contamination Assessment:

- As noted in the EPA VSI report, a pool of reddish-green oily water and dark colored sludge were contained in the recovery pad area.
- During the WESTON study, two surface soil samples (SS-10 and SS-25) were collected around the recovery pad and analyzed for HSL metals. The results, as shown in Table 7-6, indicate that concentrations of copper in these samples at 83,800 and 1,740 mg/kg, respectively, are higher than in other samples collected onsite. Blue-green staining of surface soils was observed in this area during sampling. Iron and chromium were also elevated in the SS-10 sample.

7.13 HALOWAX AREA (AREA 17)

Area Characterization:

- Location: Northeastern corner of east plant, along the Detroit River.
- Dimensions: Approximately 500-foot by 500-foot area based on previous investigations.
- Description: Process area operated by former lessees for manufacture of chlorinated napthalenes, chlorinated benzene, chlorinated paraffin, chlorinated terphenols, Aroclors and epoxy resin, and bisphenol-a. Included pitch pits for still bottom residues.
- Waste Managed: Still bottom residues (pitch) and salt precipitate.

Table 7-6

Surface Soil Sample Results
Copper Recovery Pad Area

Sample	Detected Inorganic Compounds	Concentration (mg/kg)
SS-10	Aluminum	3,490
	Arsenic	1.4
	Barium	117
	Beryllium	5.0
	Calcium	40,200
	Cadmium	1.7
	Cobalt	15.2
	Chromium	2,440
	Copper	83,800
	Iron	123,000
	Mercury	0.6
	Potassium	1,510
	Magnesium	22,600
	Manganese	640
	Sodium	4,040
	Nickel	191
	Lead	295
	Antimony	12.8
	Vanadium	54.4
	Zinc	403
	Cyanide	0.6
SS-25	Aluminum	4,620
	Arsenic	8.7
	Barium	89.6
	Calcium	8,560
	Cobalt	2.4
	Chromium	29.9
	Copper	1,740
	Iron	57,700
	Mercury	1.6
	Potassium	868
	Manganese	177
	Sodium	1,030
	Nickel	34.3
	Lead	382
	Vanadium	20.2
	Zinc	135
	Cyanide	1.2

- Hazardous Constituents: Chlorinated napthalenes, chlorinated benzene, Aroclors, cresols, toluene, phenol, and acetone.

Contaminant Assessment:

- Soil boring samples collected during the WESTON study exhibited elevated napthalene/chloronapthalene concentrations, as shown in Table 7-7. To determine the vertical and horizontal extent of contamination in the Halowax area, visual observations made during excavation of the of test pits were combined with soil boring analytical data and evaluated. From these combined data, the vertical and horizontal extent of contaminated soils in the Halowax area, were determined and are presented in Figure 7-3. The affected area was delineated by contours representing the minimum depth at which a combined napthalene/chloronapthalene level concentration sum of approximately 100 mg/kg or higher was observed.

- Groundwater quality in the Halowax production area was established by MW-9. Ssample analyses indicated that the combined napthalene and 2-chloronapthalene concentrations in the groundwater was 25,000 ug/L. Chloroform, vinyl chloride, and chlorobenzene were also detected as shown in Table 7-8. Groundwater samples from MW-10, which is east of the Halowax area at the edge of the visibly contaminated soil, were characterized by lower concentrations of napthalene and chloroform at 270 ug/L respectively.

7.14 FORMER AMMONIUM CHLORIDE PLANT (AREA 18)

Area Characterization:

- Location: Buildings 64 and 64B.

- Dimensions: 50-foot by 50-foot area.

- Description: Former ammonium chloride process area within buildings - concrete floor with drain to sump and discharge to NPDES neutralization facilities. This area is now vacant.

- Waste Managed: None.

- Hazardous Constituents: None.

Contaminant Assessment:

- Noted to be heavily vegetated in the EPA VSI report.

- This area was not addressed in the WESTON study.

7.15 FORMER SYNTHETIC HCl PLANT (AREA 19)

Area Characterization:

- Location: Buildings 64 and 64B.

Table 7-7

Naphthalene and Chlorinated Naphthalene Concentrations in Soil Borings - Halowax Area

Boring Number	Sample Number	Naphthalene (mg/kg)	2-Chloronaphthalene (mg/kg)
BH-1	S-1	18	212
BH-3	S-1	ND	228
BH-5	S-2	ND	20
	S-3	10	269
BH-6	S-1	3	11
	S-2	23	171
	S-3	23	132
	S-4	8.6	78
BH-7	S-1	2.9	5
BH-8	S-2	2	9.2
BH-10	S-1	600	5,100
BH-11	S-2	17	144

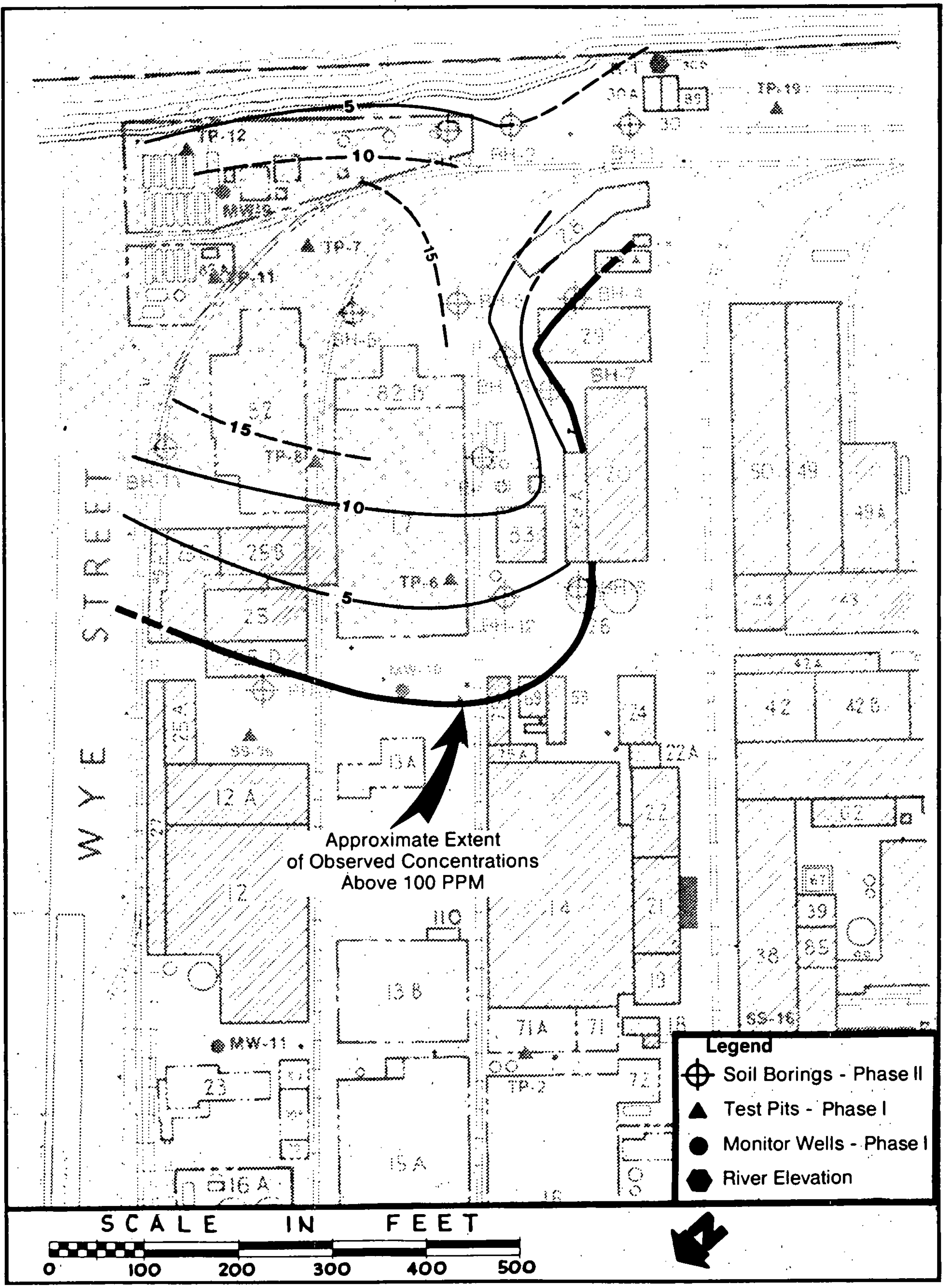


FIGURE 7-3 HALOWAX AREA: CONTOUR LINES INDICATE DEPTH (IN FEET) OF SOIL CONTAINING OVER 100 MG/KG COMBINED NAPTHALENE AND 2-CHLORONAPTHALENE

Table 7-8

Groundwater Results for Monitor Well 9, Halowax Area

Detected Organic Compounds	MW-9 May 86 (ug/L)	 September 86 (ug/L)
Semivolatiles		
2-Chlorophenol	200	ND
1,3-Dichlorobenzene	86	ND
1,4-Dichlorobenzene	860	ND
1,2-Dichlorobenzene	320	ND
4-Methylphenol	45	ND
2,4-Dimethylphenol	12	ND
Naphthalene	3,400	950
Benzo(k)Fluoranthene	14	25J
2-Chloronaphthalene	71,700	14,400
2-Methylnaphthalene	6J	ND
Phenanthrene	10J	75J
Fluoranthene	9J	50J
Pyrene	4J	50J
Butyl Benzyl Phthalate	3J	ND
Benzo(b)fluoranthene	11J	75J
Benzo(a)Pyrene	4J	50J
Anthracene di-n-Butyl	ND	25J
Phthalate	ND	225J
Benzo(a)Anthracene	ND	25J
Cyrsene	ND	25J
Volatiles		
Methylene Chloride	1,700	1,180
trans-1,2-Dichloroethene	70J	97
Chloroform	8,500	4,620
Benzene	130J	
Toluene	74J	
Chlorobenzene	1,000	
Acetone	ND	15
Vinyl Chloride	ND	28
1,1-Dichloroethene	ND	1J
1,1-Dichloroethane	ND	4J
1,2-Dichloroethane	ND	59

Table 7-8

Groundwater Results for Monitor Well 9, Halowax Area
(continued)

Detected Organic Compounds	MW-9 May 86 (ug/L)	 September 86 (ug/L)
1,2-Dichloropropane	ND	26
trans-1,2-Dichloropropene	ND	2J
Trichloroethene	ND	60
1,1,2-Trichloroethane	ND	8
Benzene	ND	75
Tetrachloroethene	ND	39

Notes: ND = None detected.
J = Compound present below detection level. Value is estimated.

- Dimensions: 50-foot by 50-foot area.
- Description: Former HCl process area, inside building, concrete floor with drain to sump and discharge to NPDES neutralization facilities. Now an abandoned building with process equipment and empty process tanks.
- Waste Managed: Related wastewaters.
- Hazardous Constituents: None.

Contaminant Assessment:

- No observations of visual contamination in the EPA VSI report.
- This area was not addressed in the WESTON study.

7.16 BUILDINGS 35A AND 38A (AREA 20)

Area Characterization:

- Location: Center of east plant along railroad tracks between Buildings 35A and 38A, which have been demolished.
- Dimension: Approximate 400-foot by 50-foot area.
- Description: Adjacent to chlor-caustic cell room.
- Waste Managed: None.
- Hazardous Constituents: Lead.

Contaminant Assessment: Soil investigation results of the WESTON study indicated elevated lead concentrations in soil samples SS-18 and SS-17 (667 and 1,370 mg/kg, respectively) located along the tracks between the buildings. This area was resampled and, the results showed only slightly elevated lead concentrations of 60 to 105 mg/kg in borings SS-17 and SS-18.

7.17 FORMER LIME SLUDGE STORAGE/DISPOSAL AREA (SWMU 21)

SWMU Characterization:

- Location: West of surface impoundments.
- Dimensions: Approximately 300-foot by 100-foot area.
- Description: Waste pile - landfill, inactive.
- Waste Managed: Lime sludge from surface impoundments, sludge is nonhazardous waste based on EP toxicity (Table 7-3).
- Hazardous Constituents: None known.

Contaminant Assessment: Soil samples from test pits TP-26 and TP-27 were collected and analyzed during the WESTON Study. The results are presented in Table 7-9.

7.18 FORMER MOND GAS AREA (AREA 22)

Area Characterization:

- Location: Near Building 107.
- Dimensions: Approximately 150-foot by 300-foot area of operations.
- Description: Produced coal gas for power plant, inactive.
- Waste Managed: Insufficient information to determine; no records available, typical waste includes coal tar (based on literature review) which was reportedly used to make asphalt for the plant roads.
- Hazardous Constituents: Volatiles PAHs, cyanide, carbon disulfide (based on literature review).

Contaminant Assessment: As shown in Table 7-10, soil samples collected from TP-21 during the WESTON Study showed PAHs concentrations at greater than 1,000 ppm and very low concentrations of other semivolatile and volatile compounds. PAHs are known constituents of coal tars. Chlorinated benzenes may be attributable to the former Taylor Chemical area discussed below.

7.19 FORMER TAYLOR CHEMICAL AREA (AREA 23)

Area Characterization:

- Location: Near Building 107.
- Dimensions: 100-foot by 200-foot area of operations, inactive.
- Description: Production plant for carbon tetrachloride and monochlorobenzene. Presently a vacant area.
- Waste Managed: Insufficient information available to determine; no records available.
- Hazardous Constituents: Carbon disulfide, carbon tetrachloride, monochlorobenzene, benzene (based on knowledge of the process).

Contaminant Assessment:

- In the EPA VSI report, the area was described as containing small piles of a mixture of coal, gravel, and stone with spots of vegetated and nonvegetated areas.

Table 7-9

Test Pit Soil Samples
Former Lime Sludge Disposal Area

Test Pit	Detected Organic Compounds	Concentration (mg/kg)
TP-26	Naphthalene	0.27J
	2-Methylnaphthalene	0.38J
	Acenaphthylene	0.18J
	Dibenzofuran	0.25J
	Fluorene	0.24J
	Phenanthrene	2.3
	Anthracene	0.36J
	di-n-Butyl Phthalate	0.16J
	Fluoranthene	2.9
	Pyrene	2.1
	Benzo(a)Anthracene	1.3
	bis(2-Ethylhexyl)Phthalate	0.61J
	Chrysene	1.4
	Benzo(b)Fluoranthene	2.1
	Benzo(a)Pyrene	1.4
	Indeno(1,2,3-cd)Pyrene	1.2
	Dibenz(a,h)Anthracene	0.27J
	Benzo(g,h,i)Perylene	1.0
	Methylene Chloride	0.06J
	Acetone	0.73
	Chloroform	0.01J
	2-Butanone	0.28
	Chlorobenzene	0.02J

Test Pit	Detected Inorganic Parameters	Concentration(mg/kg)
TP-26		
	Aluminum	4,660
	Arsenic	26.9
	Barium	51.2
	Berylium	1.2
	Calcium	15,600
	Cadmium	0.3
	Cobalt	2.5
	Chromium	8.2
	Copper	26.6

Table 7-9

Test Pit Soil Samples
Former Lime Sludge Disposal Area
(continued)

Test Pit	Detected Inorganic Parameters	Concentration (mg/kg)
<u>TP-26</u>	Iron	15,800
	Mercury	0.5
	Magnesium	2,030
	Manganese	99.4
	Sodium	15,900
	Nickel	12.0
	Lead	261
	Vanadium	13.3
	Zinc	44.5
<u>TP-27</u>	Aluminum	4,390
	Arsenic	20.7
	Barium	34.4
	Beryllium	0.7
	Calcium	176,000
	Cadmium	0.6
	Cobalt	4.8
	Chromium	14.8
	Copper	13.1
	Iron	62,800
	Potassium	732
	Magnesium	24,100
	Manganese	445
	Sodium	11,300
	Nickel	17.5
	Lead	21.8
	Vanadium	19.9
	Zinc	4,840

Table 7-10

Test Pit TP-21 Soil Samples
Former Mond Gas Area

Detected Organic Compounds	Concentration (mg/kg)
2,4-Dimethylphenol	160
Benzoic Acid	110
Napathalene	67
2-Methylnapthalene	162
2-Chloronaphthalane	5.5
Acenaphthylene	72
Acenaphthene	16
Dibenzofuran	42
Fluorene	95
Phenanthrene	190
Anthracene	85
di-n-butyl phthalate	ND
Fluoranthene	140
Butyl Benzyl Phthalate	ND
Benzo(a)Anthracene	76
Chrysene	44
Benzo(b)Fluoranthene	51
Benzo(a)Pyrene	25
Indeno(1,2,3-cd)Pyrene	9.5
Dibenz(a,h)Anthracene	3.0
Benzo(g,h,i,)Perylene	7.2
Methylene Chloride	0.06
Acetone	0.18
Carbon Disulfide	0.03
Chloroform	0.03
2-Butanone	0.38
Benzene	0.01J
Toluene	0.01J
Chlorobenzene	0.13
Total Xylenes	0.03

Note: J = Detected below quantification limit.

- In the WESTON study, soil samples were collected from TP-9 located in this area. As listed in Table 7-11, the TP-9 soil analyses show elevated concentrations of total chlorobenzenes and trace concentrations of carbon tetrachloride.

7.20 WYANDOTTE OIL AND FAT PLANT (AREA 24)

Area Characterization:

- Location: Formerly located in the vicinity of Buildings 71A, 71, and 16.
- Dimensions: Unknown; no records available.
- Description: Inactive production area operated by a former lessee for the manufacturer of hydrogenated fish oil using nickel catalyst; buildings have been demolished.
- Waste Managed: Unknown; no records available.
- Hazardous Constituents: Nickel (based on knowledge of the process).

Contaminant Assessment:

- As detailed in the EPA VSI report, the area was characterized by "some dark brown, nonvegetated sections and some vegetated (grasses and weeds) sections."
- In the WESTON study, soils collected from TP-2 near the former production area were analyzed for HSL metals. The results are presented in Table 7-12.

7.21 MONITOR WELL 12 (AREA 25)

Area Characterization:

- Location: Biddle Avenue behind Building 79, guard house.
- Dimension: Not applicable.
- Description: Shallow groundwater monitor well.
- Waste Managed: None.
- Hazardous Constituent: PCB, Arochlor-1254.

Contaminant Assessment: In the WESTON study, Aroclor 1254 was detected in the groundwater at NW-12 at a concentration of 32 ug/L. Arochlor-1254 was detected at 28.0 ug/L. Since PCBs are highly insoluble in water and typically do not migrate large distances, the study concluded that their presence in MW-12 indicated that contaminants may be limited to soil and groundwater immediately surrounding MW-12. The specific source of the material could not be determined.

Table 7-11

Test Pit TP-9 Soil Samples
Former Taylor Chemical Area

Organic Compounds	Concentration (mg/kg) TP-9	TP-9 Dup
1,3-Dichlorobenzene	0.26J	0.28J
1,4-Dichlorobenzene	8.4	8.8
1,2-Dichlorobenzene	16.0	15.0
1,2,4-Trichlorobenzene	11.0	7.2
2-Methylnaphthalene	0.44J	0.37J
Acenaphthylene	0.35J	ND
Dibenzofuran	0.31J	0.25J
Fluorene	0.40J	0.28J
N-Nitrosodiphenylomine	0.57J	ND
Hexachlorobenzene	1.6J	1.1J
Phenathrene	2.1J	0.51J
Anthracene	0.35J	ND
di-n-Butyl Phthalate	0.7J	0.81J
Fluoranthene	2.6	3.0
Pyrene	1.7J	1.9J
Benzo(a)Anthracene	1.6J	1.7J
Chrysene	1.7J	1.7J
Benzo(b)Fluoranthene	2.6	2.8
Benzo(a)Pyrene	0.59J	0.79J
Indeno(1,2,3-cd)Pyrene	0.84J	0.9J
Dibenz(a,h)Anthracene	0.4J	0.37J
Benzo(g,h,i)Perylene	0.88J	1.0J
Methylene Chloride	0.28	0.04
Acetone	0.01J	0.01J
Carbon Disulfide	0.01J	NDJ
Chloroform	0.26	0.05
2-Butanone	0.015J	0.010J
1,1,1-Trichloroethane	0.02J	NDJ
Carbon Tetrachloride	0.81J	0.21
Vinyl Acetate	0.29	ND
1,2-Dichloropropane	0.01J	ND
Trichloroethene	0.38	0.07
Tetrachloroethene	0.66	0.14
Trichlorofluoromethane	0.01J	ND
4,4-DDE	0.42J	0.30J
Chlorobenzene	0.02J	ND

Notes: J = Detected below quanitification limit.
ND = Not detected.

Table 7-12

Test Pit TP-2 Soil Samples
Wyandotte Oil and Fat Plant

Inorganic Parameters	Concentration (mg/kg)
Aluminum	8,140
Arsenic	28.9
Barium	152
Beryllium	1.2
Calcium	53,500
Cadmium	1.2
Cobalt	5.1
Chromium	34.2
Copper	60
Iron	19,800
Potassium	760
Magnesium	11,300
Manganese	314
Sodium	631
Nickel	34
Lead	199
Selenium	6.1
Vanadium	16.9
Zinc	379

7.22 DETROIT EDISON COMPANY POND

Area Characterization: former Detroit-Edison Pond

- Location: North of surface impoundments, southwest of Building 109.
- Dimensions: 150 feet by 50 feet.
- Description: Settling pond associated with boiler plant, clay lined, dredged out and capped with clay from pond banks in 1986.
- Waste Managed: Entrained fly ash from air scrubbers.
- Hazardous Constituents: Metals.

Contaminant Assessment:

- Not included within the Scope of Work of the WESTON study or the EPA VSI report.

SECTION 8

PATHWAYS AND RECEPTORS

8.1 MIGRATION PATHWAYS

The Consent Order requests that potential migration pathways for contaminants be identified at the East Plant. These pathways include groundwater, surface water and sediment, air, and direct contact with the public. A characterization of each pathway, based on the geology, hydrogeology, pedology, and meterology of the East Plant site, is presented in Subsections 8.1.1 through 8.1.4. In Subsection 8.1.5, the migration pathways for each of the 21 source areas are summarized.

8.1.1 GROUNDWATER

Two distinct groundwater pathways were identified in the WESTON study: a shallow, unconfined, water-bearing zone and a deep, confined, water-bearing zone.

From the previous geologic and hydrogeologic investigations at the site, it was determined that the shallow water-bearing zone is characterized by a sequence of fill, marsh soils, and Pleistocene glacial lacustrine deposits. Stratigraphic information obtained from soil test pits and monitor wells onsite indicate that the fill typically consists of 5 to 15 feet of gray or brown gravelly, silty sands with occcasional slag and brick refuse. Underlying the fill is a soft dark brown to black peat layer approximately 0.5 to 1.0-foot thick that represents the original marsh surface prior to filling and development. The peat layer is underlain by lacustrine deposits consisting of brown silty sands grading to a mottled brown sandy clay or clay.

Underlying the approximate 2 to 10 feet layer of brown sandy clay is a very low permeability, 30 to 40-foot unit of blue to gray silty clay. This clay functions as an aquiclude, separating groundwater migrating in the upper water-bearing fill and glacial deposits from groundwater migrating in the deep water-bearing zone.

The deep water-bearing zone consists of solution cavities within the Dundee Limestone Formation that underlies the glacial deposits at the East Plant. In Wayne County, the Dundee Limestone has been described as a gray to buff cherty to siliceous limestone ranging in thickness from 0 to 152 feet (Mazolo, 1969).

During the WESTON study, site-specific information was collected on the hydrogeology of the shallow water-bearing zone from 12 monitor wells, two piezometers, and three river staff gauges. The hydraulic gradient is estimated to be 0.002 ft/ft or 0.2 foot of head loss for every 100 feet of horizontal distance. Due to the gentleness of the gradient and flucuations in the Detroit River water elevations, groundwater flow directions are variable throughout the year. A contour map (Figure 8-1) of groundwater elevations in

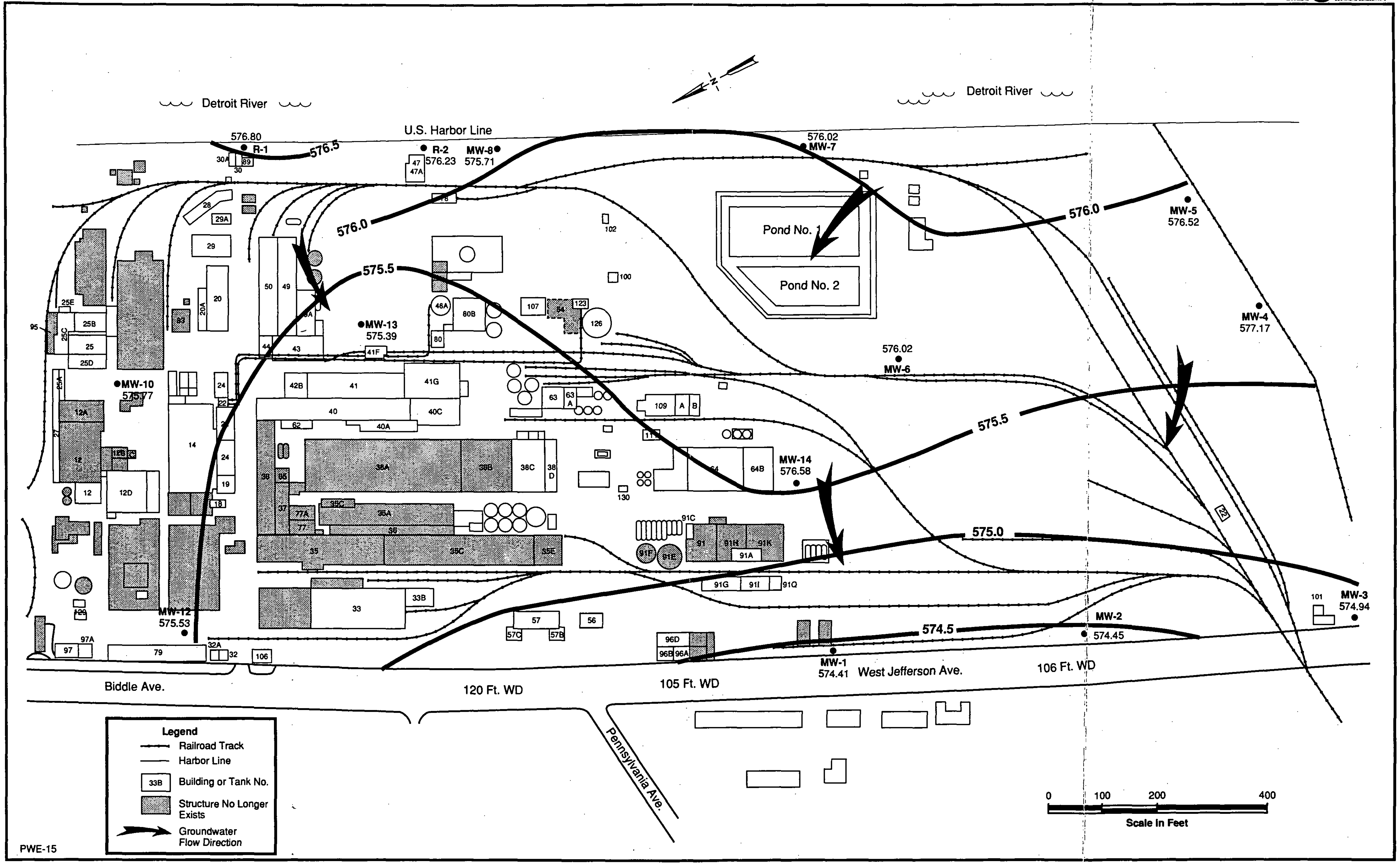


FIGURE 8-1 EAST PLANT SITE MAP, PENNWALT CORPORATION SHALLOW GROUNDWATER ELEVATION CONTOUR MAP, 13 MAY 1986

May 1986 shows that groundwater is essentially east to west away from the Detroit River toward Biddle Avenue. A contour map of groundwater elevations in October 1986 (Figure 8-2) shows that a groundwater divide oriented north and south in the central part of the plant. Groundwater to the east of the divide flows east and discharges to the river; groundwater to the west of the divide flows west toward Biddle Avenue.

A literature review of NOAA Detroit River water elevation data indicates that during the 1960s and early 1970s base flow conditions at the East Plant probably resulted in discharge of shallow groundwater. Since 1971, increased river water elevations have resulted in a reversal of flow direction, causing the river to periodically recharge the shallow water-bearing zone at the site.

Hydraulic conductivity values of the shallow unconfined saturated zone were derived from results of slug tests conducted on eleven monitor wells at the East Plant in 1986. The hydraulic conductivity ranges from a low of 9.8 by 10^{-5} ft/min at MW-12 to a high of 8.6 x 10^{-2} ft/min at MW-8. In general, the hydraulic conductivity increases in a southeastward direction across the site toward the Detroit River. The silty sand, silt, and clays encountered at the western end of the site result in low hydraulic conductivities. Higher hydraulic conductivities observed at the eastern end of the site are a result of the porous fill that was used to reclaim land along the river.

8.1.2 SURFACE WATER AND SEDIMENT

Pennwalt's East Plant is located in the Erie-Huron Lowlands physiographic province. The average elevation at the plant is 575-feet MSL with less than 5 feet of total relief across the site.

Because of the low relief, surface water drainage pathways are not well defined. Only storm water runoff along the eastern edge of the plant probably drains directly into the Detroit River. Based on previous observations of shallow standing water throughout the plant and particularly in the former coal storage area after periods of precipitation, it is assumed that runoff water from central and western areas remains onsite, eventually percolating through the soils to the water table or expiring through evapotranspiration.

Runoff from areas adjacent to facility drains and manholes in and around the leased ferric chloride production area discharges to outfall 003 and eventually discharges to the Detroit River. Outfalls 001, 002, and 005 are no longer active.

8.1.3 AIR

Air is not considered a significant potential migration pathway for site contaminants. The identified potential source areas are generally not characterized by volatile componds. Where volatile compounds are constituents of concern, they are not exposed to air. Dust generation at the East Plant is minimal since the majority plant grounds are paved or vegetated.

A wind rose diagram collected for Wayne County (Figure 8-3) indicates that winds are principally directed from the west to southwest with an average speed of 11.1 mph.

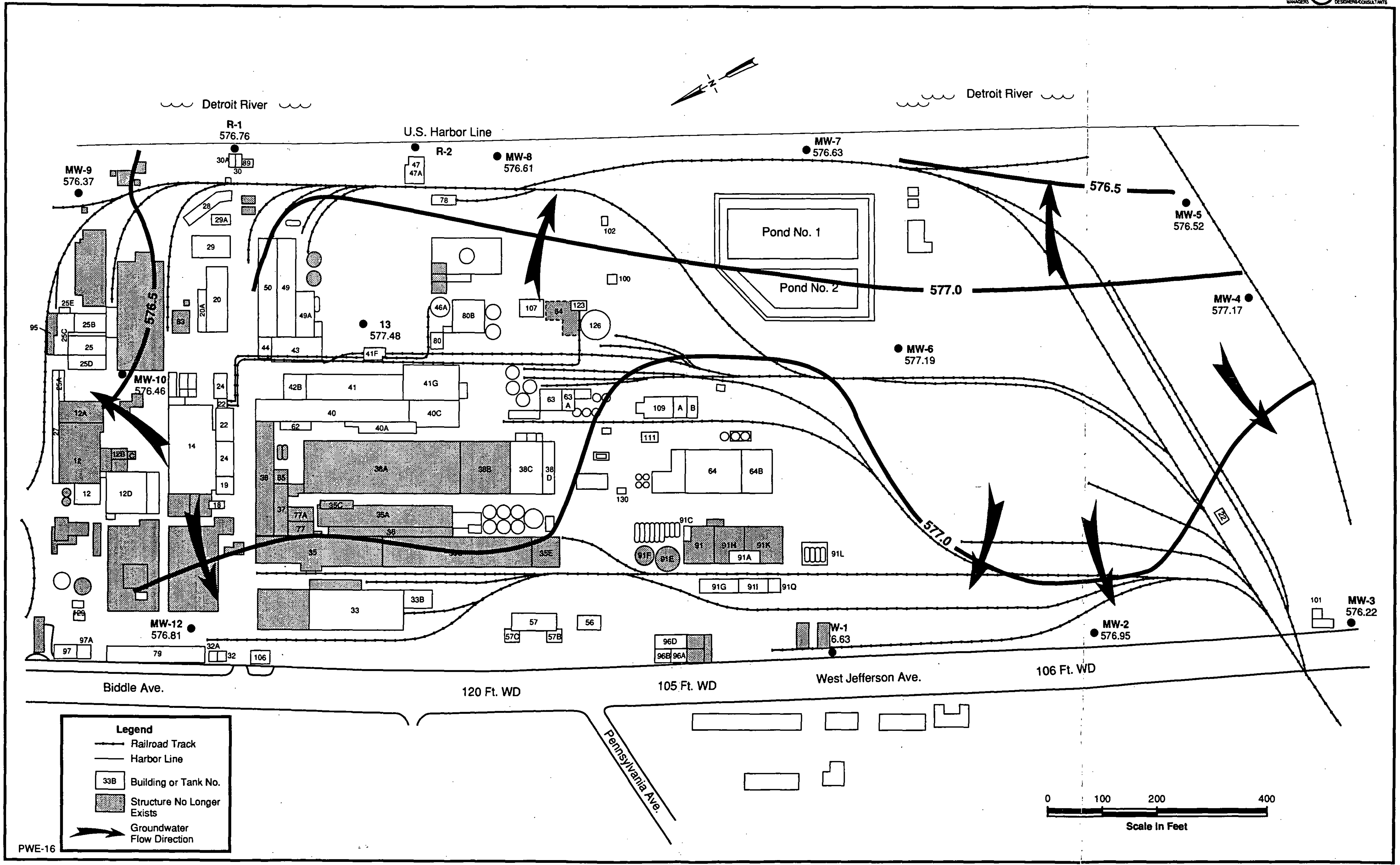
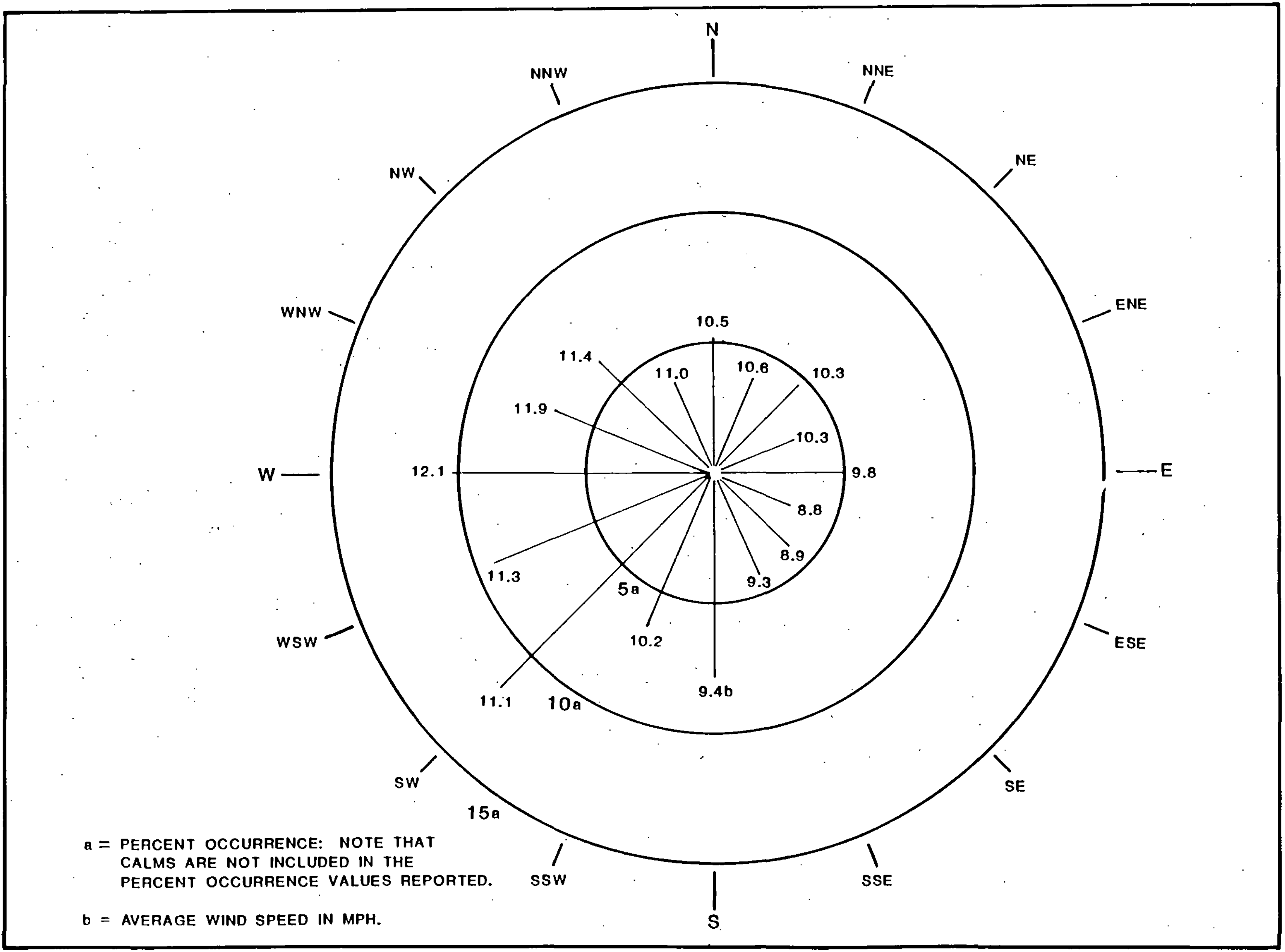


FIGURE 8-2 EAST PLANT MAP, PENNWALT CORPORATION SHALLOW GROUNDWATER ELEVATION CONTOUR MAP, 9 OCTOBER 1986



a = PERCENT OCCURRENCE: NOTE THAT CALMS ARE NOT INCLUDED IN THE PERCENT OCCURRENCE VALUES REPORTED.

b = AVERAGE WIND SPEED IN MPH.

FIGURE 8-3 WIND ROSE DETROIT (WAYNE COUNTY) MI. (1961 - 1978 DATA)

8.1.4 DIRECT CONTACT

Direct contact between the public and potential source-contaminated soil at the East Plant is limited. Access to plant grounds is restricted by a fenced enclosure of the area. Security guards regulate admittance to the plant at the main gate.

8.1.5 SUMMARY OF POTENTIAL PATHWAYS

Groundwater could be considered a potential pathway for contaminant migration at the site for each area. This does not suggest that contaminant migration through the groundwater has occurred in these areas, only that the pathway exists.

Surface water is only considered a potential pathway for the three areas located directly adjacent to the Detroit River. Storm water received in other areas across the site is either drained by the storm sewer system to outfall 003, percolates to the water table, or expires by evapotranspiration.

As determined in previous investigations, air and direct contact are not considered potential pathways. Significant concentrations of volatile compounds have not been detected onsite. Where these compounds do exist, they have a limited potential for exposure. Only the unauthorized access to the East Plant could result in potential exposure to an individual. The general public is restricted from access by a fence and security guards.

8.2 <u>POTENTIAL RECEPTORS</u>

Pursuant to Attachment I, Task I, of the Consent Order, this subsection defines receptors potentially impacted by existing contamination at the site.

As noted in the previous section groundwater and surface water are the primary potential contaminant migration pathways. As a result, the potential receptors will be associated with the groundwater and surface water downgradient from the East Plant. The communities of Wyandotte and Riverview encompass the area west of Pennwalt's East Plant. Within a 1-mile radius of the plant, land usage is variable, including industrial, business, and residential property, as discussed in Section 1. As of 1 July 1986, 14,000 people resided in Riverview and 31,850 resided in Wyandotte.

Conversations with officials at the Wayne County Health Department indicated that groundwater in the Wyandotte and Riverview areas is not used for drinking water. Since the 1960s, no wells have been installed to be used for water supply. Residents and businesses within the Riverview and Wyandotte communities are serviced by the City of Detroit and the City of Wyandotte water departments, respectively. Potable water for these utilities is obtained from water intakes near Belle Isle, Windsor, Amhurstburg, and Wyandotte in the Detroit River, north of the Pennwalt plant.

The receptors of potential contamination which could migrate from the Pennwalt site are users of the Detroit River, since surface water and groundwater discharge to the river. These potential users may include industrial, commercial, and recreational users and aquatic life. The preliminary assessment of environmental conditions at the East Plant has shown that an impact has occurred to soil and groundwater within certain areas as a result of site activities. However, the potential for impacts from these plant areas with respect to offsite receptors has not yet been determined. This will be an objective of the Phase I RFI.

Description of
Current Conditions Report

For:

ATOCHEM North America, Inc
(formerly Pennwalt Corporation)
Wyandotte, Michigan
East Plant

Appendices

EPA I.D. Number MID 005 363 114
Administrative Consent Order V-W-89R-45

Prepared For:

ATOCHEM North America, Inc.
(formerly Pennwalt Corporation)
Safety and Environmental Service
King of Prussia, Pennsylvania

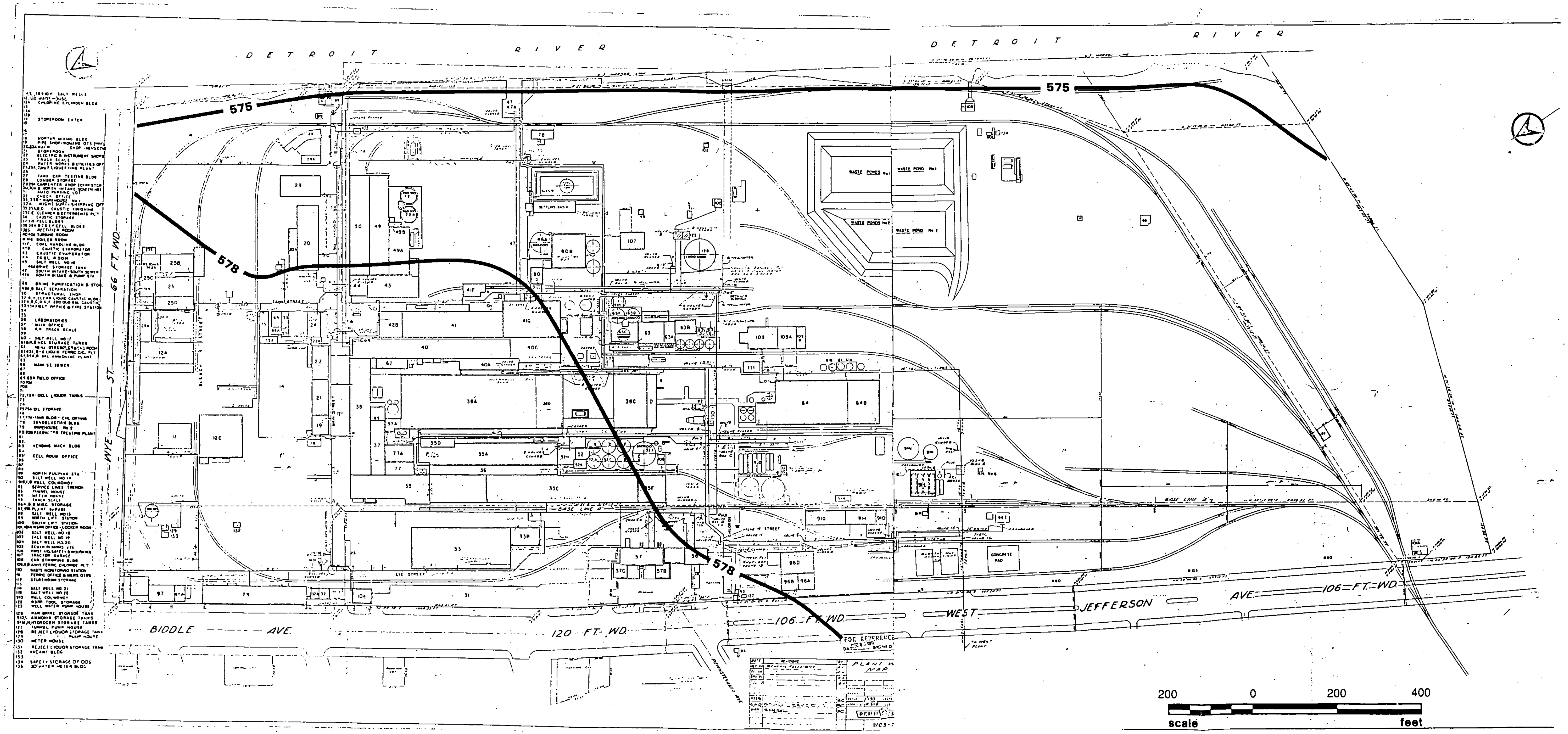
January 1990

WESTON SM
MANAGERS DESIGNERS/CONSULTANTS
Roy F. Weston, Inc.
Weston Way
West Chester, Pennsylvania 19380

APPENDIX A

TOPOGRAPHIC MAP SHOWING SURFACE DRAINAGE

APPENDICES

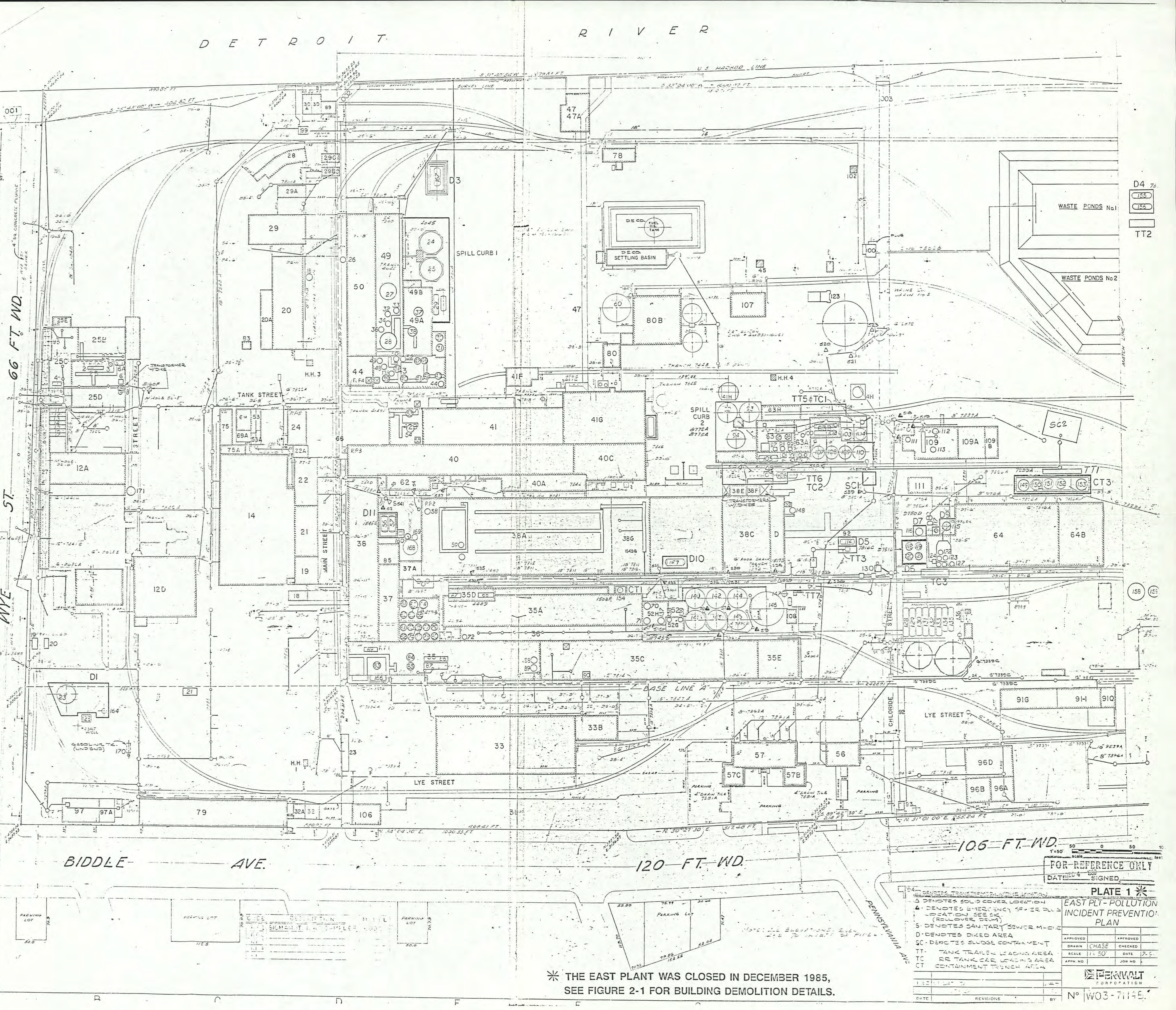


TOPOGRAPHIC AND SURFACE DRAINAGE MAP

APPENDIX B

DRAWINGS

4,5, 7,8,9,10,11	SALT WELLS
12,12B,C,D	PERCHLORON
12A.	CHLORINE CYLINDER BLDG.
13	
13A	
13B	
14	STOREROOM EXTEN.
15	
16	
17	
18	MORTAR MIXING BLDG.
19	PIPE SHOP-WOMENS Q'TS. 2ND FL.
20,20A	MACH. SHOP -MENS QTRS.
21	STOREROOM
22	ELECTRIC & INSTRUMENT SHOPS
23	TRUCK SCALE
24	WATER WORKS & UTILITIES OFF.
25,25A, Thru F	LIQUEFYING PLANT
26	
27	TANK CAR TESTING BLDG.
28	LUMBER STORAGE
29,29A	CARPENTER SHOP, EQUIP. STOR.
30,30A,B	NORTH INTAKE-SCREEN HSE.
31	AUTO PARKING LOT
32,32A	CHECK OFFICE, EMPLOYMENT
33, 33B	- WAREHOUSE No. 1
34	
35,35A,B,D	CAUSTIC FINISHING
35C,E	CLEANER & DETERGENTS PL'T.
36	CAUSTIC STORAGE
37,37A	CELL BLDGS
38,38A,B,C,D,E,F	CELL BLDGS.
38G	RECTIFIER ROOM
40,40A	TURBINE ROOM
41,41G	BOILER ROOM
41F	COAL HANDLING BLDG.
42B	CAUSTIC EVAPORATOR
43	CAUSTIC EVAPORATOR
44	TOOL ROOM
45	SALT WELL NO. 16
47	SOUTH INTAKE-SOUTH SEWER
47A	SOUTH INTAKE & PUMP STA.
48	
49	BRINE PURIFIC. & STOR.
49A	SALT SEPARATION
50	STRUCTURAL SHOP
52,G,H	CLEAR LIQUID CAUSTIC BLDG.
53,53A	FIELD OFFICE & FIRE STATION
54	
55	
56	LABORATORIES
57	MAIN OFFICE
58	R.R. TRACK SCALE
59	
60	SALT WELL NO. 17
62	MENS QTRS. BOILER & ENG. ROOM
63,63A, B-H	LIQUID FERRIC CHL. PLT.
64,64A,B	SAL AMMONIAC PLANT
65	
66	MAIN ST. SEWER
67	
68	
69,69A	FIELD OFFICE
70,70A	
70B	
71	
73	
74	
75,75A	OIL STORAGE
76	
77,77A	-TANK BLDG.- CHL. DRYING
78	SANDBLASTING BLDG.
79	WAREHOUSE No. 2
80,80B	FEEDWATER TREATING PLANT
81	
82.	
83	VENDING MACH. BLDG.
84	
85	CELL ROOM OFFICE
86	
87	
88	
89	NORTH PUMPING STA.
90	SALT WELL NO. 14
91,G,I,Q	WALL COLOMONOY
92	SERVICE LINES TRENCH
93	TUNNEL HOUSE
94	METER HOUSE
95	TRACK SCALE
96,A,B,D	MISC. STORAGE
97,97A	PLANT GARAGE
98	SALT WELL NO. 15
99	NORTH LIFT STATION
100	SOUTH LIFT STATION
101, 101A	WSRR OFFICE-LOCKER ROOM
102	SALT WELL NO. 18
103	SALT WELL NO. 19
104	SALT WELL NO. 20
105	SOUTH PUMPING STA.
106	FIRST AID, SAFETY & INSURANCE
107	TRACTOR GARAGE
108	CAR STRIPPING BLDG.
109,A,B	ANHY. FERRIC CHLORIDE PL'T.
110	WASTE MONITORING STATION
111	FERRIC OFFICE & MENS QTRS.
112	STOREROOM STORAGE
113	
114	SALT WELL NO. 21
115	SALT WELL NO. 22
91Q	WALL COLMONOY
122	WSRR TOOL STORAGE
123	WELL WATER PUMP HOUSE
127	TUNNEL PUMP HOUSE
129	PUMP HOUSE
130	METER HOUSE



FOR REFERENCE ONLY
DATE DEC 4 [illegible] SIGNED

▨ DENOTES TRANSFORMER W/DIKE LOCATION
Δ DENOTES SOLID COVER LOCATION
▲- DENOTES EMERGENCY SEWER PLUG LOCATION SEE SK. (ROLLOVER DRUM)
S- DENOTES SANITARY SEWER M-HOLE
D- DENOTES DIKED AREA
SC - DENOTES SLUDGE CONTAINMENT
TT- TANK TRAILER LOADING AREA
TC RR TANK CAR LOADING AREA
CT CONTAINMENT TRENCH AREA

DATE	REVISIONS	BY

PLATE 1 ✳

EAST PLT - POLLUTION INCIDENT PREVENTIO
PLAN

APPROVED		APPROVED	
DRAWN	CHASE	CHECKED	
SCALE	1" = 50'	DATE	7-9
APPR. NO		JOB NO.	

PENNWALT CORPORATION

N° W03-7114-5.

✳ THE EAST PLANT WAS CLOSED IN DECEMBER 1985, SEE FIGURE 2-1 FOR BUILDING DEMOLITION DETAILS.

3,9,10,11 SALT WELLS
WAREHOUSE
CHLORINE CYLINDER BLDG.

STOREROOM EXTEN.

MORTAR MIXING BLDG.
PIPE SHOP-WOMENS Q'TS. 2ND FL.
MACH. SHOP -MENS QTRS.
STOREROOM
ELECTRIC & INSTRUMENT SHOPS
TRUCK SCALE
WATER WORKS & UTILITIES OFF.
Thru F LIQUEFYING PLANT

TANK CAR TESTING BLDG.
UMBER STORAGE
ARPENTER SHOP, EQUIP. STOR.
3 NORTH INTAKE-SCREEN HSE.
AUTO PARKING LOT
HECK OFFICE,
- WAREHOUSE No. 1
IGHT SUPT. & SHIPPING OFFICE
3,D CAUSTIC FINISHING
LEANER & DETERGENTS PL'T.
AUSTIC STORAGE
ELL BLDGS
B,C,D,E,F CELL BLDGS.
RECTIFIER ROOM
TURBINE ROOM
BOILER ROOM
COAL HANDLING BLDG.
CAUSTIC EVAPORATOR
CAUSTIC EVAPORATOR
TOOL ROOM
SALT WELL NO. 16
BRINE STORAGE TANK
SOUTH INTAKE-SOUTH SEWER
SOUTH INTAKE & PUMP STA.

BRINE PURIFIC. & STOR.
SALT SEPARATION
STRUCTURAL SHOP
H, CLEAR LIQUID CAUSTIC BLDG.
C,D,E,F 200,000 GAL. CAUSTIC
FIELD OFFICE & FIRE STATION

LABORATORIES
MAIN OFFICE
R.R. TRACK SCALE

SALT WELL NO. 17
,B,HCL STORAGE TANKS
MENS QTRS. BOILER & ENG. ROOM
A, B-H LIQUID FERRIC CHL. PLT.
A,B SAL AMMONIAC PLANT

MAIN ST. SEWER

A FIELD OFFICE

- CELL LIQUOR TANKS

OIL STORAGE

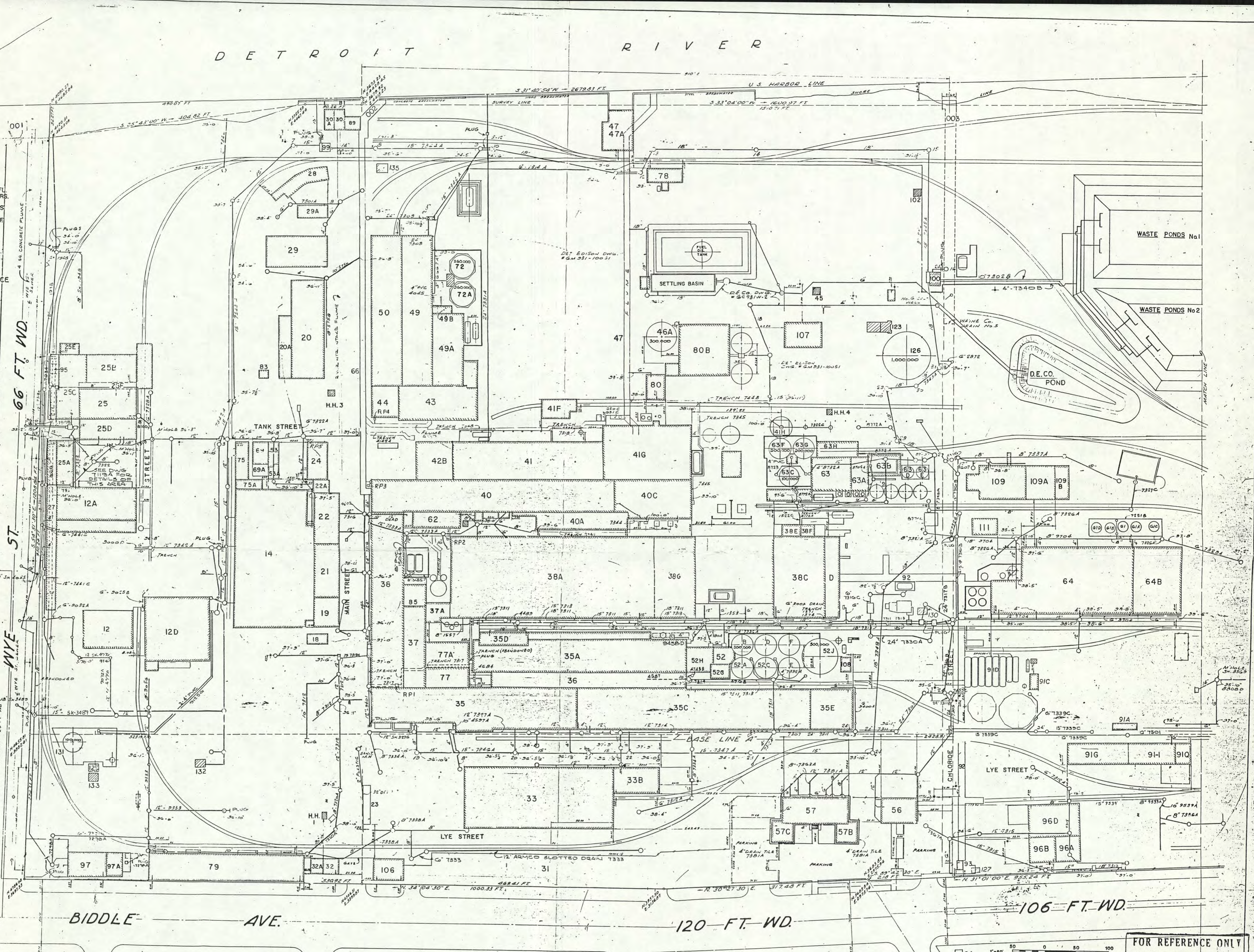
-TANK BLDG.- CHL. DRYING
ANDBLASTING BLDG.
WAREHOUSE No. 2
FEEDWATER TREATING PLANT

VENDING MACH. BLDG.

CELL ROOM OFFICE

NORTH PUMPING STA.
SALT WELL NO. 14
Q WALL COLOMONOY
SERVICE LINES TRENCH
TUNNEL HOUSE
METER HOUSE
TRACK SCALE
D MISC. STORAGE
PLANT GARAGE
ALT WELL NO. 15
ORTH LIFT STATION
OUTH LIFT STATION
WSRR OFFICE-LOCKER ROOM
ALT WELL NO. 18
ALT WELL NO. 19
ALT WELL NO. 20
OUTH PUMPING STA.
IRST AID, SAFETY & INSURANCE
RACTOR GARAGE
AR STRIPPING BLDG.
NHY. FERRIC CHLORIDE PL'T.
ASTE MONITORING STATION
ERRIC OFFICE & MENS QTRS.
TOREROOM STORAGE

LT WELL NO. 21
LT WELL NO. 22
LL COLMONOY
RR TOOL STORAGE
ELL WATER PUMP HOUSE
W BRINE STORAGE TANK
NNEL PUMP HOUSE
MMONIA STORAGE TANKS
YDROGEN STORAGE TANKS
EJECT LIQUOR STORAGE TANK
" " PUMP HOUSE
ETER HOUSE
EJECT LIQUOR STORAGE TANK
ACANT BLDG
" "
TY STORAGE OF 005
ATER METER BLDG



NOTE: ALL ELEVATIONS GIVEN ARE TO INVERT OF PIPE

CODE	DESCRIPTION	MODEL
RP1	SIGMAMOTOR RP SAMPLER	6000
RP2	" " "	"
RP3	" " "	"
RP4	" "	"
RP5	"	"

94

1"=50'

50 0 50 100
scale feet

FOR REFERENCE ONLY
DATE DEC 4 1989 SIGNED

DATE	REVISIONS	BY
10/2-58	GENERAL REVISIONS	R.F.
2/1-60	" "	F.N.
11/12-75	" "	D.J.
5/12-77	" "	B.C.
3/6-78	ADDED RP WATER SAMPLERS	J.J.
10/79	GENERAL REVISION	EC
6/80	GENERAL REVISION	BC
6/83	GENERAL REVISIONS	F.N.

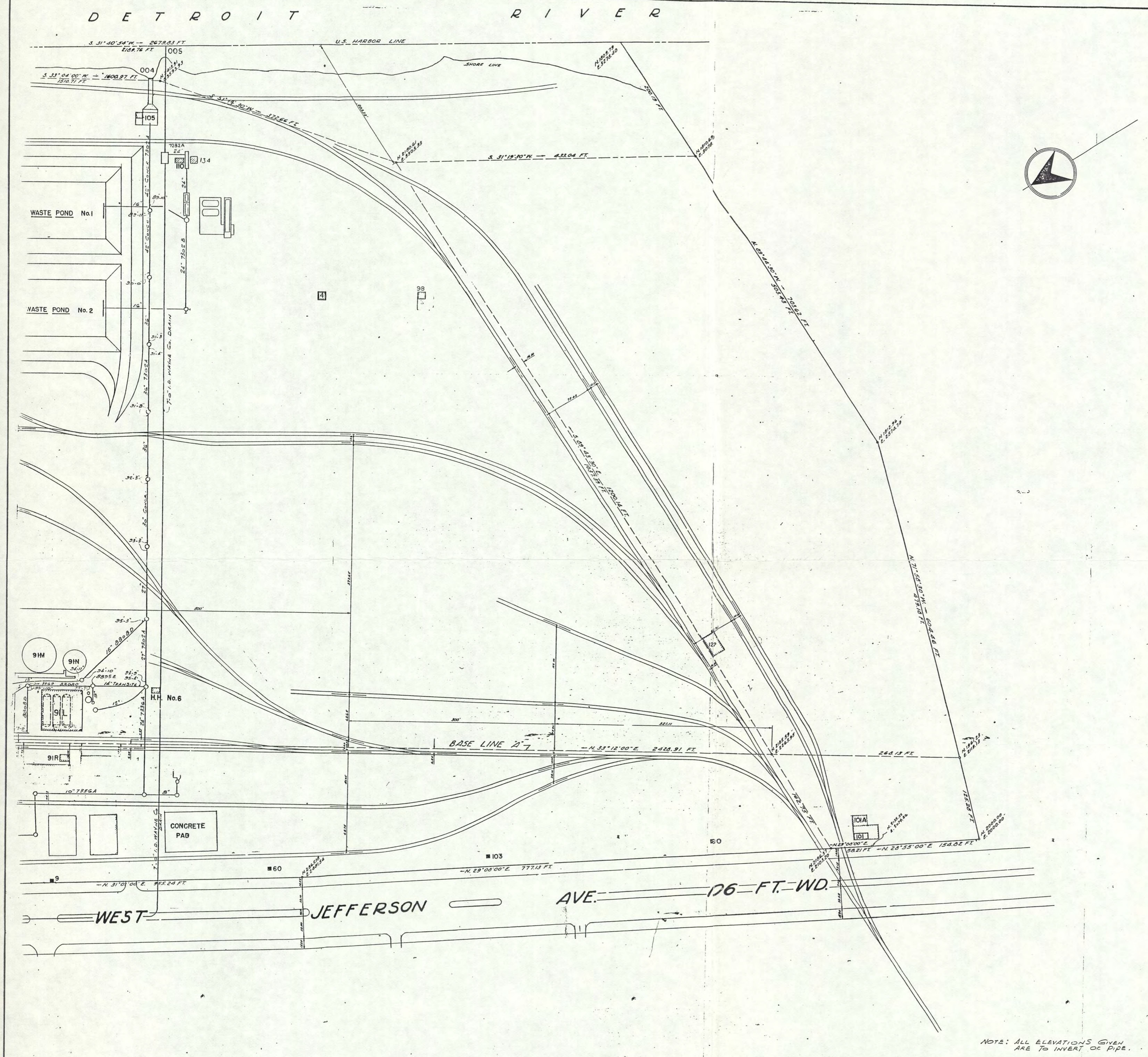
PROCESS SEWER MAP

APPROVED		APPROVED	
DRAWN		CHECKED	
SCALE	1"=50'	DATE	12-11-53
APPR. NO.	W-668	JOB NO.	172

PENN SALT

PLATE 2

W03-7149



NOTE: ALL ELEVATIONS GIVEN ARE TO INVERT OF PIPE.

1"=50'
50 0 50 100
scale feet

FOR REFERENCE ONLY
DATE: DEC 4 1989 SIGNED

DATE	REVISIONS	BY
3-8-71	GENERAL REVISIONS	FN
11-16-75	" "	DJ.
5/12/77	" "	BC
7/83	GENERAL REVISIONS	BC

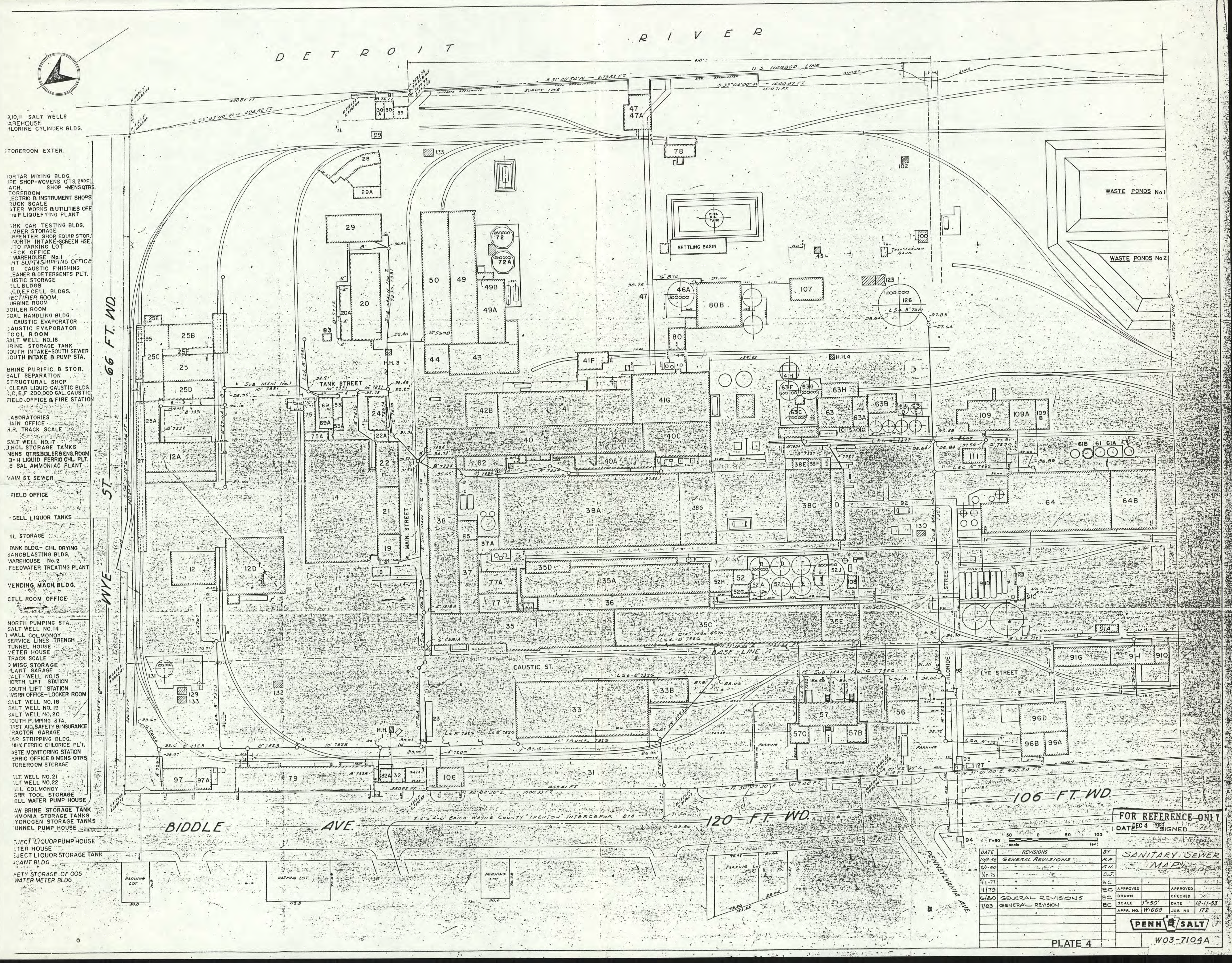
PROCESS SEWER MAP
FERSON AVE.
FRVIEW

APPROVED		APPROVED	
DRAWN		CHECKED	
SCALE	1"=50'	DATE	12-11-53
APPR. NO.	W-668	JOB NO.	172

PENN SALT

W03-710CA

PLATE 3



FOR REFERENCE ONLY
DATE DEC 4 1989 SIGNED

DATE	REVISIONS	BY
10/2-58	GENERAL REVISIONS	R.F.
2/1-60	"	F.N.
11/17-75	" "	D.J.
5/12-77	" "	B.C.
11/79	" "	BC
6/80	GENERAL REVISIONS	BC
7/83	GENERAL REVISION	BC

SANITARY SEWER MAP

APPROVED		APPROVED	
DRAWN		CHECKED	
SCALE	1"=50'	DATE	12-11-53
APPR. NO.	W-668	JOB NO.	172

PENN SALT

PLATE 4

W03-7104A

7,8,9,10,11 SALT WELLS
WAREHOUSE
CHLORINE CYLINDER BLDG.

STOREROOM EXTEN.

MORTAR MIXING BLDG.
PIPE SHOP-WOMENS Q'TS. 2ND FL.
:OA MACH. SHOP -MENS QTRS.
STOREROOM
ELECTRIC & INSTRUMENT SHOPS
TRUCK SCALE
WATER WORKS & UTILITIES OFF.
A, Thru F LIQUEFYING PLANT

TANK CAR TESTING BLDG.
LUMBER STORAGE
CARPENTER SHOP, EQUIP. STOR.
,B NORTH INTAKE-SCREEN HSE.
AUTO PARKING LOT
CHECK OFFICE
B- WAREHOUSE No. 1
NIGHT SUPT. & SHIPPING OFF.
,B,D CAUSTIC FINISHING
CLEANER & DETERGENTS PL'T.
CAUSTIC STORAGE
CELL BLDGS
,B,C,D,E,F CELL BLDGS.
RECTIFIER ROOM
TURBINE ROOM
BOILER ROOM
COAL HANDLING BLDG.
CAUSTIC EVAPORATOR
CAUSTIC EVAPORATOR
TOOL ROOM
SALT WELL NO. 16
A BRINE STORAGE TANK
SOUTH INTAKE-SOUTH SEWER
SOUTH INTAKE & PUMP STA.

BRINE PURIFICATION & STOR.
SALT SEPARATION
STRUCTURAL SHOP
H, CLEAR LIQUID CAUSTIC BLDG.
3,C,D,E,F 200,000 GAL. CAUSTIC
A FIELD OFFICE & FIRE STATION

LABORATORIES
MAIN OFFICE
R.R. TRACK SCALE

SALT WELL NO. 17
3,HCL STORAGE TANKS
MENS QTRS. BOILER & ENG. ROOM
A, B-G LIQUID FERRIC CHL. PLT.
-A,B SAL AMMONIAC PLANT

MAIN ST. SEWER

A FIELD OFFICE

A-CELL LIQUOR TANKS

OIL STORAGE

-TANK BLDG.- CHL. DRYING
SANDBLASTING BLDG.
WAREHOUSE No. 2
FEEDWATER TREATING PLANT

VENDING MACH. BLDG.

CELL ROOM OFFICE

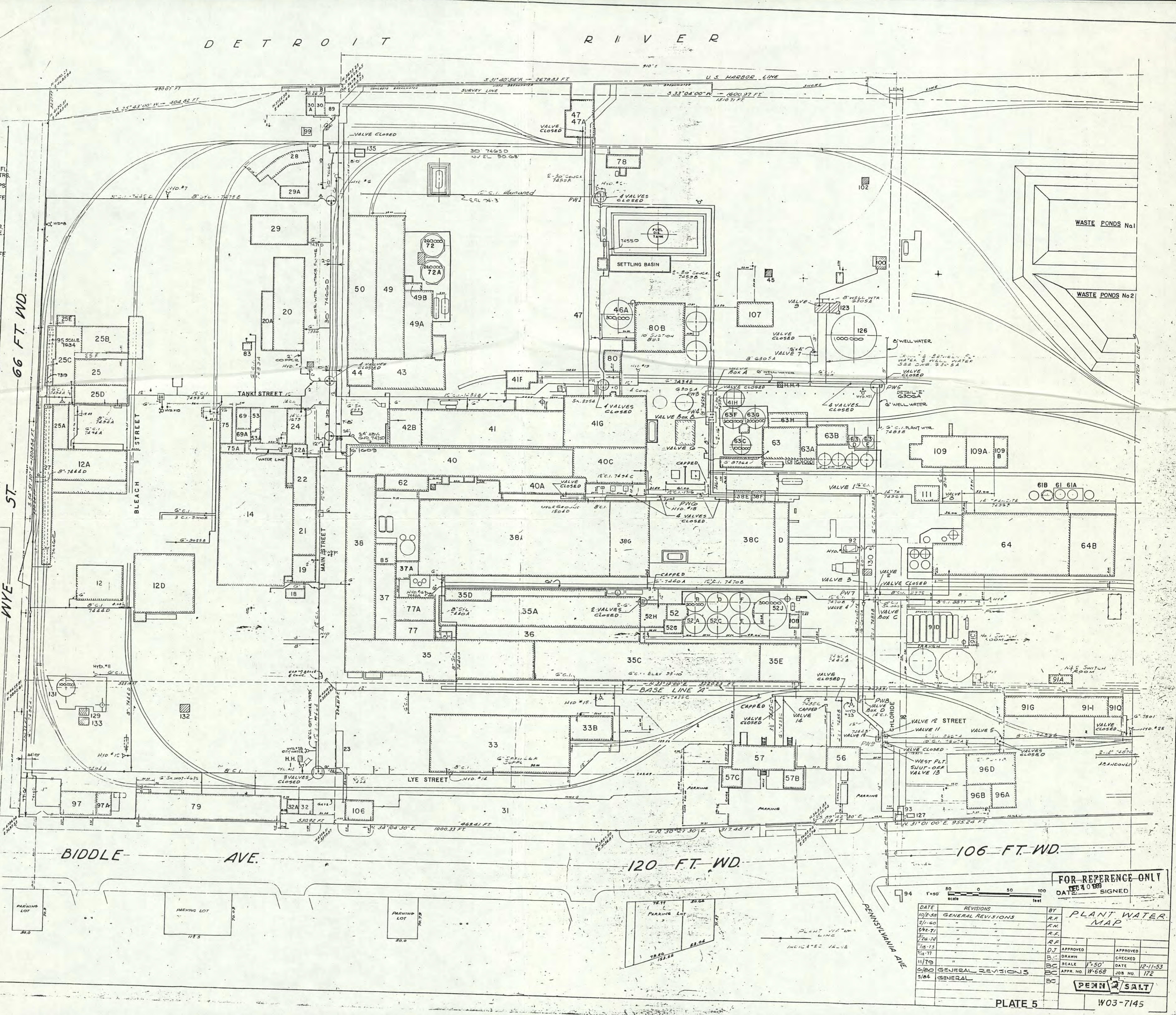
NORTH PUMPING STA.
SALT WELL NO. 14
D WALL COLMONOY
SERVICE LINES TRENCH
TUNNEL HOUSE
METER HOUSE
TRACK SCALE
D MISC. STORAGE
PLANT GARAGE
SALT WELL NO. 15
ORTH LIFT STATION
OUTH LIFT STATION
VSRR OFFICE-LOCKER ROOM
ALT WELL NO. 18
ALT WELL NO. 19
ALT WELL NO. 20
OUTH PUMPING STA.
RST AID, SAFETY & INSURANCE
RACTOR GARAGE
AR STRIPPING BLDG.
HY. FERRIC CHLORIDE PL'T.
STE MONITORING STATION
RRIC OFFICE & MENS QTRS.
OREROOM STORAGE

LT WELL NO. 21
LT WELL NO. 22
LL COLMONOY
RR TOOL STORAGE
LL WATER PUMP HOUSE

V BRINE STORAGE TANK
MONIA STORAGE TANKS
ROGEN STORAGE TANKS
INEL PUMP HOUSE
JECT LIQUOR STORAGE TANK
" " PUMP HOUSE
TER HOUSE

ECT LIQUOR STORAGE TANK
ANT BLDG

ETY STORAGE O.F. OOS
WATER METER BLDG



FOR REFERENCE ONLY
DATE: DEC 4 0 1989 SIGNED

DATE	REVISIONS	BY
10/2-58	GENERAL REVISIONS	R.F.
2/1-60	" "	F.N.
2/22-71	" "	R.F.
3/26-74	" "	RF
11/18-75	" "	DJ
5/12-77	" "	B.C.
11/79	" "	BC
6/80	GENERAL REVISIONS	BC
5/84	GENERAL	BC

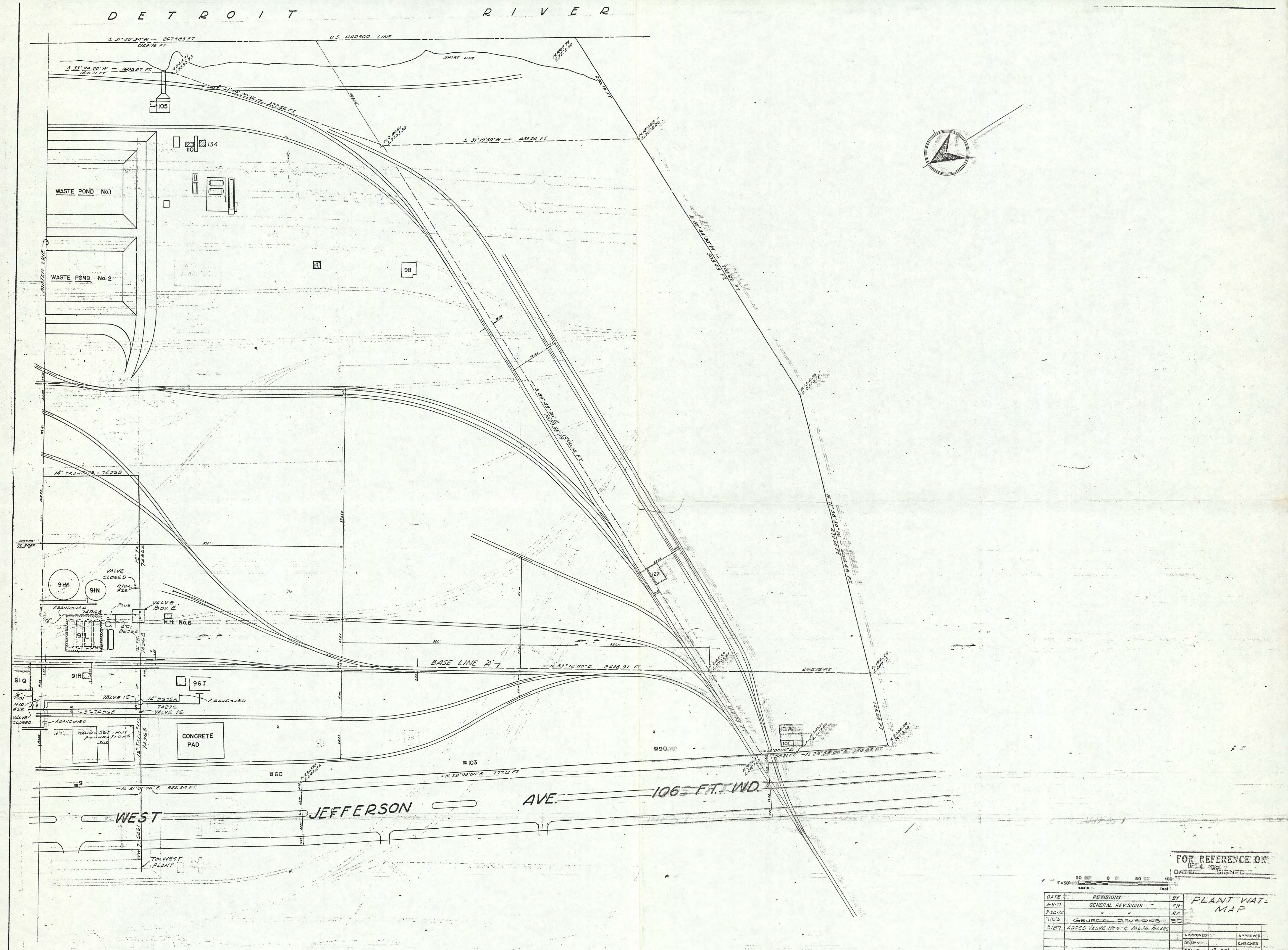
PLANT WATER MAP

APPROVED		APPROVED	
DRAWN		CHECKED	
SCALE	1" = 50'	DATE	12-11-53
APPR. NO.	W-668	JOB NO.	172

PENN SALT

PLATE 5

W03-7145



FOR REFERENCE ON
DEC 4 1969
DATE: SIGNED

1"=50' 50 0 50 100
scale feet

DATE	REVISIONS	BY
3-8-71	GENERAL REVISIONS	FN
3-26-74	" "	RF
7/83	GENERAL REVISIONS	BC
3/87	ADDED VALVE NOS & VALVE BOXES	

PLANT WAT
MAP

APPROVED		APPROVED	
DRAWN		CHECKED	
SCALE	1"=50'	DATE	12
APPR. NO.	W-668	JOB NO.	

PENN SAL

W03-714

PLATE 6

,9,10,11 SALT WELLS
VAREHOUSE
CHLORINE CYLINDER BLDG.

STOREROOM EXTEN.

MORTAR MIXING BLDG.
PIPE SHOP-WOMENS Q'TS. 2ND FL.
MACH. SHOP -MENS QTRS.
STOREROOM
ELECTRIC & INSTRUMENT SHOPS
TRUCK SCALE
WATER WORKS & UTILITIES OFF.
Thru F LIQUEFYING PLANT

ANK CAR TESTING BLDG.
UMBER STORAGE
ARPENTER SHOP, EQUIP. STOR.
NORTH INTAKE-SCREEN HSE.
UTO PARKING LOT
HECK OFFICE
WAREHOUSE No.1
HT SUPT.& SHIPPING OFFICE
,D CAUSTIC FINISHING
LEANER & DETERGENTS PL'T.
AUSTIC STORAGE
ELL BLDGS
B,C,D,E,F CELL BLDGS.
RECTIFIER ROOM
URBINE ROOM
BOILER ROOM
COAL HANDLING BLDG.
CAUSTIC EVAPORATOR
CAUSTIC EVAPORATOR
TOOL ROOM
SALT WELL NO.16
BRINE STORAGE TANK
SOUTH INTAKE-SOUTH SEWER
SOUTH INTAKE & PUMP STA.

BRINE PURIFIC. & STOR.
SALT SEPARATION
STRUCTURAL SHOP
H, CLEAR LIQUID CAUSTIC BLDG.
,C,D,E,F 200,000 GAL. CAUSTIC
FIELD OFFICE & FIRE STATION

LABORATORIES
MAIN OFFICE
R.R. TRACK SCALE

SALT WELL NO.17
B,HCL STORAGE TANKS
MENS QTRS. BOILER & ENG. ROOM
A, B-G LIQUID FERRIC CHL. PLT.
A,B SAL AMMONIAC PLANT

MAIN ST. SEWER

FIELD OFFICE

CELL LIQUOR TANKS

OIL STORAGE

TANK BLDG.- CHL. DRYING
SANDBLASTING BLDG.
WAREHOUSE No.2
FEEDWATER TREATING PLANT

NDING MACH. BLDG.

CELL ROOM OFFICE

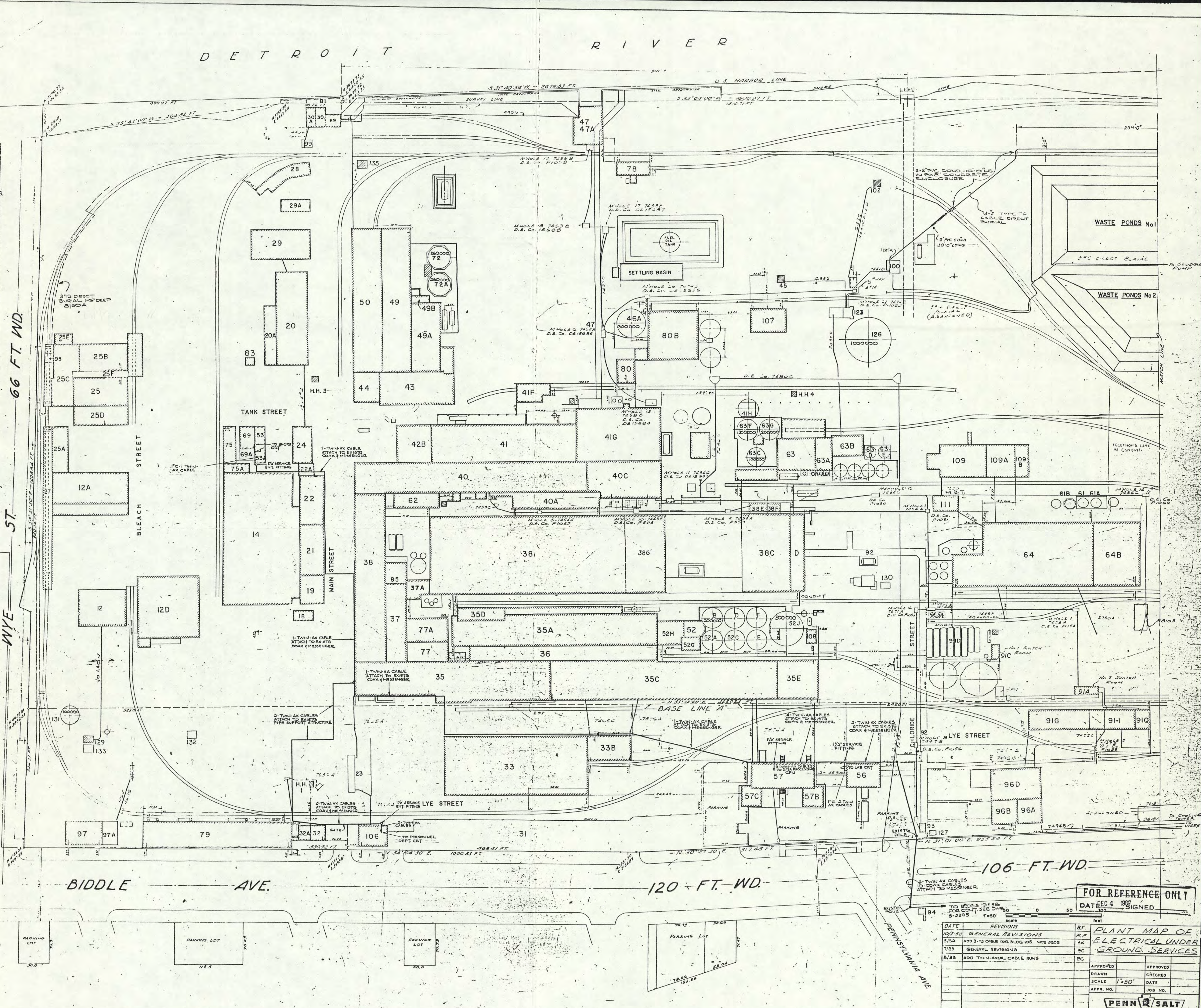
NORTH PUMPING STA.
SALT WELL NO.14
WALL COLMONOY
SERVICE LINES TRENCH
TUNNEL HOUSE
METER HOUSE
TRACK SCALE
), MISC. STORAGE
PLANT GARAGE
SALT WELL NO.15
ORTH LIFT STATION
OUTH LIFT STATION
VSRR OFFICE-LOCKER ROOM
ALT WELL NO.18
ALT WELL NO.19
SALT WELL NO.20
SOUTH PUMPING STA.
FIRST AID, SAFETY & INSURANCE
RACTOR GARAGE
AR STRIPPING BLDG.
HY. FERRIC CHLORIDE PL'T.
ASTE MONITORING STATION
ERRIC OFFICE & MENS QTRS.
TOREROOM STORAGE

LT WELL NO.21
T WELL NO.22
LL COLMONOY
RR TOOL STORAGE
LL WATER PUMP HOUSE

V BRINE STORAGE TANK
NNEL PUMP HOUSE

ECT LIQUOR PUMP HOUSE
TER BLDG
ECT LIQUOR STORAGE TANK
ANT BLDG

ETY STORAGE OF OOS.
VATER METER BLDG



FOR REFERENCE ONLY
DATE DEC 4 1989 SIGNED

DATE	REVISIONS	BY.
10/2-58	GENERAL REVISIONS	R.F.
5/82	ADD 3-#2 CABLE FOR BLDG 105 WCE 2505	SK
7/83	GENERAL REVISIONS	BC
8/83	ADD TWIN-AXIAL CABLE RUNS	BC

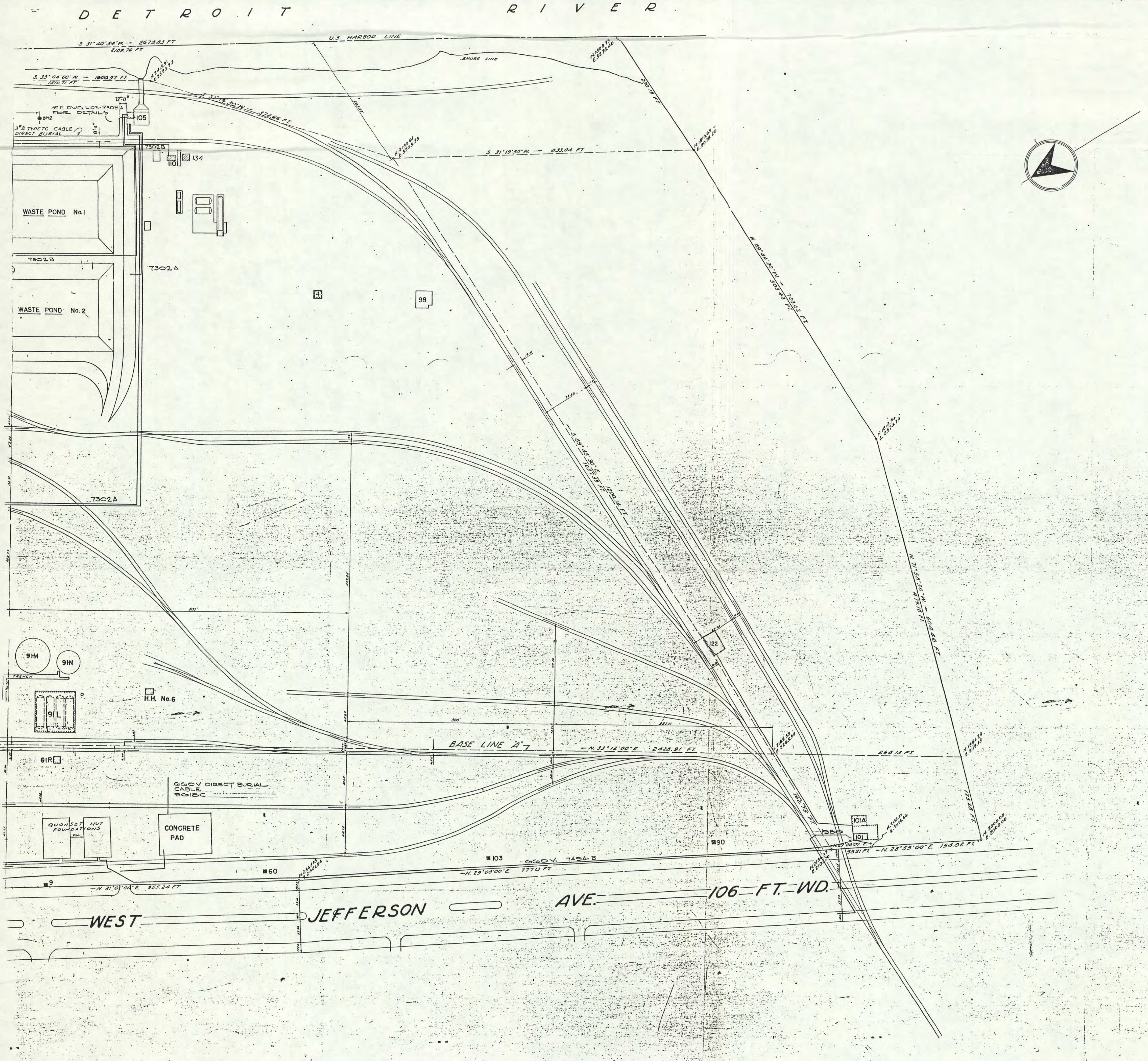
PLANT MAP OF ELECTRICAL UNDERGROUND SERVICES

APPROVED		APPROVED	
DRAWN		CHECKED	
SCALE	1"=50'	DATE	
APPR. NO.		JOB NO.	

PENN SALT

PLATE 7

W03-7101A



FOR REFERENCE ONLY
DATE DEC 4 1989 SIGNED

1"=50' 50 0 50 100 scale feet

DATE	REVISIONS	BY
3/25-74	GENERAL REVISIONS	RF
7/83	GENERAL REVISIONS	BC

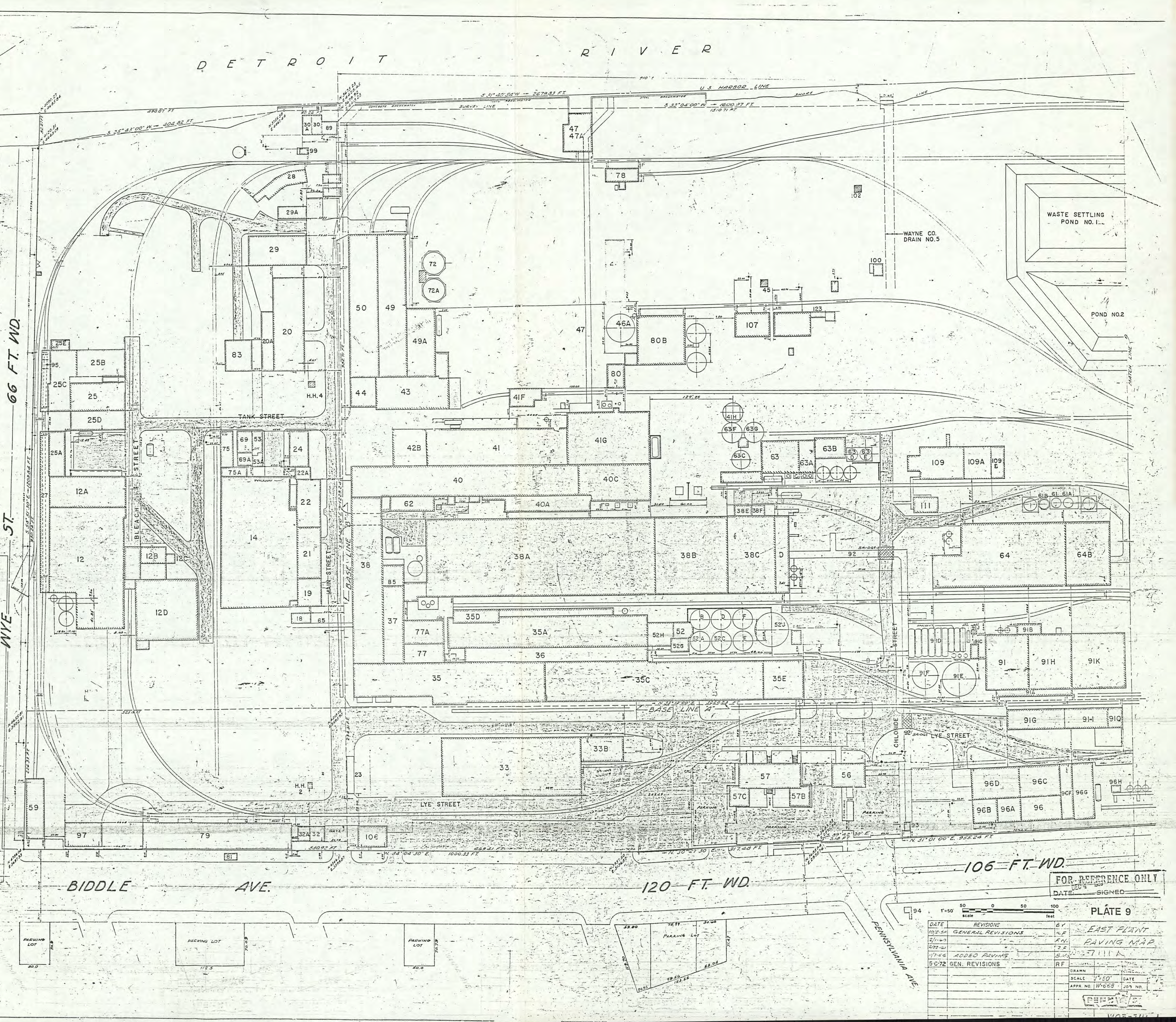
PLATE 8

PLANT MAP-ELECTRIC UNDERGROUND LINES

APPROVED		APPROVED	
DRAWN		CHECKED	
SCALE -	1"=50'	DATE	12-11-53
APPR. NO.	W-668	JOB NO.	172

PENN SALT

W03-7102A



4,5, ,7,8,9,10,11	SALT WELLS
12,12B,C	PERCHLORON
12A	CHLORINE CYLINDER BLDG.
13	
13A	DASHER WASHERS
13B	
14	STOREROOM EXTEN.
15	
16	
17	
18	MORTAR MIXING BLDG.
19	PIPE SHOP-WOMENS Q'TS. 2ND FL.
20,20A	MACH. & SHOPS-MENS QTRS.
21	STOREROOM
22	
23	TRUCK SCALE
24	WATER WORKS BLDG.
25,25A,B,C,D	ELIQUEFYING PLANT
26	
27	TANK CAR TESTING BLDG.
28	LUMBER STORAGE
29,29A	CARPENTER SHOP, EQUIP. STOR.
30,30A,B	NORTH INTAKE-SCREEN HSE.
31	AUTO PARKING LOT
32,32A	CHECK OFFICE, CREDIT UNION
33	WAREHOUSE
34	
35,35A,B,D	CAUSTIC FINISHING
35C,E	CLEANER & DETERGENTS PL'T.
36	CAUSTIC STORAGE
37,37A	CELL BLDG.
38,38A,B,C,D,E,F	CELL BLDGS.
39	
40,40A	TURBINE ROOM
41,41G	BOILER ROOM
41F	COAL HANDLING BLDG.
42B	CAUSTIC EVAP.
43	CAUSTIC EVAPORATOR
44	TOOL ROOM
45	SALT WELL NO.16
46,46A	BRINE STORAGE TANKS
47	SOUTH INTAKE-SOUTH SEWER
47A	SOUTH SCREEN HSE.-PUMP STA.
48	
49	BRINE PURIFIC. & STOR.
49A	SALT SEPARATION
50	STRUCTURAL SHOP
52,G,H	CLEAR LIQUID CAUSTIC BLDG.
52A,B,C,D,E,F	200,000 GAL. CAUSTIC
53,53A	FIELD OFFICE & FIRE STATION
54	
55	MIXED GOODS WAREHOUSE
56	LABORATORIES
57	MAIN OFFICE
58	R.R. TRACK SCALE
59	SEMI-TRUCK GARAGE
60	SALT WELL NO.17
61,61A	HCL STORAGE TANKS
62	MENS QTRS. BOILER & ENG. ROOM
63,63A	" FERRIC CHL. PLANT
64,64A,B	SAL AMMONIAC PLANT
65	CHLORINE CONDUIT
66	MAIN ST. SEWER
67	
68	
69,	FIELD OFFICE
70,70A	
70B	
71	
72,72A	CELL LIQUOR TKS.
73	
74	
75,75A	OIL STORAGE
76	
77,77A	
78	SANDBLASTING BLDG.
79	
80,80B	FEEDWATER TREATING PLANT
81	BUS STOP SHELTER
82	
83	
84	CONSTRUCTION MAT'LS. WHSE.
85	CELL ROOM OFFICE
86	
87	
88	
89	NORTH PUMPING STA.
90	SALT WELL NO. 14
91,A,B,C,D,E THRU N,	AMMONIA PL'T.
92	SERVICE LINES CONDUIT
93	TUNNEL HOUSE
94	METER HOUSE
95	TRACK SCALE
96,A,B,C,D,F	HYDROGEN PEROXIDE
97	PLANT GARAGE
98	SALT WELL NO.15
99	NORTH LIFT STATION
100	SOUTH " "
101	W.S.R.R. OFFICE
102	SALT WELL NO. 18
103	SALT WELL NO. 19
104	SALT WELL NO. 20
105	SOUTH PUMPING STA.
106	FIRST AID & EMPLOYMENT
107	TRACTOR GARAGE
108	CAR STRIPPING BLDG.
109	ANHY. FERRIC CHLORIDE PL'T.
110	WASTE MONITORING STA.
111	OFFICE & MENS Q'TS. BLDG.
112	STOREROOM STORAGE
113	STOREROOM STORAGE
114	SALT WELL NO. 21
115	SALT WELL NO. 22
91Q	WALL COLMONOY
116	BRINE STOR. TK.-W. BRINE FIELD
117	PUMP HOUSE — " "
118	SALT WELL 23 — " "
119	" " 24 — " "
120	" " 25 — " "
121	" " 26 — " "
122	R.R. TOOL STORAGE
123	WELL WATER PUMP HOUSE
124	SALT WELL 27—W. BRINE FIELD
125	" " 28— " "

FOR REFERENCE ONLY
DATE: DEC 4 1989 SIGNED

PLATE 9

DATE	REVISIONS	BY
10/2-58	GENERAL REVISIONS	R.F
2/1-60	"	F.N.
2/22-61	" "	J.F
11/7-66	ADDED PAVING	S.M.
5-6-72	GEN. REVISIONS	RF

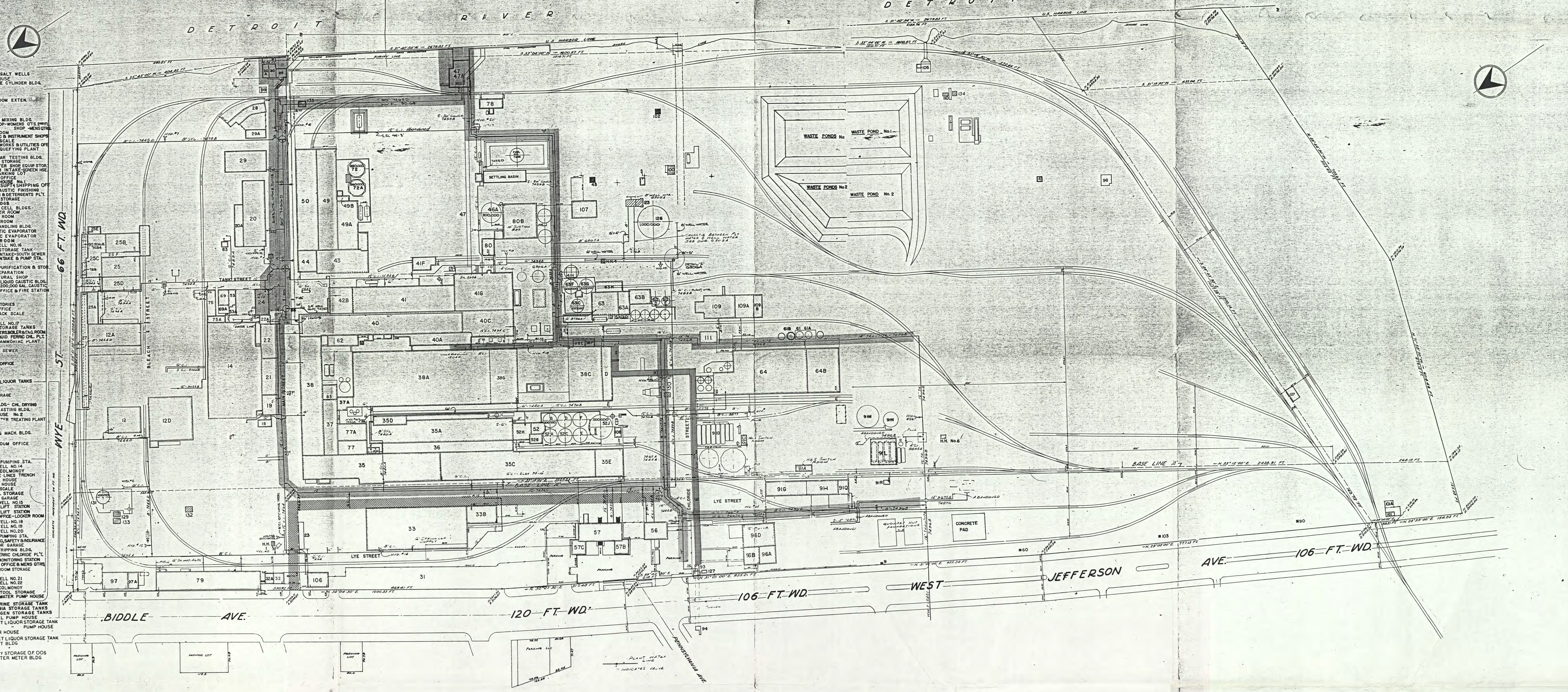
EAST PLANT
PAVING MAP
7111A

DRAWN		CHECKED	
SCALE	1"=50'	DATE	
APPR. NO.	W-668	JOB NO.	

PENNWALT

W03-7111

air?
Water - separate
Elect } on map
Sewer
Steam



4,5, 7,8,9,10,11	SALT WELLS
12, 12D	WAREHOUSE
12A	CHLORINE CYLINDER BLDG.
13	
13A	
13B	
14	STOREROOM EXTEN.
15	
16	
17	
18	MORTAR MIXING BLDG.
19	PIPE SHOP-WOMENS Q'TS. 2ND FL.
20,20A	MACH. SHOP -MENS QTRS.
21	STOREROOM
22	ELECTRIC & INSTRUMENT SHOPS
23	TRUCK SCALE
24	WATER WORKS & UTILITIES OFF
25,25A, Thru F	LIQUEFYING PLANT
26	
27	TANK CAR TESTING BLDG.
28	LUMBER STORAGE
29,29A	CARPENTER SHOP, EQUIP. STOR.
30,30A,B	NORTH INTAKE-SCREEN HSE.
31	AUTO PARKING LOT
32	CHECK OFFICE
33, 33B	- WAREHOUSE No. 1
32A	NIGHT SUPT & SHIPPING OFF
35,35A,B,D	CAUSTIC FINISHING
35C,E	CLEANER & DETERGENTS PL'T.
36	CAUSTIC STORAGE
37,37A	CELL BLDGS
38,38A,B,C,D,E,F	CELL BLDGS.
38G	RECTIFIER ROOM
40,40A	TURBINE ROOM
41,41G	BOILER ROOM
41F	COAL HANDLING BLDG.
42B	CAUSTIC EVAPORATOR
43	CAUSTIC EVAPORATOR
44	TOOL ROOM
45	SALT WELL NO. 16
46A	BRINE STORAGE TANK
47	SOUTH INTAKE-SOUTH SEWER
47A	SOUTH INTAKE & PUMP STA.
49	BRINE PURIFICATION & STOR.
49A,B	SALT SEPARATION
50	STRUCTURAL SHOP
52,G,H	CLEAR LIQUID CAUSTIC BLDG.
52A,B,C,D,E,F	200,000 GAL. CAUSTIC
53,53A	FIELD OFFICE & FIRE STATION
54	
55	
56	LABORATORIES
57	MAIN OFFICE
58	R.R. TRACK SCALE
59	
60	SALT WELL NO. 17
61,61A,B	HCL STORAGE TANKS
62	MENS QTRS. BOILER & ENG. ROOM
63,63A, B-G	LIQUID FERRIC CHL. PLT.
64,64A,B	SAL AMMONIAC PLANT
65	
66	MAIN ST. SEWER
67	
68	
69,69A	FIELD OFFICE
70,70A	
70B	
71	
72,72A	- CELL LIQUOR TANKS
73	
74	
75,75A	OIL STORAGE
76	
77,77A	-TANK BLDG.- CHL. DRYING
78	SANDBLASTING BLDG.
79	WAREHOUSE No. 2
80,80B	FEEDWATER TREATING PLANT
81	
82, 83	VENDING MACH. BLDG.
84	
85	CELL ROOM OFFICE
86	
87	
88	
89	NORTH PUMPING STA.
90	SALT WELL NO. 14
91G,I,Q	WALL COLMONOY
92	SERVICE LINES TRENCH
93	TUNNEL HOUSE
94	METER HOUSE
95	TRACK SCALE
96A,B,D	MISC. STORAGE
97,97A	PLANT GARAGE
98	SALT WELL NO. 15
99	NORTH LIFT STATION
100	SOUTH LIFT STATION
101,101A	WSRR OFFICE-LOCKER ROOM
102	SALT WELL NO. 18
103	SALT WELL NO. 19
104	SALT WELL NO. 20
105	SOUTH PUMPING STA.
106	FIRST AID, SAFETY & INSURANCE
107	TRACTOR GARAGE
108	CAR STRIPPING BLDG.
109,A,B	ANHY. FERRIC CHLORIDE PL'T.
110	WASTE MONITORING STATION
111	FERRIC OFFICE & MENS QTRS.
112	STOREROOM STORAGE
113	
114	SALT WELL NO. 21
115	SALT WELL NO. 22
91Q	WALL COLMONOY
122	WSRR TOOL STORAGE
123	WELL WATER PUMP HOUSE
126	RAW BRINE STORAGE TANK
91D,L	AMMONIA STORAGE TANKS
91M,N,	HYDROGEN STORAGE TANKS
127	TUNNEL PUMP HOUSE
128	REJECT LIQUOR STORAGE TANK
129	" " PUMP HOUSE
130	METER HOUSE
131	REJECT LIQUOR STORAGE TANK
132	VACANT BLDG
133	" "
134	SAFETY STORAGE O.F. OOS
135	30" WATER METER BLDG

▨ WATER LINE EASEMENT
▥ STEAM EASEMENT
▨ ACCESS EASEMENT

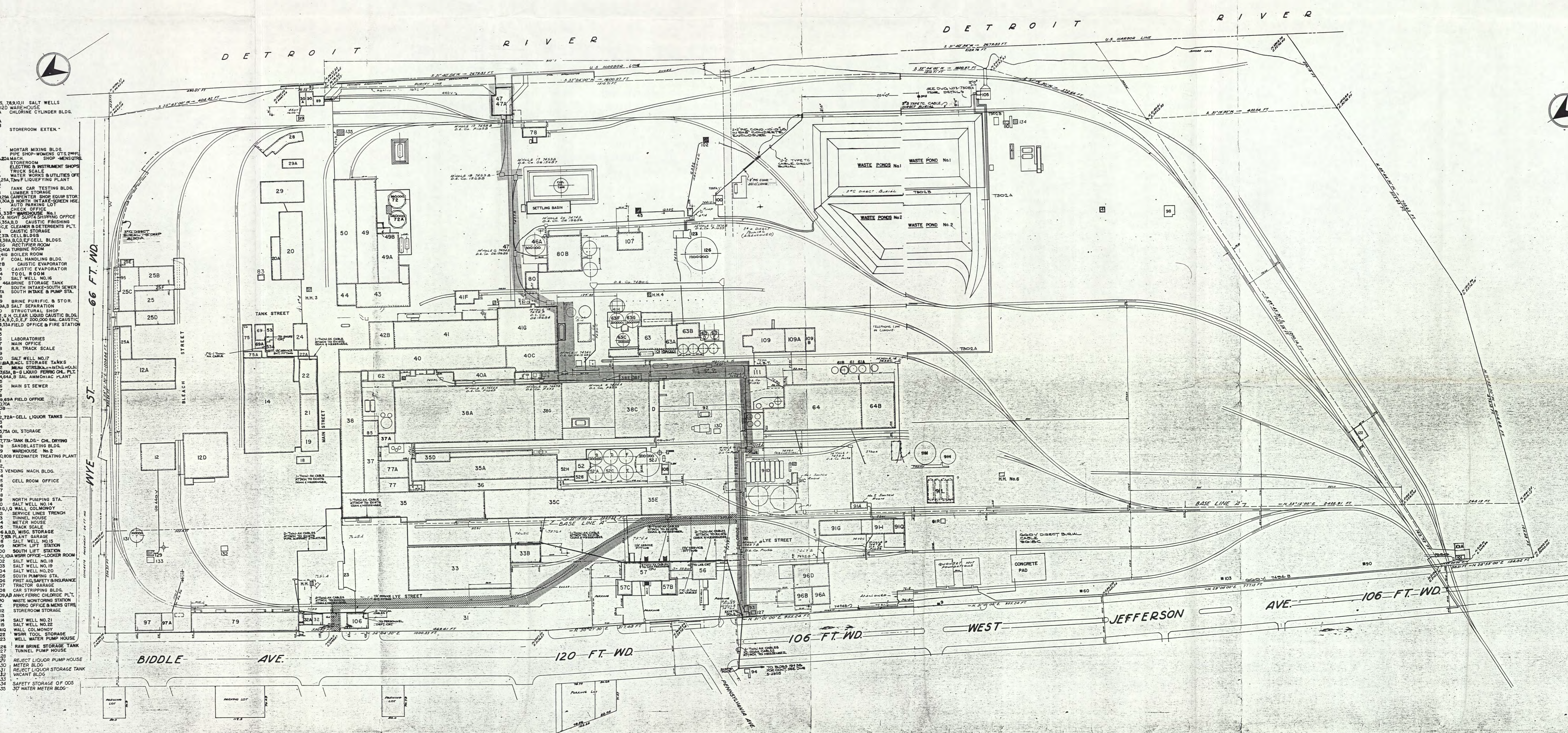
FOR REFERENCE ONL
DATE: DEC 4 1989 SIGNED

PRESSURE VESSEL SERVIC
PENNWALT EASEMENT
WATER & STEAM

APPROVED		APPROVED	
DRAWN		CHECKED	
SCALE	1"=89'	DATE	4-8
APPR. NO.		JOB NO.	

PENNWALT
CORPORATION

N° PLATE 10



▨ POWER EASEMENT

▩ ACCESS EASEMENT

EASEMENTS REQUIRED AFTER NEW WEST PLANT SUB STATION.

FOR REFE

DATE: DEC 4

PRESSURE

PENNWAL

APPROVED	
DRAWN	
SCALE	1"=8
APPR. NO.	

N° | PI

APPENDIX C

SPILL INCIDENT REPORTS

REPORT OF OIL, SALT OR POLLUTING MATERIAL LOSSES

Pursuant to the provisions of Act 245 of the Public Acts of Michigan 1929 as amended, regulations have been is which require that all owners, managers or operators of vessels, oil storage or on land facilities shall notify the V Resources Commission or his authorized representative of oil, salt and polluting material losses. This notification sha made promptly by telephone or telegraph, giving briefly the particulars, and by mail, giving a detailed account of e and conditions.

Date August 20, 1981	Company Name PENNWALT CORPORATION

Location of Loss (Be Specific)
East Plant - West of Reduction Tanks (Dwg. W03-7114B, coordinate 4-H)

Material Lost Reduction Tank Sludge	Amount 100-200 gallons	Name of surface water involved Detroit River

Date Loss was Discovered August 20, 1981	Time of Discovery 2:15 P.M.

Name of Department of Natural Resources Representative Contacted
Ms. Jan Gorman - Pte. Mouillee State Game Area

Telephoned or Telegraphed, by Whom J. J. Lewis	Time 3:50 P.M.; 8/20/8

Cause of Loss (Include Type of Equipment and Other Details)
A roll-off box filled with the residue from the reduction tanks was being loaded onto a vehicle, and the angle it attained during loading resulted in 100-200 gallons of reduction tank sludge spilled to the ground.

Nature of Loss (Include Complete Description of Damage)
20-60 gallons of sludge flowed through surface drain west of the reduction tanks to outfall 003. The pH was below 6.0 pH for 43 minutes attaining a low of 4.9 pH.

Additional Comments (Include Method of Control, Plans for Prevention of Recurrence, etc.)
The manhole was dammed off temporarily with earth to confine liquid drainage. The remaining liquid will be absorbed in Speedy Dry for off-site disposal. The manhole will be fitted with roll-over drum to prevent future spills.

Company Name PENNWALT CORPORATION	By (Signature) JJLewis J. J. Lewis

Return this form to:

Department of Natural Resources
Bureau of Water Management
8th Floor Stevens T. Mason Bldg.
Lansing, Michigan 48926

24 hr. Emergency Notification Number
517 — 373-7660

REPORT OF OIL, SALT OR POLLUTING MATERIAL

Pursuant to the provisions of Act 245 of the Public Acts of Michigan 1929 as amended, regulations have b which require that all owners, managers or operators of vessels, oil storage or on land facilities shall notify Resources Commission or his authorized representative of oil, salt and polluting material losses. This notificatio made promptly by telephone or telegraph, giving briefly the particulars, and by mail, giving a detailed account and conditions.

Date: September 14, 1980

Company Name: PENNWALT CORPORATION

Location of Loss (Be Specific): Vicinity SW Corner Bldg. 63A - Liquid Ferric Chloride - East Plant

Material Lost: Water solution of 35% $FeCl_2$, 5% $FeCl_3$, 1% HCl

Amount: Est. 500-700 gallons

Name of Surface Water Involved: None

Date Loss was Discovered: September 14, 1980

Time of Discovery: 11:55 P.M.

Name of Department of Natural Resources Representative Contacted: Sue Norton - Pte. Mouillee State Game Area

Telephoned or Telegraphed by Whom: R. A. Heineman

Time: 8:30 A.M. 9/15

Cause of Loss (Include Type of Equipment and Other Details):

Pipe elbow on liquid feed to South absorption tower failed allowing liquid to leak to groun Portion of solution recovered in containment - process water system. Remainder leaked to ground. No surface drains in area - spill retained in depressed area.

Nature of Loss (Include Complete Description of Damage):

500-700 gallons solution which was partially reclaimed.

Remedial Comments (Include Methods of Control, Plans for Prevention of Recurrence, etc.):

Material on ground neutralized with soda ash. Spill picked up by contract hauler vacuum truck and disposed of off-site by licensed disposer by fixation. Flow to tower shut off and Bondstrand elbow replaced.

Company Name: PENNWALT CORPORATION

By (Signature): Heineman

R. A. Heineman

Return this form to:

Department of Natural Resources
Bureau of Water Management
8th Floor Stevens T. Mason Bldg.
Lansing, Michigan 48926

24 hr. Emergency Notification:
517 — 373-7660

DEPARTMENT OF NATURAL RESOURCES

REPORT OF OIL, SALT OR POLLUTING MATERIAL LOSSES

Pursuant to the provisions of Act 245 of the Public Acts of Michigan 1929 as amended, regulations have been [illegible]h require that all owners, managers or operators of vessels, oil storage or on land facilities shall notify the [illegible]ources Commission or his authorized representative of oil, salt and polluting material losses. This notification sh made promptly by telephone or telegraph, giving briefly the particulars, and by mail, giving a detailed account of and conditions.

Date
July 26, 1983

Company Name
PENNWALT CORPORATION

Location of Loss (Be Specific)
East Plant - Anhydrous Ferric Chloride - Bldg. 109

Material Lost
Ferric Chloride

Amount
1000 lbs. (estimate)

Name of surface water involved
Detroit River

Date Loss was Discovered
July 25, 1983

Time of Discovery
8:05 P.M.

Name of Department of Natural Resources Representative Contacted
Brian Reicks-Grosse Ile Office. (T. Eftaxiadias - Emergency Response Center, Lansing - 9:50 P.M., 7/25/83)

Telephoned or Telegraphed by Whom
J. J. Lewis

Time
8:15 A.M.; 7/26/8

Cause of Loss (Include Type of Equipment and Other Details)
Anhydrous Ferric Chloride furnace developed a leak in the wall of the reaction chamber and [illegible]ic Chloride leaked into the non-contact cooling water.

Nature of Loss (Include Complete Description of Damage)
About 1,000 pounds of Ferric Chloride leaked into the non-contact cooling water and to outfall 003. Hydrolysis of the ferric caused the pH of the outfall to drop suddenly. The pH was below 6 for about 1 hour and 5 minutes.

Additional Comments (Include Method of Control, Plans for Prevention of Recurrence, etc.)
As a result of the response to the low pH, the furnace was found to be leaking and the chlorine flow to the furnace was shut off immediately. As soon as practical, the flow of cooling water was stopped. The emission lasted between 50 minutes and 1 hour. The minimum pH was 2.2.

Company Name
PENNWALT CORPORATION

By (Signature)
J J Lewis
J. J. Lewis

Return this form to:

Department of Natural Resources
Bureau of Water Management
8th Floor Stevens T. Mason Bldg.
Lansing, Michigan 48926

24 hr. Emergency Notification Number
517 — 373-7660

REPORT OF OIL, SALT OR POLLUTING MATERIAL LOSSES

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Date: June 24, 1983

Company Name: PENNWALT CORPORATION

Location of Loss (Be Specific): East Plant - Anhydrous Ferric Chloride - Bldg. 109

Material Loss: Process Wash Water

Amount: Est. 1200 gal. @ 2% $FeCl_3$

Name of surface water involved: Detroit River - Outfall 003

Date Loss was Discovered: June 24, 1983

Time of Discovery: 2:40 A.M.

Name of Department of Natural Resources Representative Contacted: Mr. Jack Patel, Grosse Ile & PEAS (Lansing)

Telephoned or Telegraphed by Whom: J. J. Lewis

Time: 9:30 A.M.; 6/24/83

Cause of Loss (Include Type of Equipment and Other Details):

Sump pump in the Anhydrous Ferric Chloride failed and spare was also inoperable. When the process was being washed out, sufficient water accumulated on the floor of the process tha[illegible] the level exceeded the containment curbs, and wash water overflowed to the surface drain leading to Outfall 003. This wash water is normally routed to the Liquid Ferric process.

Nature of Loss (Include Complete Description of Damage):

The pH of the outfall remained in compliance, but sufficient iron reached the outfall to cause the treatment system to have a red color. By the time there was sufficient light to observe the point of confluence with the river, no color was evident. Loss of $FeCl_3$ was less than RQ of 1000 pounds.

Additional Comments (Include Method of Control, Plans for Prevention of Recurrence, etc.)

As soon as the color at the neutralization station was observed, the addition of water at Anhydrous Ferric was stopped. Repair personnel were called in to repair the pumps. It was found that there was sufficient solids accumulation in the sump to interfere with the pumps. The solids in the sump will be removed by a licensed contractor who will haul it to an approved disposal facility.

Company Name: PENNWALT CORPORATION

By (Signature): J J Lewis

J. J. Lewis

Return this form to:

Department of Natural Resources
Bureau of Water Management
8th Floor Stevens T. Mason Bldg.
Lansing, Michigan 48926

24 hr. Emergency Notification Number
517 — 373-7660

DEPARTMENT OF NATURAL RESOURCES

REPORT OF OIL, SALT OR POLLUTING MATERIAL LOSSES

[illegible]ant to the provisions of Act 245 of the Public Acts of Michigan 1929 as amended, regulations have been issu w[illegible]equire that all owners, managers or operators of vessels, oil storage or on land facilities shall notify the Wat Res[illegible]ces Commission or his authorized representative of oil, salt and polluting material losses. This notification shall made promptly by telephone or telegraph, giving briefly the particulars, and by mail, giving a detailed account of even and conditions.

Date: October 20, 1983

Company Name: PENNWALT CORPORATION

Location of Loss (Be Specific): Copper Recovery Slab West of Bldg. 63B - East Plant

Material Lost: Ferrous Chloride Solution

Amount: Est. total 1,000 gal.

Name of surface water involved: Detroit River

Date Loss was Discovered: October 20, 1983

Time of Discovery: 10:45 A.M. & 2:00 P.M.

Name of Department of Natural Resources Representative Contacted: PEAS - Lansing & Mr. R. Schrameck - Grosse Ile Office

Telephoned or Telegraphed by Whom: R. A. Heineman

PEAS - Time 5:00 P.M.; 10/20/

Grosse Ile - 8:30 A.M.; 10/21/8

Cause of Loss (Include Type of Equipment and Other Details): Drain plug used to drain natural precipitation from slab, when inactive, was in place but l[illegible]d during time material was being placed on slab.

Nature of Loss (Include Complete Description of Damage): pH of Outfall 003 dropped to a low of 5.4 and was below pH 6.0 for about one-half hour in the morning. pH dropped to a low of 4.9 and was below pH 6.0 for about one hour in the afternoon. Reported to National Response Center.

Additional Comments (Include Method of Control, Plans for Prevention of Recurrence, etc.) The drain for natural precipitation is normally plugged and opened, after analysis, to the outfall to drain water from the slab. The excursion in the morning corrected itself before the cause was discovered. In the P.M., the reason was learned and transfer of sludge stopped. Drainage from the sludge is normally pumped back to the process, but the plug in the drain to 003 apparently leaked. This is a three or four time per year operation. The facility will be thoroughly inspected and closure for outlet to outfall made more positive. There is no evidence of overflow of dike curbs to surrounding area.

Company Name: PENNWALT CORPORATION

By (Signature): RAHeineman

R. A. Heineman

Return this form to:

Department of Natural Resources
Bureau of Water Management
8th Floor Stevens T. Mason Bldg.
Lansing, Michigan 48926

24 hr. Emergency Notification Number
517 — 373-7660

DEPARTMENT OF NATURAL RESOURCES

REPORT OF OIL, SALT OR POLLUTING MATERIAL LOSSES

uant to the provisions of Act 245 of the Public Acts of Michigan 1929 as amended, regulations have been issu ich require that all owners, managers or operators of vessels, oil storage or on land facilities shall notify the Wat esources Commission or his authorized representative of oil, salt and polluting material losses. This notification [illegible] made promptly by telephone or telegraph, giving briefly the particulars, and by mail, giving a detailed account o [illegible] and conditions.

Date: 4/25/80

Company Name: PENNWALT CORPORATION

Location of Loss (Be Specific): Copper sludge recovery slab approx. 75 ft. west Bldg. 63B - East Plant

Liquid Ferric Chloride Process

Material Lost: Solution containing approx. 25% $FeCl_2$, *1.9% Tot. Cu, <1% HCl

Amount: Est. 200 gal.

Name of surface water involved: Detroit River

Date Loss was Discovered: 4/25/80

Time of Discovery: 3:00 p.m.

Name of Department of Natural Resources Representative Contacted: Operator #4. - PEAS - Lansing, MI.

Telephoned or Telegraphed by Whom: R. A. Heineman

Time: 5:10 p.m. - 4/25/8

Cause of Loss (Include Type of Equipment and Other Details):
Crane operator overfilled curbed slab used for copper sludge recovery. Liquid ran to adjacent surface drain and to Outfall 003 to River. Curbing needs repair.

Nature of Loss (Include Complete Description of Damage):
Solution containing approx. 25% $FeCl_2$, 1.9% Tot. Cu & <1% HCl was spilled on ground, some of which reached surface drain. pH of outfall 003 did not go below Permit limit of 6.5.

* Tot. Copper assumed to be essentially colloidal, metallic copper.

Additional Comments (Include Method of Control, Plans for Prevention of Recurrence, etc.):
Operator reprimanded for careless handling of material. Curb repairs are needed & will be done. Manhole covers included in PIP Plan would have prevented loss to outfall. Liquid on ground picked up by vac-truck and returned to process.

Company Name: PENNWALT CORPORATION

By (Signature):
R. A. Heineman

Return this form to:

Department of Natural Resources
Bureau of Water Management
8th Floor Stevens T. Mason Bldg.
Lansing, Michigan 48926

24 hr. Emergency Notification Number
517 — 373-7660

DEPARTMENT OF NATURAL RESOURCES

REPORT OF OIL, SALT OR POLLUTING MATERIAL LOSSES

Pursuant to the provisions of Act 245 of the Public Acts of Michigan 1929 as amended, regulations have been is which require that all owners, managers or operators of vessels, oil storage or on land facilities shall notify the W. Resources Commission or his authorized representative of oil, salt and polluting material losses. This notification sha made promptly by telephone or telegraph, giving briefly the particulars, and by mail, giving a detailed account of e and conditions.

Date: 3-21-80

Company Name: Pennwalt Corporation

Location of Loss (Be Specific): Pumphouse vic. tanks 63C, F & G, Liquid Ferric Chloride Process - East Plant

Material Lost: 40% Fe Cl_3 solution

Amount: Approx. 40 gal.

Name of surface water involved: Detroit River

Date Loss was Discovered: 3-21-80

Time of Discovery: 7:40 a.m.

Name of Department of Natural Resources Representative Contacted: Mr. Bill Stone - Pte. Mouillee State Game Area

Telephoned or Telegraphed by Whom: R. A. Heineman

Time: 11:50 a.m. - 3-21

Cause of Loss (Include Type of Equipment and Other Details):
Leak in rubber-lined steel piping at flange in pumphouse at Liquid Ferric Chloride process. Pipe failure due to external corrosion of steel pipe.

Nature of Loss (Include Complete Description of Damage):
Approximately 40 gal. of solution leaked to curbed floor of pump-house and reached settlinc ponds and 005 outfall because floor-drain plugs had been removed due to water from inclemer weather running into building.

Additional Comments (Include Method of Control, Plans for Prevention of Recurrence, etc.):
Leakage would normally have been contained by curbed floor and material reclaimed. Operat replaced plug upon leak discovery. Acidic $FeCl_3$ solution partially neutralized in pond. content of Pond influent and effluent to 005 outfall reported on M.O.R.

Company Name: Pennwalt Corporation

By (Signature):

R. A. Heineman

Return this form to:

Department of Natural Resources
Bureau of Water Management
5th Floor Stevens T. Mason Bldg.
Lansing, Michigan 48926

24 hr. Emergency Notification Number
517 — 373-7660

MICHIGAN DEPARTMENT OF NATURAL RESOURCES
WATER QUALITY DIVISION
505 WEST MAIN STREET
NORTHVILLE, MICHIGAN 48167

Date: April 1, 1987

Company Name: PENNWALT CORPORATION

Location of Loss (Be Specific): Bldg. 43, East Plant

Material Lost: PCB Liquid

Amount: Approx. 5 gallons

Name of surface water involved: None

Date Loss was Discovered: March 31, 1987

Time of Discovery: 4:00 P.M.

Name of Department of Natural Resources Representative Contacted: PEAS (Also discussed with Maggie Fields, Northville, 9:30 A.M. on 4/1/87.)

Telephoned or Telegraphed by Whom: T. M. Ray also NRC

Time: 5:30 P.M. 3/31/87

Cause of Loss (Include Type of Equipment and Other Details):

Contractor was disconnecting low voltage transformer electrical connection when bushing began leaking. (Transformer was being readied for disposal, prior to building demolition.)

Nature of Loss (Include Complete Description of Damage):

Material dripped from transformer on roof of building through conduit to floors below. A small amount of material reached the ground floor and a floor drain. It appears that material was contained in the drain trap.

Additional Comments (Include Method of Control, Plans for Prevention of Recurrence, etc.):

As soon as Pennwalt personnel discovered the leak, sorbent material was obtained and spread on floors and a pan placed to contain drips. The drain was covered and sealed with plastic. The transformer and contaminated articles will be disposed of off-site at approved facilities. Affected building areas will be decontaminated.

Company Name: PENNWALT CORPORATION

By (Signature): T. M. Ray 4/2/

bcc: B19, D97, D108, H36, ~~H69~~, R3, R39
circ. bcc: B100

4/2

REPORT OF OIL, SALT OR POLLUTING MATERIAL LOSSES

ursuant to the provisions of Act 245 of the Public Acts of Michigan 1929 as amended, regulations have been iss ch[illegible]equire that all owners, managers or operators of vessels, oil storage or on land facilities shall notify the W Res[illegible]es Commission or his authorized representative of oil, salt and polluting material losses. This notification shal nade promptly by telephone or telegraph, giving briefly the particulars, and by mail, giving a detailed account of ev and conditions.

Date: April 30, 1981

Company Name: PENNWALT CORPORATION

Location of Loss (Be Specific): Building 109 - East Side North End - East Plant (Anhydrous Ferric Chloride)

Material Lost: Wash water containing 5-10% $FeCl_3$ (est.)

Amount: est. 50 gallons

Name of surface water involved: Detroit River

Date Loss was Discovered: April 30, 1981

Time of Discovery: 7:55 A.M.

Name of Department of Natural Resources Representative Contacted: Mrs. Sue Norton - Pte. Mouillee State Game Area

Telephoned or Telegraphed by Whom: R. A. Heineman

Time: 9:10 A.M.; 4/30/81

Cause of Loss (Include Type of Equipment and Other Details):
Contaminated water holding tank pump failed (casing leaked) and material leaked to floor and to g[illegible]d outside building and to adjacent surface drain to 003 outfall.

Nature of Loss (Include Complete Description of Damage):
An estimated 20 to 40 lbs. of $FeCl_3$ in water used to wash exterior of product drums was lost to 003 outfall. The pH of the outfall dropped to a low point of 6.3 and returned to normal over a span of about 25 minutes. A very minor brownish discoloration in the river in the immediate vicinity of the outfall was observed during this period.

Additional Comments (Include Method of Control, Plans for Prevention of Recurrence, etc.):
Upon observing the pump leakage, the operator switched to the installed spare pump, stopping the leak and transferring the contaminated wash water to the Liquid Ferric Process where it is used as make-up water per normal operating practice. Installation of curbing around this tank and pump will be investigated.

Company Name: PENNWALT CORPORATION

By (Signature):

R. A. Heineman

copy - Marine Safety Office
477 Michigan Avenue
Room 550
Detroit, Michigan 48226
Attn: Lt. Boynton

Return this form to:

Department of Natural Resources
Bureau of Water Management
8th Floor Stevens T. Mason Bldg.
Lansing, Michigan 48926

24 hr. Emergency Notification Number
517 — 373-7660

REPORT OF OIL, SALT OR POLLUTING MATERIAL LOSSES

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Date
April 7, 1982

Company Name
PENNWALT CORPORATION

Location of Loss (Be Specific)
East Plant - Street North of Building 64

Material Lost
Ferric Chloride Solution

Amount
50 gallons est.

Name of surface water involved
Detroit River via Outfall 003

Date Loss was Discovered
April 6, 1982

Time of Discovery
11:15 A.M.

Name of Department of Natural Resources Representative Contacted
Mr. William Stone - Grosse Ile Office

Telephoned or Telegraphed by Whom
J. J. Lewis

Time
4:25 P.M.; 4/7/82

Cause of Loss (Include Type of Equipment and Other Details)
A contract hauler's truck loaded with liquid ferric chloride product had left the loading area and was driving along the road north of Building 64 (Chloride Street), the truck lurched and solution flowed from the hose connected to the top loading connection of the tanker.

Nature of Loss (Include Complete Description of Damage)
About 50 gallons flowed to the roadway in front of the instrument house for outfall 003. Some of the material reached the outfall.

Additional Comments (Include Method of Control, Plans for Prevention of Recurrence, etc.)
Both valves on the top loading connection were not closed, and the cap for the end of the loading hose was not in place. The loading personnel have been cautioned to ensure that the trucks are properly secured before releasing them.

Company Name
PENNWALT CORPORATION

By (Signature)
J. J. Lewis

Return this form to:

Department of Natural Resources
Bureau of Water Management
8th Floor Stevens T. Mason Bldg.
Lansing, Michigan 48926

24 hr. Emergency Notification Number
517 — 373-7660

REPORT OF OIL, SALT OR POLLUTING MATERIAL LOSSES

Pursuant to the provisions of Act 245 of the Public Acts of Michigan 1929 as amended, regulations have been is ch require that all owners, managers or operators of vessels, oil storage or on land facilities shall notify the W ources Commission or his authorized representative of oil, salt and polluting material losses. This notification sha made promptly by telephone or telegraph, giving briefly the particulars, and by mail, giving a detailed account of e and conditions.

Date
June 16, 1980

Company Name
PENNWALT CORPORATION

Location of Loss (Be Specific)
No. 3 run-down tank, inside south wall Bldg. 25, East Plant.

Material Lost
95% H_2SO_4

Amount
40-50 gal.

Name of Surface Water Involved
Detroit River

Date Loss was Discovered
June 16, 1980

Time of Discovery
10:10 A.M.

Name of Department of Natural Resources Representative Contacted
Mr. Bill Stone, Pte. Mouillee State Game Area

Telephoned or Telegraphed by Whom
R. A. Heineman

Time
10:50 A.M. 6/16/

Cause of Loss (Include Type of Equipment and Other Details)
Bottom of tank leaked when acid was introduced into tank. Tank had been empty.

Nature of Loss (Include Complete Description of Damage)
Seal acid from chlorine compressors was diverted to run-down tank #3 which began leaking to floor and thence to 002 outfall. Leak observed immediately and flow switched to alternate tank. Estimated 40-50 gal. loss occurred while switching valves. Outfall 002 pH dropped some 0.1 pH unit, but remained in compliance.

Additional Comments (Include Method of Control, Plans for Prevention of Recurrence, etc.)
Tank removed from service. Will be inspected, repaired, and tested before re-installation. Will consider benefit of improved curbing in tank area.

Company Name
PENNWALT CORPORATION

By (Signature)
RAHeineman
R. A. Heineman

Return this form to:

Department of Natural Resources
Bureau of Water Management
8th Floor Stevens T. Mason Bldg.
Lansing, Michigan 48926

24 hr. Emergency Notification Number
517 — 373-7660

MICHIGAN DEPARTMENT OF NATURAL RESOURCES
9311 GROH ROAD
GROSSE ILE, MICHIGAN 48138

Date	Company Name
July 17, 1984	PENNWALT CORPORATION

Location of Loss (Be Specific)
East of Bldg. 56 - Control Laboratory - East Plant.

Material Lost	Amount	Name of surface water involved
FeCl$_3$ Solution	Est. 10-20 gallons.	None

Date Loss was Discovered	Time of Discovery
July 17, 1984	1:30 P.M.

Name of Department of Natural Resources Representative Contacted
Mr. Brian Reicks - Grosse Ile Office

Telephoned or Telegraphed by Whom	Time
R. A. Heineman	3:45 P.M.; 7/17/

Cause of Loss (Include Type of Equipment and Other Details)
Accumulated samples of FeCl$_3$ product from Control Laboratory were being transferred back to process for recovery and sale. Drum leaked on pavement.

Nature of Loss (Include Complete Description of Damage)
The solution on the pavement was neutralized with soda ash and picked up for contract off-site disposal by stabilization.

Additional Comments (Include Method of Control, Plans for Prevention of Recurrence, etc.)
Future transfers will be made in corrosion resistant containers which are intact of leaks.

Company Name	By (Signature)
PENNWALT CORPORATION	RAHeineman R. A. Heineman

Report to Grosse Ile, only, adequate per Mr. Brian Reicks.

7/19
bcc: B84, H36, H59, L5, M47, M54, R14
circ. bcc: B100, D55, D108, K4, M41

REPORT OF OIL, SALT OR POLLUTING MATERIAL LOSSES

Pursuant to the provisions of Act 245 of the Public Acts of Michigan 1929 as amended, regulations have been is hich require that all owners, managers or operators of vessels, oil storage or on land facilities shall notify the V sources Commission or his authorized representative of oil, salt and polluting material losses. This notification sha made promptly by telephone or telegraph, giving briefly the particulars, and by mail, giving a detailed account of e and conditions.

Date: August 20, 1981

Company Name: PENNWALT CORPORATION

Location of Loss (Be Specific): East Plant - West of Reduction Tanks (Dwg. W03-7114B, coordinate 4-H)

Material Lost: Reduction Tank Sludge

Amount: 100-200 gallons

Name of surface water involved: Detroit River

Date Loss was Discovered: August 20, 1981

Time of Discovery: 2:15 P.M.

Name of Department of Natural Resources Representative Contacted: Ms. Jan Gorman - Pte. Mouillee State Game Area

Telephoned or Telegraphed by Whom: J. J. Lewis

Time: 3:50 P.M.; 8/20/8

Cause of Loss (Include Type of Equipment and Other Details):

A roll-off box filled with the residue from the reduction tanks was being loaded onto a ehicle, and the angle it attained during loading resulted in 100-200 gallons of reduction tank sludge spilled to the ground.

Nature of Loss (Include Complete Description of Damage):

20-60 gallons of sludge flowed through surface drain west of the reduction tanks to outfall 003. The pH was below 6.0 pH for 43 minutes attaining a low of 4.9 pH.

Additional Comments (Include Method of Control, Plans for Prevention of Recurrence, etc.):

The manhole was dammed off temporarily with earth to confine liquid drainage. The remaining liquid will be absorbed in Speedy Dry for off-site disposal. The manhole will be fitted with roll-over drum to prevent future spills.

Company Name: PENNWALT CORPORATION

By (Signature): JJLewis

J. J. Lewis

eturn this form to:

Department of Natural Resources
Bureau of Water Management
8th Floor Stevens T. Mason Bldg.
Lansing, Michigan 48926

24 hr. Emergency Notification Number
517 — 373-7660

REPORT OF OIL, SALT OR POLLUTING MATERIAL

rsuant to the provisions of Act 245 of the Public Acts of Michigan 1929 as amended, regulations have
which require that all owners, managers or operators of vessels, oil storage or on land facilities shall notify
Resources Commission or his authorized representative of oil, salt and polluting material losses. This notificatio
made promptly by telephone or telegraph, giving briefly the particulars, and by mail, giving a detailed account
and conditions.

Date: September 14, 1980

Company Name: PENNWALT CORPORATION

Location of Loss (Be Specific): Vicinity SW Corner Bldg. 63A - Liquid Ferric Chloride - East Plant

Material Lost: Water solution of 35% FeCl$_2$, 5% FeCl$_3$, 1% HCl

Amount: Est. 500-700 gallons

Name of Surface Water Affected: None

Date Loss was Discovered: September 14, 1980

Time of Discovery: 11:55 P.M.

Name of Department of Natural Resources Representative Contacted: Sue Norton - Pte. Mouillee State Game Area

Telephoned or Telegraphed by Whom: R. A. Heineman

Time: 8:30 A.M. 9/1

Cause of Loss (Include Type of Equipment and Other Details):

Pipe elbow on liquid feed to South absorption tower failed allowing liquid to leak to groun
Portion of solution recovered in containment - process water system. Remainder leaked to ground. No surface drains in area - spill retained in depressed area.

Nature of Loss (Include Complete Description of Damage):

500-700 gallons solution which was partially reclaimed.

Additional Comments (Include Methods of Control, Plans for Prevention of Recurrence, etc.):

Material on ground neutralized with soda ash. Spill picked up by contract hauler vacuum truck and disposed of off-site by licensed disposer by fixation. Flow to tower shut off and Bondstrand elbow replaced.

Company Name: PENNWALT CORPORATION

By (Signature): Heineman

R. A. Heineman

Return this form to:

Department of Natural Resources
Bureau of Water Management
6th Floor Stevens T. Mason Bldg.
Lansing, Michigan 48926

24 hr. Emergency Notification [illegible]
517 — 373-7660

DEPARTMENT OF NATURAL RESOURCES

REPORT OF OIL, SALT OR POLLUTING MATERIAL LOSSES

ursuant to the provisions of Act 245 of the Public Acts of Michigan 1929 as amended, regulations have been issu w[illegible]equire that all owners, managers or operators of vessels, oil storage or on land facilities shall notify the Wat Resources Commission or his authorized representative of oil, salt and polluting material losses. This notification shall made promptly by telephone or telegraph, giving briefly the particulars, and by mail, giving a detailed account of even and conditions.

Date: October 20, 1983

Company Name: PENNWALT CORPORATION

Location of Loss (Be Specific): Copper Recovery Slab West of Bldg. 63B - East Plant

Material Lost: Ferrous Chloride Solution

Amount: Est. total 1,000 gal.

Name of surface water involved: Detroit River

Date Loss was Discovered: October 20, 1983

Time of Discovery: 10:45 A.M. & 2:00 P.M.

Name of Department of Natural Resources Representative Contacted: PEAS - Lansing & Mr. R. Schrameck - Grosse Ile Office

Telephoned or Telegraphed by Whom: R. A. Heineman

PEAS - Time 5:00 P.M.; 10/20/

Grosse Ile - 8:30 A.M.; 10/21/

Cause of Loss (Include Type of Equipment and Other Details): Drain plug used to drain natural precipitation from slab, when inactive, was in place but [illegible]d during time material was being placed on slab.

Nature of Loss (Include Complete Description of Damage): pH of Outfall 003 dropped to a low of 5.4 and was below pH 6.0 for about one-half hour in the morning. pH dropped to a low of 4.9 and was below pH 6.0 for about one hour in the afternoon.

Reported to National Response Center.

Additional Comments (Include Method of Control, Plans for Prevention of Recurrence, etc.) The drain for natural precipitation is normally plugged and opened, after analysis, to the outfall to drain water from the slab. The excursion in the morning corrected itself before the cause was discovered. In the P.M., the reason was learned and transfer of sludge stopped. Drainage from the sludge is normally pumped back to the process, but the plug in the drain to 003 apparently leaked. This is a three or four time per year operation. The facility will be thoroughly inspected and closure for outlet to outfall made more positive. There is no evidence of overflow of dike curbs to surrounding area.

Company Name: PENNWALT CORPORATION

By (Signature): RAHeineman

R. A. Heineman

Return this form to:

Department of Natural Resources
Bureau of Water Management
8th Floor Stevens T. Mason Bldg.
Lansing, Michigan 48926

24 hr. Emergency Notification Number
517 — 373-7660

DEPARTMENT OF NATURAL RESOURCES

REPORT OF OIL, SALT OR POLLUTING MATERIAL LOSSES

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Date
4/25/80

Company Name
PENNWALT CORPORATION

Location of Loss (Be Specific)
Copper sludge recovery slab approx. 75 ft. west Bldg. 63B - East Plant
Liquid Ferric Chloride Process

Material Lost
Solution containing approx. 25% $FeCl_2$, *1.9% Tot. Cu, <1% HCl

Amount
Est. 200 gal.

Name of surface water involved
Detroit River

Date Loss was Discovered
4/25/80

Time of Discovery
3:00 p.m.

Name of Department of Natural Resources Representative Contacted
Operator #4. - PEAS - Lansing, MI.

Telephoned or Telegraphed by Whom
R. A. Heineman

Time
5:10 p.m. - 4/25/8

Cause of Loss (Include Type of Equipment and Other Details)
Crane operator overfilled curbed slab used for copper sludge recovery. Liquid ran to adjacent surface drain and to Outfall 003 to River. Curbing needs repair.

Nature of Loss (Include Complete Description of Damage)
Solution containing approx. 25% $FeCl_2$, 1.9% Tot. Cu & <1% HCl was spilled on ground, some of which reached surface drain. pH of outfall 003 did not go below Permit limit of 6.5.

* Tot. Copper assumed to be essentially colloidal, metallic copper.

Additional Comments (Include Method of Control, Plans for Prevention of Recurrence, etc.)
Operator reprimanded for careless handling of material. Curb repairs are needed & will be done. Manhole covers included in PIP Plan would have prevented loss to outfall. Liquid on ground picked up by vac-truck and returned to process.

Company Name
PENNWALT CORPORATION

By (Signature)
R. A. Heineman

Return this form to:

Department of Natural Resources
Bureau of Water Management
8th Floor Stevens T. Mason Bldg.
Lansing, Michigan 48926

24 hr. Emergency Notification Number
517 — 373-7660

DEPARTMENT OF NATURAL RESOURCES

REPORT OF OIL, SALT OR POLLUTING MATERIAL LOSSES

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Date: July 26, 1983

Company Name: PENNWALT CORPORATION

Location of Loss (Be Specific): East Plant - Anhydrous Ferric Chloride - Bldg. 109.

Material Lost: Ferric Chloride

Amount: 1000 lbs. (estimate)

Name of Surface Water Involved: Detroit River

Date Loss was Discovered: July 25, 1983

Time of Discovery: 8:05 P.M.

Name of Department of Natural Resources Representative Contacted: Brian Reicks-Grosse Ile Office. (T. Eftaxiadias - Emergency Response Center, Lansing - 9:50 P.M., 7/25/83)

Telephoned or Telegraphed by Whom: J. J. Lewis

Time: 8:15 A.M.; 7/26/8

Cause of Loss (Include Type of Equipment and Other Details):

Anhydrous Ferric Chloride furnace developed a leak in the wall of the reaction chamber and [illegible]c Chloride leaked into the non-contact cooling water.

Nature of Loss (Include Complete Description of Damage):

About 1,000 pounds of Ferric Chloride leaked into the non-contact cooling water and to outfall 003. Hydrolysis of the ferric caused the pH of the outfall to drop suddenly. The pH was below 6 for about 1 hour and 5 minutes.

Additional Comments (Include Method of Control, Plans for Prevention of Recurrence, etc.):

As a result of the response to the low pH, the furnace was found to be leaking and the chlorine flow to the furnace was shut off immediately. As soon as practical, the flow of cooling water was stopped. The emission lasted between 50 minutes and 1 hour. The minimum pH was 2.2.

Company Name: PENNWALT CORPORATION

By (Signature): J J Lewis

J. J. Lewis

Return this form to:

Department of Natural Resources
Bureau of Water Management
8th Floor Stevens T. Mason Bldg.
Lansing, Michigan 48926

24 hr. Emergency Notification Number
517 — 373-7660

REPORT OF OIL, SALT OR POLLUTING MATERIAL LOSSES

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Date: June 24, 1983

Company Name: PENNWALT CORPORATION

Location of Loss (Be Specific): East Plant - Anhydrous Ferric Chloride - Bldg. 109

Material Lost: Process Wash Water

Amount: Est. 1200 gal. @ 2% $FeCl_3$

Name of surface water involved: Detroit River - Outfall 003

Date Loss was Discovered: June 24, 1983

Time of Discovery: 2:40 A.M.

Name of Department of Natural Resources Representative Contacted: Mr. Jack Patel, Grosse Ile & PEAS (Lansing)

Telephoned or Telegraphed by Whom: J. J. Lewis

Time: 9:30 A.M.; 6/24/83

Cause of Loss (Include Type of Equipment and Other Details)

Sump pump in the Anhydrous Ferric Chloride failed and spare was also inoperable. When the process was being washed out, sufficient water accumulated on the floor of the process tha the level exceeded the containment curbs, and wash water overflowed to the surface drain leading to Outfall 003. This wash water is normally routed to the Liquid Ferric process.

Nature of Loss (Include Complete Description of Damage)

The pH of the outfall remained in compliance, but sufficient iron reached the outfall to cause the treatment system to have a red color. By the time there was sufficient light to observe the point of confluence with the river, no color was evident. Loss of $FeCl_3$ was less than RQ of 1000 pounds.

Additional Comments (Include Method of Control, Plans for Prevention of Recurrence, etc.)

As soon as the color at the neutralization station was observed, the addition of water at Anhydrous Ferric was stopped. Repair personnel were called in to repair the pumps. It was found that there was sufficient solids accumulation in the sump to interfere with the pumps. The solids in the sump will be removed by a licensed contractor who will haul it to an approved disposal facility.

Company Name: PENNWALT CORPORATION

By (Signature): J J Lewis

J. J. Lewis

Return this form to:

Department of Natural Resources
Bureau of Water Management
8th Floor Stevens T. Mason Bldg.
Lansing, Michigan 48926

24 hr. Emergency Notification Number
517 — 373-7660

REPORT OF OIL, SALT OR POLLUTING MATERIAL LOSSES

Pursuant to the provisions of Act 245 of the Public Acts of Michigan 1929 as amended, regulations have been is which require that all owners, managers or operators of vessels, oil storage or on land facilities shall notify the W Resources Commission or his authorized representative of oil, salt and polluting material losses. This notification sha made promptly by telephone or telegraph, giving briefly the particulars, and by mail, giving a detailed account of e and conditions.

Date: June 16, 1980

Company Name: PENNWALT CORPORATION

Location of Loss (Be Specific): No. 3 run-down tank, inside south wall Bldg. 25, East Plant.

Material Lost: 95% H_2SO_4

Amount: 40-50 gal.

Name of surface water involved: Detroit River

Date Loss was Discovered: June 16, 1980

Time of Discovery: 10:10 A.M.

Name of Department of Natural Resources Representative Contacted: Mr. Bill Stone, Pte. Mouillee State Game Area

Telephoned or Telegraphed by Whom: R. A. Heineman

Time: 10:50 A.M. 6/16/

Cause of Loss (Include Type of Equipment and Other Details): Bottom of tank leaked when acid was introduced into tank. Tank had been empty.

Nature of Loss (Include Complete Description of Damage): Seal acid from chlorine compressors was diverted to run-down tank #3 which began leaking to floor and thence to 002 outfall. Leak observed immediately and flow switched to alternate tank. Estimated 40-50 gal. loss occurred while switching valves. Outfall 002 pH dropped some 0.1 pH unit, but remained in compliance.

Additional Comments (Include Method of Control, Plans for Prevention of Recurrence, etc.): Tank removed from service. Will be inspected, repaired, and tested before re-installation. Will consider benefit of improved curbing in tank area.

Company Name: PENNWALT CORPORATION

By (Signature): R A Heineman

R. A. Heineman

Return this form to:

Department of Natural Resources
Bureau of Water Management
8th Floor Stevens T. Mason Bldg.
Lansing, Michigan 48926

24 hr. Emergency Notification Number
517 — 373-7660

MICHIGAN DEPARTMENT OF NATURAL RESOURCES
9311 GROH ROAD
GROSSE ILE, MICHIGAN 48138

Date	Company Name
July 17, 1984	PENNWALT CORPORATION

Location of Loss (Be Specific)
East of Bldg. 56 - Control Laboratory - East Plant.

Material Lost	Amount	Name of surface water involved
FeCl3 Solution	Est. 10-20 gallons.	None

Date Loss was Discovered	Time of Discovery
July 17, 1984	1:30 P.M.

Name of Department of Natural Resources Representative Contacted
Mr. Brian Reicks - Grosse Ile Office

Telephoned or Telegraphed by Whom	Time
R. A. Heineman	3:45 P.M.; 7/17/

Cause of Loss (Include Type of Equipment and Other Details)
Accumulated samples of $FeCl_3$ product from Control Laboratory were being transferred back to process for recovery and sale. Drum leaked on pavement.

Nature of Loss (Include Complete Description of Damage)
The solution on the pavement was neutralized with soda ash and picked up for contract off-site disposal by stabilization.

Additional Comments (Include Method of Control, Plans for Prevention of Recurrence, etc.)
Future transfers will be made in corrosion resistant containers which are intact of leaks.

Company Name	By (Signed)
PENNWALT CORPORATION	RAHeineman R. A. Heineman

Report to Grosse Ile, only, adequate per Mr. Brian Reicks.

7/19

bcc: B84, H36, H69, L5, M47, M54, R14
circ. bcc: B100, D55, D108, K4, M41

DEPARTMENT OF NATURAL RESOURCES

REPORT OF OIL, SALT OR POLLUTING MATERIAL LOSSES

Pursuant to the provisions of Act 245 of the Public Acts of Michigan 1929 as amended, regulations have been is which require that all owners, managers or operators of vessels, oil storage or on land facilities shall notify the Resources Commission or his authorized representative of oil, salt and polluting material losses. This notification sha made promptly by telephone or telegraph, giving briefly the particulars, and by mail, giving a detailed account of e and conditions.

Date
3-21-80

Company Name
Pennwalt Corporation

Location of Loss (Be Specific)
Pumphouse vic. tanks 63C, F & G, Liquid Ferric Chloride Process - East Plant

Material Lost
40% $FeCl_3$ solution

Amount
Approx. 40 gal.

Name of surface water involved
Detroit River

Date Loss was Discovered
3-21-80

Time of Discovery
7:40 a.m.

Name of Department of Natural Resources Representative Contacted
Mr. Bill Stone - Pte. Mouillee State Game Area

Telephoned or Telegraphed by Whom
R. A. Heineman

Time
11:50 a.m. - 3-21

Cause of Loss (Include Type of Equipment and Other Details)
Leak in rubber-lined steel piping at flange in pumphouse at Liquid Ferric Chloride process. Pipe failure due to external corrosion of steel pipe.

Nature of Loss (Include Complete Description of Damage)
Approximately 40 gal. of solution leaked to curbed floor of pump-house and reached settlin ponds and 005 outfall because floor-drain plugs had been removed due to water from incleme weather running into building.

Additional Comments (Include Method of Control, Plans for Prevention of Recurrence, etc.)
Leakage would normally have been contained by curbed floor and material reclaimed. Operat replaced plug upon leak discovery. Acidic $FeCl_3$ solution partially neutralized in pond. content of Pond influent and effluent to 005 outfall reported on M.O.R.

Company Name
Pennwalt Corporation

By (Signature)
R A Heineman
R. A. Heineman

Return this form to:

Department of Natural Resources
Bureau of Water Management
8th Floor Stevens T. Mason Bldg.
Lansing, Michigan 48926

24 hr. Emergency Notification Number
517 — 373-7660

MICHIGAN DEPARTMENT OF NATURAL RESOURCES
WATER QUALITY DIVISION
505 WEST MAIN STREET
NORTHVILLE, MICHIGAN 48167

Date: April 1, 1987

Company Name: PENNWALT CORPORATION

Location of Loss (Be Specific): Bldg. 43, East Plant

Material Lost: PCB Liquid

Amount: Approx. 5 gallons

Name of surface water involved: None

Date Loss was Discovered: March 31, 1987

Time of Discovery: 4:00 P.M.

Name of Department of Natural Resources Representative Contacted: PEAS (Also discussed with Maggie Fields, Northville, 9:30 A.M. on 4/1/87.) also NRC

Telephoned or Telegraphed by Whom: T. M. Ray

Time: 5:30 P.M. 3/31/87

Cause of Loss (Include Type of Equipment and Other Details):

Contractor was disconnecting low voltage transformer electrical connection when bushing began leaking. (Transformer was being readied for disposal, prior to building demolition.)

Nature of Loss (Include Complete Description of Damage):

Material dripped from transformer on roof of building through conduit to floors below. A small amount of material reached the ground floor and a floor drain. It appears that material was contained in the drain trap.

Additional Comments (Include Method of Control, Plans for Prevention of Recurrence, etc.):

As soon as Pennwalt personnel discovered the leak, sorbent material was obtained and spread on floors and a pan placed to contain drips. The drain was covered and sealed with plastic. The transformer and contaminated articles will be disposed of off-site at approved facilities. Affected building areas will be decontaminated.

Company Name: PENNWALT CORPORATION

By (Signature): 4/2/

T. M. Ray

bcc: B19, D97, D108, H36, H69, R3, R39
circ. bcc: B100

REPORT OF OIL, SALT OR POLLUTING MATERIAL LOSSES

ursuant to the provisions of Act 245 of the Public Acts of Michigan 1929 as amended, regulations have been iss
h[illegible]equire that all owners, managers or operators of vessels, oil storage or on land facilities shall notify the W
Re[illegible]es Commission or his authorized representative of oil, salt and polluting material losses. This notification shal
nade promptly by telephone or telegraph, giving briefly the particulars, and by mail, giving a detailed account of ev
nd conditions.

Date: April 30, 1981

Company Name: PENNWALT CORPORATION

Location of Loss (Be Specific): Building 109 - East Side North End - East Plant (Anhydrous Ferric Chloride)

Material Lost: Wash water containing 5-10% $FeCl_3$ (est.)

Amount: est. 50 gallons

Name of surface water involved: Detroit River

Date Loss was Discovered: April 30, 1981

Time of Discovery: 7:55 A.M.

Name of Department of Natural Resources Representative Contacted: Mrs. Sue Norton - Pte. Mouillee State Game Area

Telephoned or Telegraphed by Whom: R. A. Heineman

Time: 9:10 A.M.; 4/30/81

Cause of Loss (Include Type of Equipment and Other Details):
Contaminated water holding tank pump failed (casing leaked) and material leaked to floor and to g[illegible]d outside building and to adjacent surface drain to 003 outfall.

Nature of Loss (Include Complete Description of Damage):
An estimated 20 to 40 lbs. of $FeCl_3$ in water used to wash exterior of product drums was lost to 003 outfall. The pH of the outfall dropped to a low point of 6.3 and returned to normal over a span of about 25 minutes. A very minor brownish discoloration in the river in the immediate vicinity of the outfall was observed during this period.

Additional Comments (Include Method of Control, Plans for Prevention of Recurrence, etc.):
Upon observing the pump leakage, the operator switched to the installed spare pump, stopping the leak and transferring the contaminated wash water to the Liquid Ferric Process where it is used as make-up water per normal operating practice. Installation of curbing around this tank and pump will be investigated.

Company Name: PENNWALT CORPORATION

By (Signature):
R. A. Heineman

copy - Marine Safety Office
477 Michigan Avenue
Room 550
Detroit, Michigan 48226
Attn: Lt. Boynton

Return this form to:

Department of Natural Resources
Bureau of Water Management
8th Floor Stevens T. Mason Bldg.
Lansing, Michigan 48926

24 hr. Emergency Notification Number
517 — 373-7660

REPORT OF OIL, SALT OR POLLUTING MATERIAL LOSSES

Pursuant to the provisions of Act 245 of the Public Acts of Michigan 1929 as amended, regulations have been issu which require that all owners, managers or operators of vessels, oil storage or on land facilities shall notify the Wa Resources Commission or his authorized representative of oil, salt and polluting material losses. This notification shall made promptly by telephone or telegraph, giving briefly the particulars, and by mail, giving a detailed account and conditions.

Date: April 7, 1982
Company Name: PENNWALT CORPORATION
Location of Loss (Be Specific): East Plant - Street North of Building 64

Material Lost: Ferric Chloride Solution
Amount: 50 gallons est.
Name of surface water involved: Detroit River via Outfall 003
Date Loss was Discovered: April 6, 1982
Time of Discovery: 11:15 A.M.
Name of Department of Natural Resources Representative Contacted: Mr. William Stone - Grosse Ile Office
Telephoned or Telegraphed by Whom: J. J. Lewis
Time: 4:25 P.M.; 4/7/82

Cause of Loss (Include Type of Equipment and Other Details)

A contract hauler's truck loaded with liquid ferric chloride product had left the loading area and was driving along the road north of Building 64 (Chloride Street), the truck lurched and solution flowed from the hose connected to the top loading connection of the tanker.

Nature of Loss (Include Complete Description of Damage)

About 50 gallons flowed to the roadway in front of the instrument house for outfall 003. Some of the material reached the outfall.

Additional Comments (Include Method of Control, Plans for Prevention of Recurrence, etc.)

Both valves on the top loading connection were not closed, and the cap for the end of the loading hose was not in place. The loading personnel have been cautioned to ensure that the trucks are properly secured before releasing them.

Company Name: PENNWALT CORPORATION
By (Signature):
J. J. Lewis

Return this form to:

Department of Natural Resources
Bureau of Water Management
8th Floor Stevens T. Mason Bldg.
Lansing, Michigan 48926

24 hr. Emergency Notification Number
517 — 373-7660

APPENDIX D

LISTING OF PROCESS SOURCES AND CERTIFICATE NUMBERS

Table D-1

Air Permits - 1971, 1974, and 1975

Permitted Manufacturing Process	Rating CFM	Invoice Number	Certificate of Operation Number	
		1971	1974	1975
Ammonia	10	18627		
Sal Ammoniac				
• H_2 Venting from Absorber	5,000	18627	A1663	7981
• Dryer Exhaust	5,000	18627	A1663	7981
• Bagger Exhaust	500	18627	A1663	7981
Anbydrous $FeCl_3$	2,000	18627	A1664	7982
Liquid $FeCl_3$	1,000	18627	A1665	7983
Soda Ash	600	18627	A1666	7984 and scrubber
Chlorine				
• Packed Tower	110	18627	A1667	7985
• Chlorine Cylinder, Paint Spray Booth	10,000	18627	A1668	7986
• Caustic Finishing Bldg., Paint Spray Booth	5,000	18627	A1669	7987
• Caustic Flaker	5,000	18627	A1670 and scrubber	7988
Perchloron				
• Packaging Station	2,500	18627	A1671	7992
• Two Dryers @ 12,000 cfm each	24,000	18627	A1671	7992
• S_aH Trangler Stn. Baghouse	1,000	18627	A1671	7992
• Lime Silo Baghouse	1,000	18627	A1671	7992
• Salt and Lime Weighing Scrubber	1,000	18627	A1671	7992
• Finished Product Baghouse	2,000	18627	A1671	7992
Sodium Orthosilicate				
• Packaging Scrubber	2,000	18627	A1672	7993
• 10,000 cfm Scrubber	10,000	18627	A1672	7993
• 5,000 cfm Scrubber	5,000	18627	A1672	7993

Table D-1

Air Permits - 1971, 1974, and 1975 (continued)

Permitted Manufacturing Process	Rating CFM	Invoice Number 1971	Certificate of Operation Number 1974	Certificate of Operation Number 1975
Caustic Finishing				
• Dowtherm Vaporizer	27 MBtu	18628	A1674 17 MBtu/hr	7994
• Perchoron Dust Collector	3,340 cfm	---	A1675	7995
• Bldg 26 Fume Scrubber & Packed Tower, Drum Filling Operation	550	---	31211	---
• Perchloron Cyclone & Scrubber	4,590	---	A1680	9620
• 1-Muriatic Acid Loading Stn. Packed Tower	500	---	A1676	7996
• 1-Muriatic Acid Ldg Stn Packed Tower	500	---	A1677	7997
• 100# Cylinder Paint Spray Booth	3,000	---	A2676	7978
• Pennwalt Corp. Dist Scrubber	4,590	---	---	9619
• 1 Heil 723V Wet Scrubber for Dry CuDCl Flr 1	3,500	---	---	A13810

Date: 19 January 1990
Revision: 0

Table D-2

Air Permits – 1976, 1977, 1979 – 1984

Process	Certificate of Operation Number							
	1976	1977	1979	1980	1981	1982	1983	1984
Spray Booth 100# Cylinders Filter	500565	600626	800862	900654				
Spray Booth Drums Filter	500566	600627	800863	900655				
Cl_2 Liquidfaction Plant By-Gas Scrubber w/Solut	500572	600628	800867	900659	0-00719	1-00845	2-00745	3-00745
Dryer Sal Ammoniac Multiple Cyclone	500573	600629	800868	900660	0-00780	1-00846	2-00746	3-00746
Packing Sal Ammoniac Single Cyclone	500574	600630	800869	900661	0-00981	1-00847	2-00747	3-00747
Weigher Percloron Centrif Type	500575	600631	800870					
Storage Bin Lime Fabric Filt Coll	500576	600633	800871					
Salt Transfer Fabric Filt Coll	500577	600635	800872					
Predryer Percloron Venturi Scrubber	500578	600637	800873					
Final Dryer Percloron Venturi Scrubber	500579	600638	800874					
Pkg Percl Pulsaire Cyclone: Fabric Filter Coll	500580	600640	800875					
Pkg Percl Amerpulse Cyclone & Fabric Filter Coll	500581	600640	800876					
Pkg Orthosil Contrif Type	500582	600642	800877	900669				
Sal Ammoniac Absorber Scrubber	500594	600643	800879	900671		1-00850	2-00750	3-00750
Anhy Ferric Reactor Scrubber w/ Solution	500595	600644	800880	900672	0-00786 0-00785	1-00851 1-00852	2-00752	3-00752
Liquid Ferric Absorber Venturi Scrubber	500597	600645	800881	900673	0-00787	1-00853	2-00753	3-00753
Soda Ash Toner Scrubber	500598	600646	800882	900674	0-00788	1-00854	2-00754	3-00754
Orthosil Mixer A Scrubber	500599	600647	800883	900675				
Orthosil Mixer B Scrubber	500601	600648	800884	900676				

Table D-2

Air Permits - 1976, 1977, 1979 - 1984
(continued)

	Certificate of Operation Number							
Process	1976	1977	1979	1980	1981	1982	1983	1984
Dowtherm Vaporizer	500603	600649	800885	900677				
Spray Booth Containers Water Fall Spray	500606	600650	800886	900678				
Repacker Percloron Scrubber	500607	600651	800887					
HCl East Loading TRL Scrubber	500608	600652	800888	900680	0-00794	1-00860	2-00760	3-00760
HCl East Loading TC Scrubber	500609	600653	800889	900681	0-00795	1-00861	2-00761	3-00761
Packing Percloron Heil Scrubber, Venturi Scrubber	500610	600654	800890	900697				
Percl Heil CL Scrubber Cyclone & Venturi Scrubber		600655	800891	900698				
Caustic Flaker Centri Type	500592		800906	900670 900697 900699				
Liquid Fer Fume Scrubber			800892	900684	0-00796	1-00862	2-00762	3-00762
Gasoline Tank					0-00817	1-00883	2-00783	3-00783
Fuel Oil Tank					0-00819	1-00885	2-00785	3-00785
Diesel Oil Tank					0-00818	1-00884	2-00784	3-00784

APPENDIX E

ENVIRONMENTAL STUDY
PENNWALT EAST PLANT
WYANDOTTE, MICHIGAN
WESTON, JANUARY 1987

WESTON

ENVIRONMENTAL STUDY
PENNWALT EAST PLANT
WYANDOTTE, MICHIGAN

M. A. Turco
Project Manager

M. N. Bhatia, Ph.D., P.E.
Project Director

January 1987

Prepared by

ROY F. WESTON, INC.
Weston Way
West Chester, Pennsylvania 19380

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PROJECT PARTICIPANTS

The following members of the staff of Roy F. Weston, Inc. have participated in the planning and execution of this project and the preparation of this report:

M. N. Bhatla, Ph.D., P.E.
Project Director

M. A. Turco
Project Manager

M. R. Dzedzy
Geosciences

B. W. Benyish
Geosciences

L. J. Bove
Concept Engineering

M. H. Corbin, P.E.
Quality Assurance
Concept Engineering

P.S. Young, P.G.
Quality Assurance
Geosciences

P. S. Saia
Senior Editor

Also, the following subcontractors supported WESTON's project activities as indicated.

McDowell & Associates
Ferndale, Michigan

Hennessey Engineers, Inc.
Trenton, Michigan

EXECUTIVE SUMMARY

GENERAL

Roy F. Weston, Inc. (WESTON) has been retained by Pennwalt Corporation to perform an environmental study at its East Plant property in Wyandotte, Michigan. The East Plant property occupies approximately 90 acres along the west bank of the Detroit River. The facility was an active chemical production facility from 1898 to 1985. Industrial manufacturing operations focused on the production of chlorine and caustic using the region's subsurface brine deposits as the primary raw material. Over the years other chemicals produced at this facility were ammonia, ammonium chloride, hydrochloric acid, hydrogen peroxide, calcium hypochlorite, carbon tetrachloride, chlorinated benzenes, and chlorinated naphthalenes. In addition, a Gasification Plant (Mond gas) was operated in the early 1900's.

Currently, a portion of this site is leased by Pennwalt to a tenant who uses the facility for the production of ferric chloride. The entire East Plant site was considered for sampling and data analysis for this environmental study.

PHASE I OBJECTIVES

The objectives of Phase I were the following:

- Define the impact of past manufacturing operations on soils and groundwater at the site.
- Locate areas of localized "hot spot" contamination.
- Identify waste management areas.

PHASE I MAJOR FINDINGS AND CONCLUSIONS

During the Phase I effort, soil samples from 26 test pits, two monitor wells, and eight surface soil locations were analyzed for Hazardous Substance List (HSL) organic (volatile, semi-volatile, pesticide/PCB) and/or inorganic parameters. Appendix C contains a complete list of parameters included in the HSL. In addition, groundwater samples were obtained from 12 monitor wells installed during Phase I activities. Each groundwater sample was also analyzed for HSL parameters.

The results of the Phase I organic compounds analysis indicate that three areas of the East Plant may have been impacted by past manufacturing, storage, and/or waste management activities. These areas are:

- The Halowax (chlorinated naphthalenes) production area in the northeast corner of the plant.
- Suspected former burn area located in the southeast corner of the plant along the Detroit River.
- The former Taylor Chemical area (coal pile storage) near the center of the East Plant.

The inorganic compound analysis of soils indicates that two areas had elevated levels of metals. These are:

- The area between Building 35A and Building 38A (former cell room).
- The area adjacent to the concrete diked area in the ferric chloride plant.

Certain HSL organic compounds were detected and quantified in groundwater from six monitor wells. The detected organics of concern are distributed in the following areas of the East Plant:

- Semi-volatiles and volatiles were identified in monitoring wells 9 and 10 located in the Halowax area in the northeast corner of the plant.
- Semi-volatiles were identified at monitor well 7, located on the southeast side of the property.
- PCB Aroclor 1254 was identified at monitor well 12, located north of the former cell room.

Inorganic analysis of groundwater samples indicated that chloride, ammonia, and certain HSL metals were detected in the monitoring wells at the East Plant. All of the parameters detected were identified at concentrations typical of groundwater background conditions.

PHASE II OBJECTIVES

The primary objectives of the Phase II field investigation were as follows:

- Delineate the horizontal and vertical extent of suspected soil contamination in the Halowax area, the burn area, and the area between Buildings 35A and 38A (former cell room).
- Quantify the presence of PCB's or chlorinated naphthalenes in the Halowax area soils.
- Define the concentration profile for pesticides in the soils surrounding Building 34 (former warehouse).
- Identify characteristic organic compounds associated with coal pile storage to determine if the semi-volatile compounds in TP-21 are due to the coal storage pile.
- Confirm the results of the Phase I groundwater sampling.
- Characterize the site hydrogeology more completely.

PHASE II MAJOR FINDINGS AND CONCLUSIONS

The results of the Phase II sampling program are as follows:

- Soils in the Halowax area contain naphthalenes, chloronaphthalenes, and chlorinated benzenes at concentrations of potential concern.
- Soils in the former burn area contain several volatile organics at concentrations believed to be of no concern.
- Phase II soil samples from the former burn area did not contain Aroclor 1260 which had been identified in this area in Phase I (TP-28). These results indicate an area of localized PCB concentrations within the former burn area.
- No pesticides or PCB's were found in the Halowax area or in the vicinity of Building 34.
- The area between Buildings 35A and 38A has elevated levels of lead in the soil.

- Groundwater collected from MW-9 (Halowax area) contains chloroform, chlorinated benzenes, and benzene at concentrations of concern, using regulatory guidelines and human health and aquatic toxicity information to define preliminary action levels.
- The Phase I groundwater sampling results were confirmed.
- The polynuclear aromatic hydrocarbon (PAH) concentrations found in the coal pile storage area may be attributed to coal storage and past plant operations.

SECTION 1

INTRODUCTION

1.1 OBJECTIVES OF THE INVESTIGATION

Roy F. Weston was retained by Pennwalt Corporation to conduct an environmental study at Pennwalt's East Plant property in Wyandotte, Michigan. This study was carried out in two phases. The objectives of Phase I were to:

- Define the impacts of past manufacturing operations on soils and groundwater at the site.
- Locate areas of localized "hot spot" contaminants.
- Identify waste management areas and associated environmental impacts.
- Present the results and significance of these findings in light of decommissioning of the facilities in an environmentally sound manner.

The results of Phase I were used to develop the objectives of Phase II. They were to:

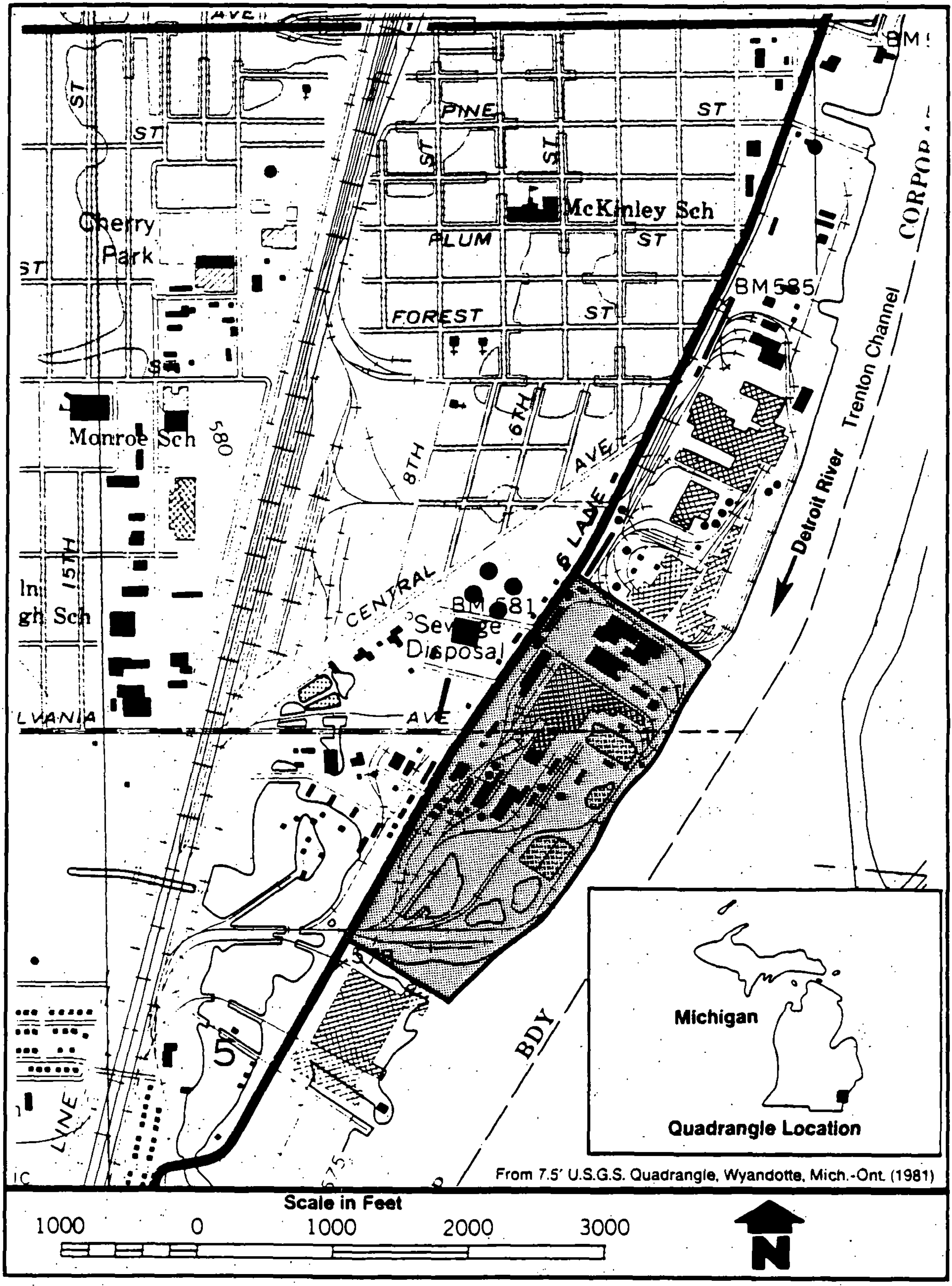
- Delineate the horizontal and vertical extent of suspected soil contamination in the Halowax area, the burn area, and in the Building 35A-38A area.
- Differentiate, analytically, between chlorinated naphthalenes (Halowaxes) and polychlorinated biphenyls (PCB's), using a chromium trioxide separation method.
- Analyze selected Phase I and Phase II soil samples from the Halowax area using the above separation method to determine whether PCB"s are present in the soil samples.
- Conduct a literature search to identify characteristic organic compounds associated with coal pile storage. The purpose of this review was to determine whether the HSL semi-volatile compounds (polynuclear aromatics) detected in Phase I soil samples from TP-21 (former coal storage area) are present due to leaching from the coal storage pile.

- Collect a second round of groundwater samples from MW-7, MW-8, MW-9, and MW-12. Analyze the samples for a limited number of parameters to confirm results of the Phase I analyses.

- Analyze Phase I soil samples from test pits 2 and 3 for HSL pesticides; if they are detected, collect additional soil samples in the vicinity of these test pits to define the areal and vertical extent of above-ground chemical concentrations in the soil.

- Collect three additional rounds of water level measurements from Phase I wells and river measuring points to better characterize the hydrogeology of the site.

To meet the objectives of the Phase I and II Environmental Study, WESTON designed and implemented integrated field investigations and data collection programs detailed in the sections that follow.



From 7.5' U.S.G.S. Quadrangle, Wyandotte, Mich.-Ont. (1981)

FIGURE 2-1 PENNWALT EAST PLANT LOCATION MAP

The USDA Soil Conservation Service has mapped the surface soils at the East Plant as "cut and fill land." The original soils are impossible to identify because of filling, mechanical mixing and leveling. Soil series mapped on undisturbed properties in the vicinity of the East Plant are Blount loam and Pewamo loam, which are poorly drained soils formed on glacial till plains, moraines, and lake plains. The subsoils in these series consist of silty clay loam and clay.

During Phase I activities, stratigraphic information obtained from soil test pits and monitor wells on the site indicated fill thickness generally increases in an eastward direction across the site toward the Detroit River. The fill typically consists of gray or brown gravelly, silty sands with occasional slag and brick refuse. Underlying the fill was a soft, dark brown to black peat layer approximately 0.5-1.0 feet thick which represents the natural land surface prior to filling and development. The peat layer is underlain by lacustrine deposits consisting of brown silty sands grading to gray and brown sandy clay or clay.

2.2.2 Regional Hydrogeology

The glacial deposits in the Detroit area consist of irregular beds of clay, silt, sand, and gravel which grade into each other laterally and vertically over relatively short distances. Groundwater occurs under water table (unconfined) and confined conditions. In areas where clays and sandy clays overlie saturated sands and gravels, the potential for confined or semiconfined groundwater conditions exists.

Geologic conditions are not favorable for obtaining significant quantities of potable groundwater in the vicinity of the East Plant site. The outcropping glacial clays and sands are the least favorable of all the glacial deposits for the development of wells with moderate to high yields. Low-yielding domestic wells can usually be developed within the interbedded sands and gravels of this deposit. The storage capacity for water-table aquifers in this glacial unit is considered limited, and wells constructed in this unit could expect failure during prolonged droughts. Groundwater quality from wells constructed in the deeper confined aquifers within this unit is often impaired by chlorides, hydrogen sulfide, and methane gas.

In the Detroit area, wells that are drilled into the bedrock formations usually yield groundwater that is highly mineralized. The Dundee limestone, underlying the glacial deposits at the East Plant, is capable of moderate yield, though, as expected, is highly mineralized. This mineralized water has been processed for salt recovery which was used as a raw material in past plant activities.

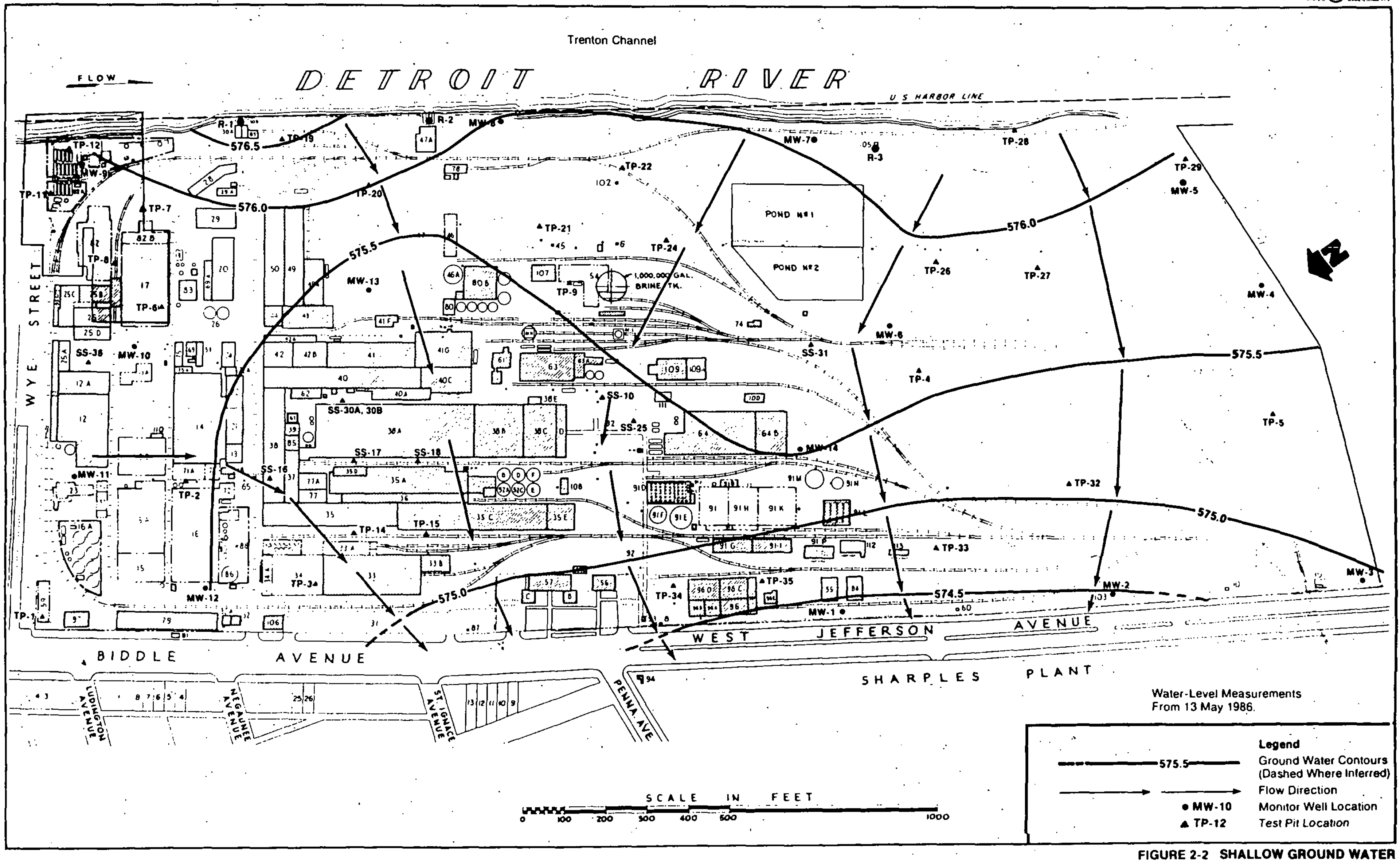
2.2.3 Site Hydrology

The Phase I environmental study included the construction of 12 groundwater monitor wells and two piezometers that intercepted the shallow water table aquifer at the East Plant facility. In addition, three river elevation gauging stations were installed along the banks of the Detroit River. Surface and groundwater measurements obtained on 13 May 1986 indicated the groundwater flow direction at the East Plant site was in a general west to northwest direction away from the Detroit River, as represented in Figure 2-2. In wet climates, groundwater base flow can normally be expected to discharge to nearby rivers and streams. However, this is not the case at the East Plant because the Detroit River is not fed by a typical drainage basin system, but rather from nearby Lake St. Clair, which is connected to the upper Great Lakes. Because of the tremendous storage capacity provided by the upper Great Lakes (Superior, Huron, and Michigan), the flow of the Detroit River is normally steady and does not depend on groundwater base flow.

Due to the very small surface-water elevation difference between Lake St. Clair (upgradient) and Lake Erie (downgradient), winds or changes in barometric pressure can cause the water to pile up at the western end of Lake Erie to an elevation above that of Lake St. Clair, and as a result, the flow of the Detroit River may actually reverse its direction. At other times, the water level at the lower end of the river may suddenly drop, causing a great increase in discharge (Wisler, et al., 1952). Thus, the surface-water hydraulics of the Great Lakes affecting the Detroit River produce local fluctuations in groundwater flow as are observed at the East Plant site.

Transmissivity (T) and hydraulic conductivity (K) values of the shallow unconfined saturated zone were derived from results of slug tests conducted on 11 monitor wells at the East Plant. These results are summarized in Table 2-1.

The hydraulic conductivity ranges from a low of 9.8×10^{-5} ft/min at MW-12 to a high of 8.6×10^{-2} ft/min at MW-8. In general, the hydraulic conductivity increases in a southeastward direction across the site toward the Detroit River. The soils encountered at the western end of the site consist of silty sands, silts, and clays which result in low hydraulic conductivities. The higher hydraulic conductivities observed at the eastern end of the site are a result of the porous fill that was used to reclaim land along the river.



Water-Level Measurements From 13 May 1986.

FIGURE 2-2 SHALLOW GROUND WATER ELEVATION CONTOUR MAP

Table 2-1

Pennwalt East Plant Slug Test Data

Well Numbers	Transmissivity* (sq ft/min)	Hydraulic Conductivity (ft/min)
MW-1	8.1×10^{-3}	1.6×10^{-3}
MW-2	8.6×10^{-3}	1.7×10^{-3}
MW-3	1.8×10^{-2}	3.6×10^{-3}
MW-4	2.0×10^{-2}	4.0×10^{-3}
MW-5	5.8×10^{-3}	1.2×10^{-3}
MW-6	4.9×10^{-2}	9.7×10^{-3}
MW-7	1.3×10^{-1}	2.6×10^{-2}
MW-8	4.3×10^{-1}	8.6×10^{-2}
MW-10	3.6×10^{-2}	7.2×10^{-3}
MW-11	1.2×10^{-2}	2.4×10^{-3}
MW-12	4.9×10^{-4}	9.8×10^{-5}

*Transmissivity (T) is calculated as the hydraulic conductivity (K) times the thickness of the saturated zone (b), e.g., $T = Kb$.

SECTION 3

PHASE I FIELD INVESTIGATION

The Phase I environmental study was accomplished on a task-by-task basis: information gathered during presurvey tasks was used to select locations for sample collection and to determine analytical requirements based on specific past manufacturing process areas.

3.1 PRESURVEY RECORDS SEARCH

3.1.1 Identification of Plant Process Areas

Former manufacturing, storage, process, and shipping areas were identified through a review of East Plant maps and records and historic aerial photographs conducted jointly by WESTON and Pennwalt project engineers. This information was supplemented with interviews with the Wyandotte East Plant engineer and other Pennwalt employees who had worked at the East Plant during its operational years.

Former process areas identified during the presurvey records search include the Halowax area that was tenant operated for the production of chlorinated naphthalenes, Wyandotte Oil and Fat that was tenant operated for the production of hydrogenated fish oil, the chlorine-caustic cell operations, the Mond gas plant, the power plant/coal storage area operated by Detroit Edison, the Taylor Chemical manufacturing area that was operated by tenants and Pennwalt for carbon tetrachloride production, and the ferric chloride and ammonium chloride manufacturing areas. Specific locations for all the process areas were indicated by coordinates on a sampling plan base map, which is included in a pocket at the end of this report.

3.1.2 Background Environmental Data Collection

Background information on regional geologic conditions was gathered through a review of existing literature published by the U.S. Geological Survey, Michigan State Geological Survey, Michigan Department of Natural Resources, and the U.S. Soil Conservation Service. A list of references is contained at the end of this report.

Site-specific geological information was obtained by reviewing Pennwalt's records of soil boring logs for foundation design and subsurface utility location projects throughout the operational life of the East Plant.

3.1.3 Locations of Test Pits and Monitor Wells

Soil test pits were proposed at the East Plant as the most cost-effective way to obtain soil samples and examine large areas in a short time period. Backhoe test pits are especially suitable for visual observation of fill depths, stained soils indicating process or spill areas, and shallow groundwater table conditions.

The locations of test pits at the East Plant were selected based on information on East Plant manufacturing, shipping, storage, and waste management operations gathered in the presurvey records search. The test pits were plotted on the sampling plan base map and were staked in the field prior to the start of excavation activities. Twenty-seven test pits were originally proposed; soil samples from a total of 26 test pits and 8 surface sample locations were actually collected during the field investigation.

Monitor wells were proposed at the East Plant to examine the occurrence, movement, and quality of the shallow groundwater at the site. Twelve 2-inch diameter wells and two 3/4-inch diameter piezometers were located to provide information on groundwater migration near the plant boundaries and to observe the influence of the Detroit River on groundwater elevations and flow direction.

A Site Investigation and Sampling Plan for the East Plant was prepared prior to field activities detailing specific sampling and monitoring procedures. WESTON also prepared a Site Safety Plan listing physical and chemical hazards at the East Plant and appropriate levels of personnel protection to be worn during field activities. Copies of both the Sampling and Safety Plans are included in Appendices A and B, respectively.

3.1.4 Development of the Phase I Analytical Program

The analytical program for the soil sampling effort was developed concurrently with the preliminary sampling plan base map. As this is a Phase I study of a site where numerous chemicals were manufactured over many years, it was decided to test for a broad spectrum of compounds.

The U.S. EPA Hazardous Substances List (HSL) of compounds is a comprehensive list of environmental contaminants, which includes volatile organics, semi-volatile organics (base neutral and acid extractable compounds), pesticides, PCB's, metals, and cyanide. A list of compounds on the HSL is included in Appendix C.

Soil samples around former inorganic process areas, such as caustic finishing, orthosilicate, chlorine production, and ammonium chloride/HCl manufacture, were specified for HSL inorganic parameter analysis. Samples near past manufacturing areas where organic materials were produced (Halowax area, former Taylor Chemical, and Mond gas plant) were targeted for HSL organic parameters. Other areas, where plant records and aerial photos indicated the potential presence of both inorganic and organic wastes, such as the former burn area and the coal pile storage area, were specified for the full HSL list of analytes.

Additions were made to the preliminary analytical list during the field investigation based on volatile organic detector readings and on visual observations of staining or discoloration of soils in the test pits.

Groundwater samples from the monitor wells were targeted for laboratory analysis of both HSL organic and inorganic compounds, plus chloride, ammonia, and total dissolved solids. In addition, the field water quality indicator parameters of pH, specific conductance, salinity, and temperature were scheduled to be measured during the well sampling procedure.

3.2 PHASE I SOIL SAMPLING

Soil samples were collected in 26 test pits and at eight surface soil sample locations and analyzed for HSL inorganic and/or organic compounds. The locations of soil sampling activities are shown in Figure 3-1.

The preinvestigation sampling plan base map (contained in a pocket at the end of this report) listed sample locations and analytical parameters based on past industrial activities conducted in specific areas of the East Plant. Before the field investigation started, several of the planned sampling sites were moved due to proximity to utilities, as mapped by the Pennwalt Engineering Department. Eight of the planned test pit locations were modified to collect surface soil samples for this reason. In addition, the Wyandotte Plant engineer suggested four additional locations for soil sample collection based on his knowledge of the East Plant history. During the field investigation, several more soil sample points and analyses were added at the direction of Pennwalt's project engineer. Table 3-1 summarizes all soil samples and analyses conducted during this study.

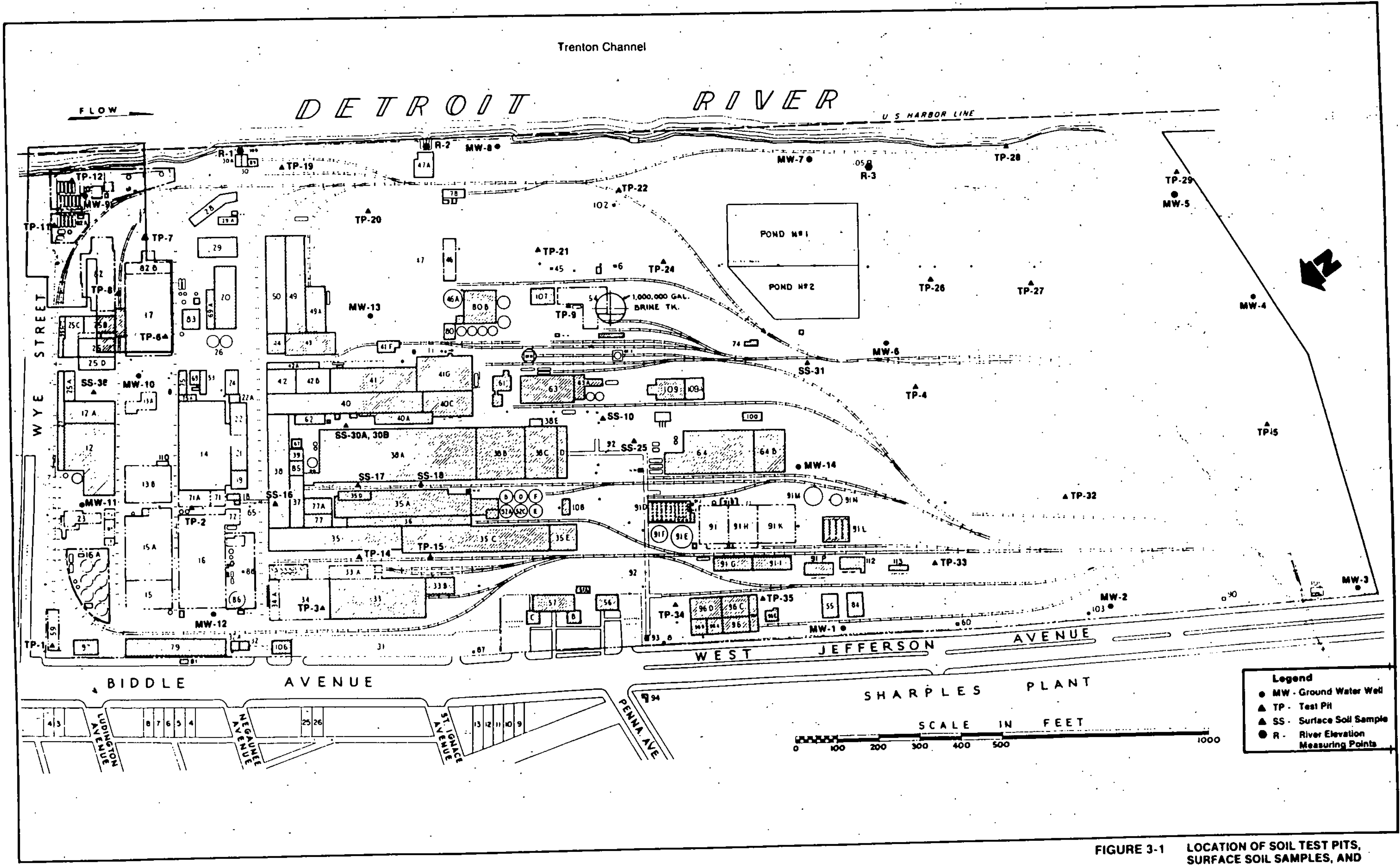


FIGURE 3-1 LOCATION OF SOIL TEST PITS, SURFACE SOIL SAMPLES, AND MONITOR WELLS AT THE EAST PLANT

Table 3-1

Summary of Laboratory Analyses Performed at Soil Sample Locations

Sample Location	Sample Depth (in.)	Matrix	HSL Parameters
TP-1	0-20	Soil	Inorganics
TP-2	0-40	Soil	Inorganics; organics
TP-3	16-52	Soil	Inorganics; organics
TP-4	0-108	Soil	Inorganics; organics
TP-5	0-24	Soil	Inorganics; organics
TP-6	0-70	Soil	Organics
TP-7	0-72	Soil	Organics
TP-8	0-54	Soil	Organics
TP-9	0-36	Soil	Organics
TP-9 (duplicate)	0-36	Soil	Organics
SS-10	0-2	Soil	Inorganics
TP-11	0-80	Soil	Organics
TP-12	48-72	Soil	Organics
TP-14	60	Soil	Inorganics; organics
TP-15	50-60	Soil	Inorganics
TP-15 (duplicate)	50-60	Soil	Inorganics
SS-16	2-4	Soil	Inorganics; organics
SS-17	2-4	Soil	Inorganics
SS-18	2-4	Soil	Inorganics
TP-19	0-72	Soil	Inorganics
TP-20	0-90	Soil	Inorganics; organics
TP-21	0-120 (composite)	Soil	Inorganics; organics
TP-21	108-113 (grab)	Soil	Organics
TP-21 (duplicate)	108-113 (grab)	Soil	VOA
TP-22	0-95	Soil	Inorganics; organics
TP-24	0-68	Soil	Inorganics; organics
TP-25	2-4	Soil	Inorganics
TP-26	0-96	Soil	Inorganics; organics
TP-27	48-60	Soil/sludge	Inorganics
TP-28	45-72 (composite)	Soil	Inorganics; organics
TP-28	72 (grab)	Sludge	Inorganics; organics (exclude VOA)

Table 3-1
(continued)

Sample Location	Sample Depth (in.)	Matrix	HSL Parameters
TP-29	0-72	Soil	Inorganics; organics
SS-30A	0-2	Soil	Inorganics
SS-30B	0-2	Soil	Inorganics
SS-31	2-4	Soil	Inorganics
TP-32	60-72	Soil	Inorganics; organics
TP-33	0-54	Soil	Inorganics; organics
TP-34	2-4	Soil	Inorganics; organics
TP-35	0-96	Soil	Inorganics; organics
SS-36	0-2	Soil	Inorganics
MW-9	192-216	Soil	Inorganics; organics
MW-10	114-138	Soil	Inorganics; organics
Field blank	---	Water	Inorganics; organics
Trip blank	---	Water	VOA

3.2.1 Test Pit Excavation and Sampling

The test pit sampling program was conducted during the week of 21 April 1986. Test pits were excavated to depths of 3 to 10 feet below ground surface using a backhoe. The use of test pits facilitated accurate depth measurements and visual descriptions of fill material and the underlying natural soil. A description of the soils in each pit was recorded by the WESTON soil scientist in the site log book. The depth to the underlying natural soil, as evidenced by a dark brown to black peat layer, was noted. An HNu organic vapor detector was used to measure the occurrence of volatile organic compounds in and around each test pit; these readings were also recorded and are included in the test pit descriptions contained in Appendix D.

Soil from each test pit was piled beside the pit by the backhoe. Soil samples for each test pit were composited from this pile into laboratory prepared sample bottles. In several cases, a fill layer unlike the rest of the test pit was encountered. These anomalous layers were sampled separately as grab samples and designated by test pit number and depth location measurements. They were analyzed for HSL organics and/or HSL inorganics as directed by Pennwalt's project engineer. Once sampled, pits were backfilled with excavated material, and the backhoe was decontaminated using the procedure described in Apendix A.

All soil samples were collected using stainless steel sampling trowels, which were cleaned and rinsed with deionized water between samples, as discussed in Appendix A.

A water field blank was collected by pouring deionized water over a sampling trowel into laboratory-prepared sample bottles, as discussed in Appendix A. This sample was analyzed along with the soils for HSL organic and inorganic parameters.

3.2.2 Surface Soil Samples

Eight locations, originally scheduled for test pit excavation, were changed to surface soil samples based on their proximity to underground utilities, no backhoe access (location inside or between buildings), or difficult digging conditions.

Soil samples at these locations were collected using stainless steel trowels on 13 May 1986. Three of the surface soil samples (SS-16, SS-30A, and SS-30B) were composites of a larger area. Details and specific sampling procedures for each location are contained with the soil test pit descriptions in Appendix D.

3.2.3 Split-Spoon Soil Sampling

Continuous split-spoon soil samples were collected during monitor well drilling in order to describe the stratigraphy at each well location. Descriptions for each of the samples were compiled on a boring log for each well, contained in Appendix D. As described in the Site Investigation and Sampling Plan (Appendix A), one soil sample from each boring of the clay underlying the water-bearing zone was placed in a sample jar and retained for possible laboratory chemical analysis. Two of these samples (from MW-9 and MW-10) were later approved for analysis by Pennwalt; they were analyzed for HSL organics and inorganics. Sampling and decontamination procedures are outlined in Appendix A.

After collection, chain-of-custody documentation was completed and all samples were carefully packed in coolers for overnight transport to WESTON's Lionville, Pennsylvania laboratory. Chain-of-custody documentation for the soil samples is contained in Appendix E.

3.3 PHASE I MONITOR WELL INSTALLATION

At the East Plant site a total of 12 monitor wells and 2 piezometers were installed during the week of 21 April 1986. The wells were completed in the fill and native sands overlying the lacustrine clay in order to intercept the shallow water table aquifer at the site. The 12 2-inch diameter monitor wells were utilized to obtain groundwater samples for chemical analysis of the shallow-water table aquifer, as well as water table elevations, while the piezometers were installed to obtain water table elevations only. The wells were drilled and installed by McDowell Associates of Ferndale, Michigan using a Central Mine Equipment (Model CME 55) drill rig with hollow stem augering and split-spoon capabilities. All drilling, sampling, and well installation activities were under direct supervision of an on-site WESTON geologist. Decontamination procedures are outlined in Appendix A.

During the drilling of the monitor wells, continuous split-spoon soil samples were obtained in accordance with ASTM test method D-1586. During the drilling of the two piezometers, a limited number of split-spoon samples were obtained at depths selected by WESTON's geologist. One soil sample from each monitor well boring was retained for potential laboratory chemical analysis, as discussed in the previous subsection (Subsection 3.2.3). This soil sample was typically obtained at a depth of 2 to 4 feet into the lacustrine clay unit underlying the fill material and the native sands at the site. No soil samples were retained for chemical analysis at the two piezometer locations.

To determine if organic vapors were emanating from the split-spoon samples, each sample was screened immediately after collection using a HNu photoionization detector or an OVA flame ionization detector. The HNu and the OVA meters were also used to monitor organic vapors in the drill-crew work area. The organic vapor measurements determined the level of personnel safety protection required at each monitor well and piezometer location as specified in the Site Safety Plan.

Total well depth and screen placement were determined by WESTON's on-site geologist based on depth to lacustrine clays and water-bearing sediments. After each boring was completed, a monitor well screen and riser was inserted inside the hollow stem auger to the specified depth. A 5-foot section of 0.01-inch slot, 2-inch diameter PVC screen was connected to an appropriate length of 2-inch diameter PVC threaded riser pipe. No solvents or glue were used at any of the casing joints. A medium to coarse sand pack (M. DOT 2NS) was poured through the inside of the hollow stem augers into the annular space between the borehole walls and the screen to approximately 2.5 feet above the top of the screen. A 1-foot bentonite pellet seal was emplaced on top of the sand pack in the annular space. The remainder of the annulus was gravity-filled with a Portland Type 1 cement and bentonite powder grout. A 4-inch diameter steel protective casing with locking cap was installed over the well into the grout. To further protect the wells from damage three metal pipe bumper guards were installed in a cement pad around each monitor well.

The two piezometers have similar construction details except the PVC screen and riser for the piezometers are 3/4-inch diameter. Lithologic descriptions for each boring and construction details for each well are contained in Appendix D.

3.4 GROUNDWATER SAMPLING

Groundwater from the 12 monitor wells at the East Plant was sampled during the week of 12 May 1986. Prior to sampling, the depth to water in each well was measured and the volume of standing water in the casing was calculated. Three to five volumes of standing water were removed from each well and discarded, using a Teflon bailer and dedicated polypropylene rope. Field water quality indicator parameters of pH, specific conductance, salinity, and temperature were measured and recorded. Table 3-2 lists these results for each of the wells. Groundwater samples from each well were collected and placed in laboratory-prepared bottles to be analyzed for the following parameters:

Table 3-2

Field Water Quality Measurements

Location	Temperature (°C)	pH (pH units)	Specific Conductance (umhos)	Salinity (o/oo)
MW-1	13	7.6	1,950	1
MW-2	14	7.0	4,300	3
MW-3	14	7.1	2,900	1.5
MW-4	12	7.0	10,000	7.5
MW-5	15	7.1	21,000	16
MW-6	15	6.7	34,000	26
MW-7	12	12.0	176,000	120
MW-8	13	6.1	5,000	3.5
MW-9	14	5.6	3,100	2
MW-10	16	7.9	10,000	6
MW-11	16	10.3	6,000	4
MW-12	14	7.2	1,300	0.0
East Pond	---	11.0	276,500	171.5
Detroit River	16	8.2	200	0.0

- HSL organics.
- HSL inorganics.
- Chloride.
- Ammonia (as nitrogen).
- Total dissolved solids.

Samples for soluble metals were filtered after collection through a 0.45-micron filter; the filtrate was preserved with HNO_3.

The Teflon bailer was cleaned between wells using a solution of Alconox detergent and potable water, with a deionized water rinse. Chain-of-custody records were completed and all samples were carefully packed in coolers for overnight shipment to WESTON's Lionville, Pennsylvania laboratory. Chain-of-custody documentation for the groundwater samples is contained in Appendix E.

3.5 AQUIFER TESTING

A slug test is a method that can give an estimate of the magnitude and variability of selected aquifer properties in individual wells located on a site. The test is accomplished by causing an instantaneous change in the water volume of a well, either by suddenly introducing or removing a known volume of water or other material, and observing the recovery of the water level in the well with time.

Slug tests were conducted on 11 wells located on the Pennwalt East Plant site on 14 and 15 May 1986. An In Situ SE-1000B data logger was used for data collection for each test; the following procedure was used on each well:

- Depth to water measurements were taken at each well before testing.

- A pressure transducer connected to the SE-1000B was lowered into the well to the bottom of the screened interval.

- A previously prepared slug (1 inch diameter PVC pipe filled with sand and sealed at both ends) was lowered into the well to a point just above the water level.

- The data logger was then activated. While the data logger was functioning, the slug was rapidly but smoothly lowered into the water in the well to a point where the slug top was just below the water level.

- The slug was then secured in this position and the test allowed to continue until the water level reestablished equilibrium.
- The slug and transducer were removed from the well and decontaminated.

The data from each slug test were transferred from the SE-1000B to a mainframe computer and was analyzed by the Bower and Rice method (1976).

The results of the data analysis from the 11 slug tests performed at the East Plant are discussed in Subsection 4.2.

3.6 GROUNDWATER ELEVATION

Top of casing elevations of the 12 monitor wells and the two piezometers were surveyed by Hennessey Engineers, a local firm recommended by Pennwalt and subcontracted by WESTON. Elevations were measured to the nearest 0.01 foot at the top of the PVC inner casing. The depth to groundwater was measured at each of the wells on 13 May 1986. Groundwater elevations were calculated and used to prepare groundwater flow direction maps contained in Subsection 4.2. Table 3-3 summarizes the surveyed top of casing elevations, depth to groundwater in the wells, and groundwater elevations for 13 May 1986.

Table 3-3

Groundwater and River Water Measurements/Elevations

Well Number	Elevation at Top of PVC Casing (ft)	Depth to Groundwater (ft) 5/13/86	Groundwater Elevation (ft) 5/13/86
MW-1	579.72	5.31	574.41
MW-2	579.32	4.87	574.45
MW-3	579.10	4.16	574.94
MW-4	580.64	5.03	575.61
MW-5	579.64	3.73	575.91
MW-6	580.06	4.24	575.82
MW-7	582.00	5.98	576.02
MW-8	580.95	5.24	575.71
MW-9	579.80	3.92	575.88
MW-10	580.09	4.32	575.77
MW-11	580.27	4.56	575.71
MW-12	580.04	4.51	575.53
Piezo. 13	580.83	5.44	575.39
Piezo. 14	580.76	5.21	575.55

River Gauging Station	Elevation at Gauging Station (ft)	Depth to Water Surface (ft) 5/13/86	Surface Water Elevation (ft) 5/13/86
Detroit River (R-1)	577.85	1.05	576.80
Detroit River (R-2)	577.63	1.37	576.23
Detroit River (R-3)	579.00	2.84	576.16

SECTION 4

PHASE I RESULTS

4.1 GEOLOGY AT THE EAST PLANT

Observations on the shallow stratigraphy beneath the East Plant site were derived from the 26 soil test pits, 12 monitor wells, and 2 piezometers, which were installed during the field sampling program. In general, the upper 2 to 10 feet of overburden consists of fill material that was used in the past to reclaim the marshy lands adjacent to the Detroit River.

The fill thickness generally increases in an eastward direction toward the Detroit River, as shown in Figure 4-1. The fill typically consists of gray or brown gravelly, silty sands with local slag and brick refuse. Underlying the fill is a soft dark brown to black peat layer approximately 0.5 to 1.0 feet thick. This layer was consistently observed in the test pits; however, during test boring activities the soft consistency of the peat material prohibited recovery by split-spoon sampling activities. Below the peat layer were lacustrine deposits consisting of brown silty sands that graded to gray, brown sandy clay, or clay. In borings MW-7, MW-8, and MW-12 no silty sand was encountered above the sandy clay. The sandy clay or clay unit was encountered in every test boring and is believed to continue laterally across the East Plant site.

4.2 SITE GROUNDWATER CONDITIONS

4.2.1 Groundwater Flow

Figure 4-2 presents a water table surface elevation map for the Pennwalt East Plant site. This map was developed utilizing groundwater and surface-water elevations measured on 13 May 1986 at the 12 monitor wells, 2 piezometers, and 3 Detroit River staff gauges. The elevation data are contained in Subsection 3.6.

The contours in Figure 4-2 represent lines of constant water head or equal water elevations; groundwater movement is generally perpendicular to the contours in the direction of the lower piezometric head. The contours indicate that at the East Plant site flow direction is in a general west to southwest direction away from the Detroit River. During field sampling activities, Pennwalt personnel noted that the Detroit River elevation was higher than normal.

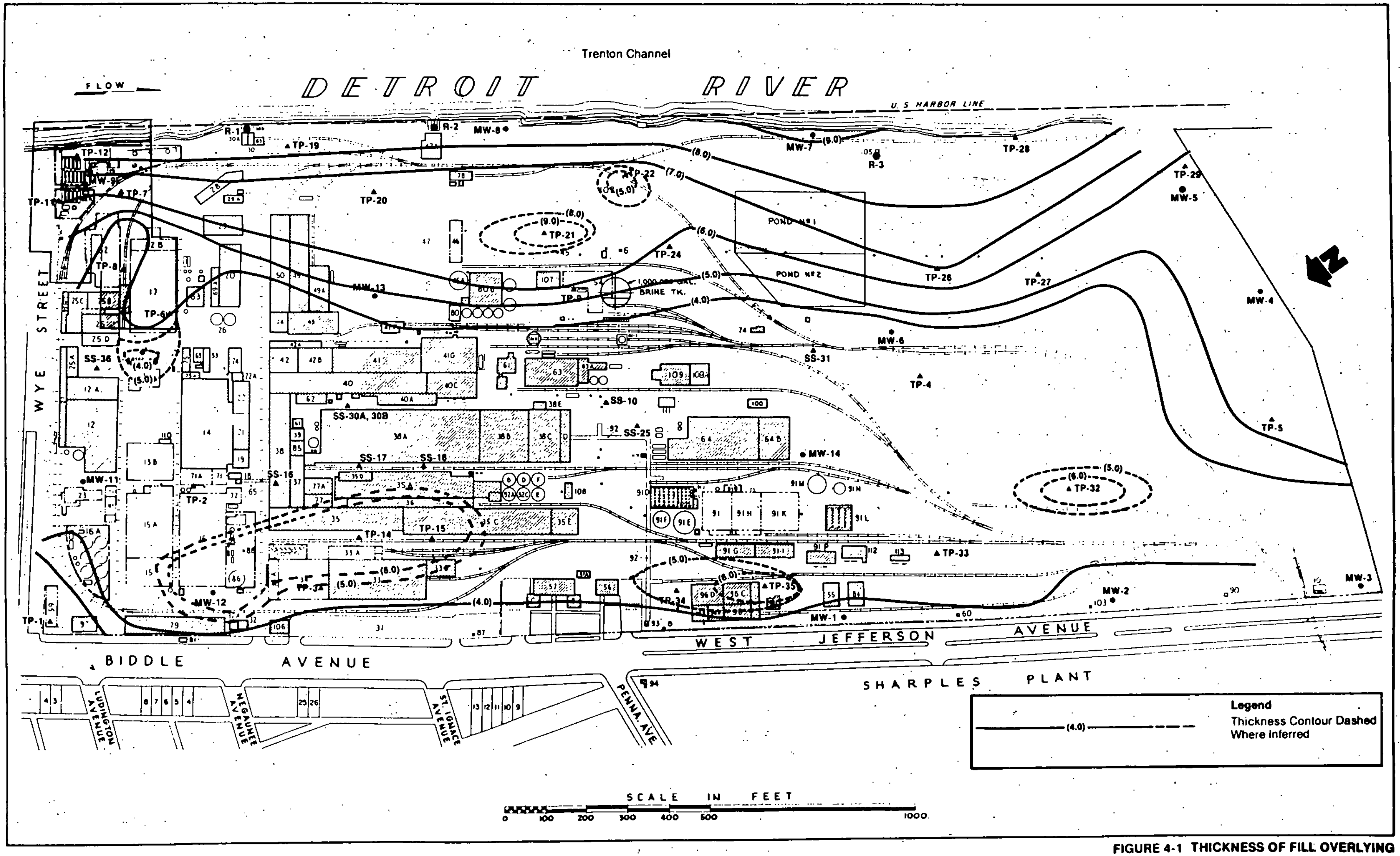


FIGURE 4-1 THICKNESS OF FILL OVERLYING EAST PLANT SITE

FIGURE 4-2 SHALLOW GROUND WATER ELEVATION CONTOUR MAP

During periods when the Detroit River elevations are normal or below normal, the shallow groundwater would be expected to flow in a general northeast to southeast direction and discharge into the Detroit River.

4.2.2 Results of Shallow Groundwater Aquifer Testing

Transmissivity (T) and hydraulic conductivity (K) values of the shallow water table aquifer were derived from the slug test data on 11 of 12 monitor wells at the East Plant. Groundwater constituents in MW-9 prevented the performance of slug tests at this location. The results are summarized in Table 4-1.

The hydraulic conductivity ranges from a low of 9.8×10^{-5} ft/min at MW-12 to a high of 8.6×10^{-2} ft/min at MW-8. In general, the hydraulic conductivity increases in a southeastward direction across the site toward the Detroit River. These values are typical of the soil and fill materials that were encountered during the drilling and test pit operations.

Generally, the measured hydraulic gradients, calculated transmissivity, and estimates of sediment porosity are used to calculate the volume and velocity of groundwater flow through the water-bearing zone using the following relationships:

$$Q = KiA$$

and $$v = \frac{Ki}{n}$$

Where:

Q = Volume of flow.
i = Hydraulic gradient.
n = Porosity.
v = Seepage velocity.
k = Hydraulic conductivity.

Because of the transitional groundwater gradients present during the field investigation, groundwater flow volume and velocity were not calculated in this report, pending the collection of additional water level data, collected under more typical site conditions.

4.3 RESULTS OF THE SOIL ANALYSES

Soil samples from 26 test pits and from 8 surface soil locations were analyzed for HSL organic compounds and/or HSL inorganic parameters. Analyses were selected based on the type of past manufacturing activities conducted in each area of the plant. Table 3-1 summarizes all soil samples and analyses conducted during this study.

Table 4-1

Pennwalt East Plant Slug Test Data

	Well Numbers			
	MW-1	MW-2	MW-3	MW-4
Transmissivity* (sq ft/min)	8.126^{-3}	8.63^{-3}	1.782^{-2}	2.016^{-2}
Hydraulic conductivity (ft/min)	1.625^{-3}	1.726^{-3}	3.564^{-3}	4.033^{-3}
	MW-5	MW-6	MW-7	MW-8
Transmissivity* (sq ft/min)	5.847^{-3}	4.871^{-2}	1.296^{-1}	4.28^{-1}
Hydraulic conductivity (ft/min)	1.169^{-3}	9.741^{-3}	2.592^{-2}	8.559^{-2}
	MW-10	MW 11	MW-12	
Transmissivity* (sq ft/min)	3.591^{-2}	1.2^{-2}	4.919^{-4}	
Hydraulic conductivity (ft/min)	7.182^{-3}	2.4^{-3}	9.837^{-5}	

*Transmissivity (T) is calculated as the hydraulic conductivity (K) times the thickness of the saturated zone (h), e.g., T = Kh.

Appendix G contains data summary tables for the soil samples listing all the parameters that were detected in each soil sample.

4.3.1 Distribution of Organic Compounds

The results of the organic compounds analysis indicate that three areas of the East Plant may have been impacted by past manufacturing, storage, and waste management activities involving organic compounds. These areas are:

- The Halowax production area in the northeast corner of the plant (TP-11, TP-12, TP-7, TP-8, and TP-6).
- The southeast corner of the plant along the Detroit River (TP-28).
- The former Taylor Chemical area near the center of the East Plant (TP-9 and TP-21).
- The area between Buildings 35A and 38A (SS-16, SS-17, and SS-18).

Soil in the northeast corner of the plant, site of the Halowax Company's production facility, contained both semi-volatile and volatile organic compounds; the primary constituents were chlorinated naphthalenes and chlorinated benzenes. A soil sample was collected from TP-12 at 48 to 72 inches, where an oily black-stained gravel fill was observed during the test pit excavation. The sample contained 37 grams/kilogram (parts per thousand) semi-volatiles, plus 48 parts per thousand tentatively identifed chlorinated naphthalenes (compounds that are not contained on the Hazardous Substances List). A soil sample from TP-11 contained 59 mg/kg (parts per million) naphthalene and 950 mg/kg tentatively identified chlorinated naphthalenes. Soil from TP-8, between former Buildings 82 and 17, contained 150 mg/kg semi-volatiles, plus 2,381 mg/kg tentatively identified chlorinated naphthalenes. Samples of soils from TP-7 and TP-6 contained 160 and 3.0 mg/kg semi-volatiles, respectively. TP-6 also contained 0.26 mg/kg Aroclor 1260. WESTON's Analytical Laboratory reported that elevated levels of chlorinated naphthalenes in these samples interfered with the pesticide/PCB analysis by masking compounds that would ordinarily have been detected if the high concentrations of chlorinated naphthalenes were not present.

Results from these sampling activities are summarized in Table 4-2.

Table 4-2

Summary of Phase I Organic Soil Results

Location	Sample Depth (inches)	Compound	Concentrations (mg/kg)
<u>Halowax Area</u>			
TP-12	48-72	Semivolatiles	37,000
		Tentatively identified chlorinated naphthalenes*	48,000
TP-11	0-80	Naphthalene	60
		Tentatively identified chlorinated naphthalenes*	950
TP-8	0-54	Semivolatiles	150
		Tentatively identified chlorinated naphthalenes*	2,381
TP-7	0-72	Semivolatiles	160
TP-6	0-70	Semivolatiles	3
		Aroclor 1260**	0.26
<u>Burn Area</u>			
TP-28	45-72	Semivolatiles	350
		Aroclor 1260	260
	72 (grab)	Semivolatiles	5
		Aroclor 1260	1.3

Table 4-2
(continued)

Location	Sample Depth (inches)	Compound	Concentrations (mg/kg)
<u>Old Taylor Chemical Area</u>			
TP-9	0-36	Semivolatiles	40
TP-21	0-120	Semivolatiles (including chlorinated naphthalenes and polynuclear aromatics)	1,000
	108-113 (grab)	Chloroform	4.2
		Chlorobenzene	5.9
<u>Building 35A/38A</u>			
SS-16		Semivolatiles	143
		Volatiles	0.30

*Compounds or elements which are not contained on the HSL.

**Analytical Laboratory reported that elevated levels of chlorinated naphthalenes in these samples interfered with the pesticide/PCB analysis by masking compounds that would ordinarily have been detected if the high concentrations of chlorinated naphthalenes were not present.

During the test pit excavation program, TP-28 was observed to contain varigated layers of dark-stained gravel, cinders and slag, over black, oily slag fill to a depth of 72 inches. At 72 inches, a 6-inch layer of white "pastey" sludge was encountered. Two samples were collected from TP-28; a composite 45 to 72 inches, and a grab of the "pastey" sludge. The composite sample contained 350 mg/kg total semi-volatiles and 260 mg/kg Aroclor 1260. The sludge grab sample contained 5 mg/kg semi-volatiles and 1.3 mg/kg Aroclor 1260. The site of this test pit is believed to be in the general area of an old burn pit where waste oil products were reportedly disposed.

The former Taylor Chemical area is located near the center of the East Plant property adjacent to the million gallon brine tank. Taylor Chemical processes included manufacture of carbon tetrachloride. Test pits 9 and 21 were located in this vicinity; TP-21 was also located in the old coal storage area. Soil from TP-9 contained 40 mg/kg semi-volatile compounds.

During excavation of TP-21, organic vapors at levels of 5 to 20 ppm were measured using an HNu photoionization detector. The highest organic vapor readings were detected on freshly-broken fragments of soil from 108 to 120 inches below ground surface. A grab sample was collected from this depth and a composite soil sample was collected from 0 to 108 inches.

The composite sample was found to contain 1,000 mg/kg semi-volatile compounds including both chlorinated naphthalenes and polynuclear aromatics. The grab sample contained 4.2 mg/kg chloroform and 5.9 mg/kg chlorobenzene.

Only the SS-16 sample collected in the Building 35A/38A area had detectable organic constituents. This sample contained 143 mg/kg semivolatiles and 0.3 mg/kg volatile organic constituents.

4.3.2 Distribution of Inorganic Compounds

A list of soil samples analyzed for HSL inorganic parameters is provided in Table 3-1. The elements included on the HSL are normally present in soil in amounts varying from trace to substantial.

Aluminum and iron are primary soil components, and calcium, potassium, magnesium, and manganese are normally present at varying levels, depending on geologic derivation of the soil materials. These were detected in all samples at the East Plant.

Sodium concentrations in site soils in the parts per thousand range are probably associated with brine processing activities.

Arsenic, barium, cadmium, chromium, copper, mercury, lead, vanadium, and zinc were detected in the soil at concentrations ranging from <10 to several hundred mg/kg. Distribution patterns correlating with past manufacturing operations were not evident, except for isolated cases.

Copper was detected in two surface soil samples, SS-10 and SS-25, at concentrations of 83,800 and 1,740 mg/kg, respectively. These concentrations are higher in copper than any soil samples analyzed during this study, and are associated with an adjacent concrete diked area in the ferric chloride plant, which is filled with copper residues. Blue-green surface soil staining was observed in this area during soil sampling procedures. The levels identified for copper in these samples are considered above background, which may range from 20 to 200 ppm (~mg/kg).

Zinc was found in TP-27 at a concentration of 4,840 mg/kg. This area was used as a scrap metal yard and burial ground, and metallic objects would be expected. Also, during test pit excavation, two pipes were observed in this pit; one was 6-inch steel and the other was 8-inch cast iron.

Although HSL metals were detected in concentrations up to hundreds of parts per million in site soils, only iron was detected at elevated concentrations in any of the groundwater samples. This indicates that the metals in the soils are not prone to leaching and are relatively immobile in the soils.

4.4 RESULTS OF THE GROUNDWATER ANALYSES

Groundwater samples from 12 monitor wells installed at the East Plant were analyzed for HSL organics, HSL inorganics, chloride, ammonia, and total dissolved solids (TDS).

Appendix G contains data tables for the wells listing all of the parameters that were detected in each groundwater sample. Key organic and inorganic parameters associated with industrial activities at the East Plant were identified from the summarized data (and presented in Table 4-3) in order to evaluate groundwater quality at the site. Note that inorganic constituents were detected at or near background conditions and are not listed in this table.

A discussion on groundwater quality at the East Plant must be prefaced with a review of the groundwater flow conditions at the site during the sampling period. Due to high river stage conditions, groundwater at this time was flowing away from the Detroit River toward Biddle Avenue. It is anticipated that at normal and low stage river conditions, the groundwater flows toward the Detroit River.

Table 4-3

Phase I - Summarized Results of Parameters of Concern in Groundwater

Well No.	Location	Contaminants	Concentration (ug/L)
MW-1	Central western edge of site by West Jefferson Avenue.	Aroclor 1260	2.0
MW-3	Southwest corner of site near railroad switching yard.	Fluoranthene	24
		Pyrene	14
		Benzo(a)anthracene	11
		Benzo(b)fluoroanthene	19
MW-7	Southeast side of site between the sludge setting ponds and river.	2-methylnaphthalene	150
		Pyrene	700
		Benzo(a)anthracene	550
		Benzo(b)fluoranthene	500
MW-8	Between river and old Taylor Chemical Company.	Chloroform	11
MW-9	Halowax Area.	Naphthalene	3,400
		2-chloronaphthalene	>1,700
		Chlorobenzene	1,000
		1,3-Dichlorobenzene	86
		1,4-Dichlorobenzene	860
		1,2-Dichlorobenzene	320
		2-chlorophenol	200
		Chloroform	8,500
		Methylene chloride	1,700
MW-10	Adjacent to Halowax Area where chlorinated naphthalene was manufactured.	Chloroform	270
		Methylene chloride	20
MW-12	Northwestern edge of site by West Jefferson Avenue.	Aroclor 1254	32

Due to the variable groundwater flow directions, the designation of any particular East Plant monitor well or wells as reflective of background water quality conditions is not appropriate. Under changing conditions, any well may be positioned, albeit intermittently, downgradient from past manufacturing and waste management areas. For this reason, background water quality cannot be defined by the groundwater quality in any one on-site well.

4.4.1 Distribution of Organic Compounds

HSL organic compounds were detected and quantified in groundwater from wells MW-1, MW-3, MW-7, MW-8, MW-9, MW-10, and MW-12.

The detected organics can be divided into three general groups:

- Semi-volatile compounds.
  - Chlorinated naphthalenes.
  - Chlorinated benzenes.
  - Polynuclear aromatics (anthracenes, fluoranthenes, and pyrenes).
- Volatile compounds.
  - Chloroform.
  - Methylene chloride.
- PCB.
  - Aroclor 1254.
  - Aroclor 1260.

These compounds are distributed in two main areas of the East Plant; the eastern corner and the southeast side along the Detroit River.

The eastern corner of the plant was the site of chlorinated naphthalene manufacture by a tenant of Pennwalt. Groundwater from MW-9, which is located in this area, contained naphthalene (3,400 ug/L), 2-chloronaphthalene (>1,700 ug/L), chlorobenzene (1,000 ug/L), total dichlorobenzenes (1,266 ug/L), 2-chlorophenol (200 ug/L), chloroform (8,500 ug/L), and methylene chloride (1,700 ug/L). Water from MW-10 also located in the Halowax area contained 270 ug/L chloroform and 20 ug/L methylene chloride. These compounds may be attributable to Halowax production.

MW-7 is located on the southeast side of the plant property, between the sludge settling ponds and the Detroit River. Groundwater from MW-7 contained 2-methylnaphthalene (150 ug/L), pyrene (700 ug/L) benzo(a)anthracene (550 ug/L), and benzo(b) fluoranthene (500 ug/L). These components are most likely attributable to leachate from the coal storage piles or residues from the Mond gas plant, but the presence of naphthalene may indicate residues from a former waste oil burn area that was reportedly located along the Detroit River.

Groundwater from MW-8 located along the Detroit River contained 11 ug/L of chloroform. This well is located in a direct line between the river and the site of the former Taylor Chemical Company, a tenant and producer of carbon tetrachloride. Taylor Chemical Company was operated prior to the 1940's; the chloroform may be residual from carbon tetrachloride production or from Halowax activities. Low concentrations of organic compounds (below 50 ug/L) were observed in three wells (MW-3, MW-1, and MW-12) along the northeast property line bordering Biddle Avenue. The west corner of the East Plant is the site of a railroad switching yard. Groundwater from MW-3, in this corner, contained fluoranthene (24 ug/L), pyrene (14 ug/L), benzo(a) anthracene (11 ug/L), and benzo(b)fluoranthene (19 ug/L). These compounds may have been leached from the slags used as fill below the railroad tracks, as slag was observed in the drilling log for MW-3.

Low concentrations of PCB Aroclors were detected in groundwater from MW-1 (Aroclor 1260 at 2.0 ug/L) and MW-12 (Aroclor 1254 at 32 ug/L). Aroclor 1254 has a very low aqueous solubility ranging from 12 to 56 mg/L. Plant records do not indicate the past use of PCB's in these areas.

4.4.2 Distribution of Inorganic Compounds

Chloride, ammonia, and several metals were detected and quantified in all 12 monitor wells at the East Plant. All of the parameters detected are found in trace amounts as natural constituents in groundwater. Groundwater metals concentrations at the East Plant ranged from 1.9 to 22.5 mg/L aluminum; <0.01 to 1,130 mg/L calcium; <0.1 to 28.7 mg/L iron, with 182 mg/L in MW-9; <5.0 to 128 mg/L potassium; <5.0 to 104 mg/L magnesium; and <0.01 to 3.8 mg/L manganese.

Silver, arsenic, barium, beryllium, cadmium, cobalt, chromium, copper, mercury, nickel, lead, antimony, thallium, and zinc were not detected or were seen at very low levels close to the analytical detection limit. Selenium was detected in MW-6 at 0.02 mg/L and in MW-7 at 0.1 mg/L. Vanadium was found at concentrations ranging from <0.001 to 0.05 mg/L, with 0.35 mg/L in MW-7.

Ammonia concentrations in the groundwater ranged from 0.13 to 24.3 mg/L. The plant areas with highest ammonia levels in the groundwater are the northeast end (MW-12 contained 24.3 mg/L and MW-10 contained 8.24 mg/L), and the southeast area of the East Plant (MW-6 contained 11.8 mg/L and MW-7 contained 6.36 mg/L ammonia). Building 64 was previously operated as an ammonium chloride manufacturing plant.

The distribution of sodium (147 to 36,900 mg/L) and chloride (550 to 54,400 mg/L; not detected in MW-10) concentrations in groundwater correlate with the location of the brine processing operations; concentrations increase on the south end of the plant near brine well activities.

4.5 AREAS IDENTIFIED FOR FURTHER INVESTIGATION IN PHASE II

Based on the field observations and analytical results reported during the Phase I Environmental Study, Pennwalt and WESTON identified several areas at the East Plant site that were targeted for further investigation or confirmation. These areas are shown in Figure 4-3 and are listed as follows:

- The Halowax Production Area
- The Burn Area (TP-28)
- The former Taylor Chemical Area (coal pile storage)
- Building 35A/38A Area (SS-16, 17, 18)

In addition to these areas, four monitor wells (MW-7, MW-8, MW-9, MW-12) were planned for resampling to confirm the analytical results of the Phase I assessment.

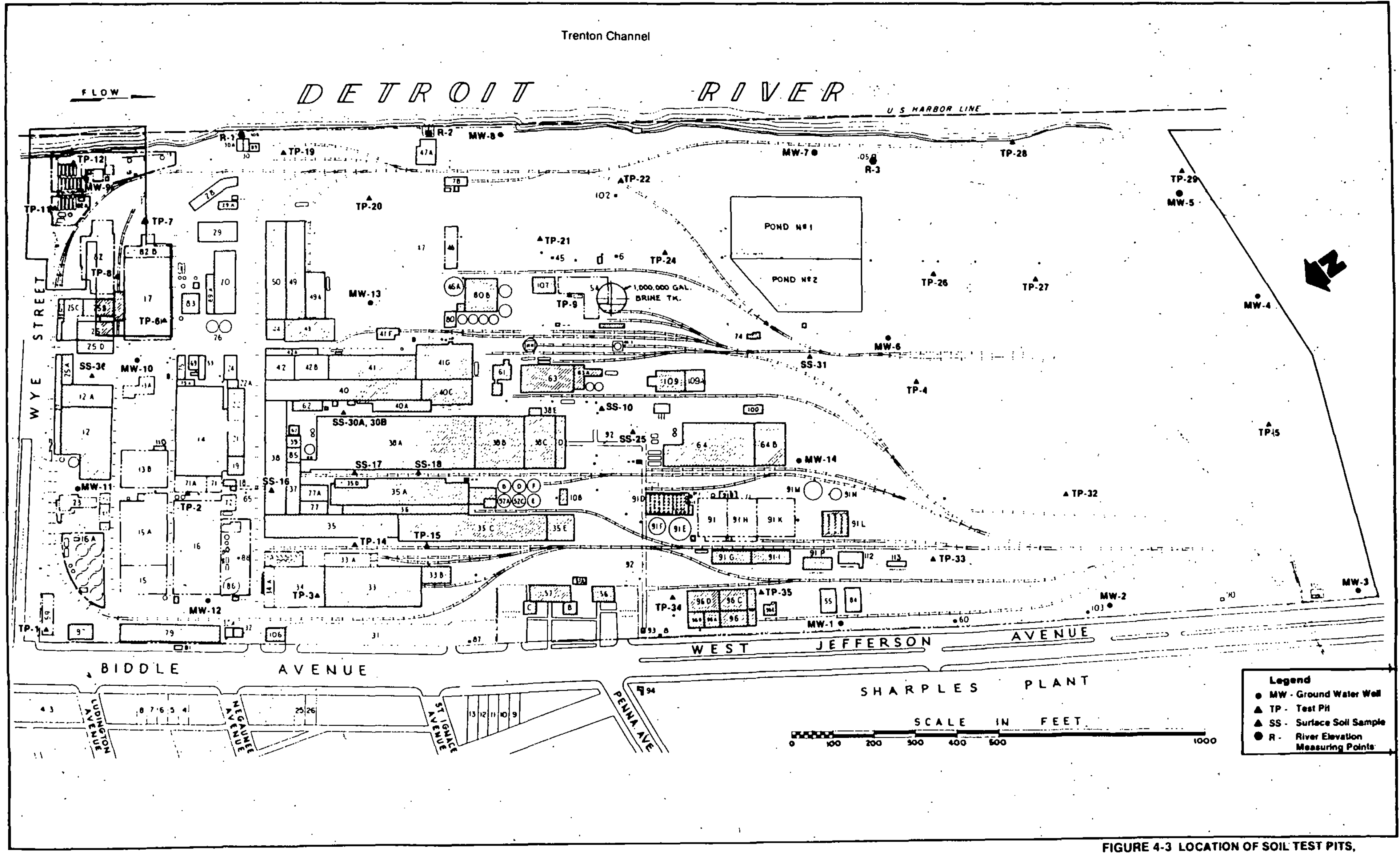


FIGURE 4-3 LOCATION OF SOIL TEST PITS, SURFACE SOIL SAMPLES, AND MONITOR WELLS AT THE EAST PLANT

SECTION 5

PHASE II OBJECTIVES AND SCOPE OF WORK

5.1 PHASE II OBJECTIVES

Roy F. Weston, Inc. (WESTON) was retained by Pennwalt Corporation to conduct Phase II of an environmental study at Pennwalt's East Plant property in Wyandotte, Michigan. The objectives of this study were to:

- Delineate the horizontal and vertical extent of suspected soil contamination in the Halowax area, the burn area, and the Building 35A/38A area.
- Differentiate, analytically, between chlorinated naphthalenes (Halowaxes) and polychlorinated biphenyls (PCB's), using a chromium trioxide separation method.
- Analyze selected Phase I and Phase II soil samples from the Halowax area using the above separation method to determine whether PCB's are present in the soil samples.
- Conduct a literature search to identify characteristic organic compounds associated with coal pile storage. The purpose of this review was to determine whether the HSL semi-volatile compounds (polynuclear aromatics) detected in Phase I soil samples from TP-21 (former coal storage area) are present due to leaching from the coal storage pile.
- Collect a second round of groundwater samples from MW-7, MW-8, MW-9, and MW-12. Analyze the samples for a limited number of parameters to confirm results of the Phase I analyses.
- Analyze Phase I soil samples from test pits 2 and 3 for HSL pesticides; if they are detected, collect additional soil samples in the vicinity of these test pits to define an areal and vertical extent of aboveground chemical concentrations in the soil.
- Collect three additional sets of water level measurements from all Phase I wells, piezometers, and river measuring points to better characterize the groundwater flow beneath the site.

The objectives of the Phase II study were based on the results of the East Plant Phase I environmental study, which was conducted during the spring of 1986.

5.2 PHASE II SCOPE OF WORK

The work scope under Phase II of the environmental study at the Pennwalt East Plant was to determine the presence and extent of suspected contamination within the areas previously identified during Phase I activities.

5.2.1 Soil Evaluation

5.2.1.1 Halowax Production Area

Backhoe test pits were excavated to delineate the extent of Halowax-type contamination by visual inspection and organic vapor monitoring. Thirteen soil borings were completed inside, and on the perimeter of, the suspected area of contamination as defined by test pit activities. Fifty-one soil samples were collected for analysis at specific depths to quantitatively verify the horizontal and vertical extent of Halowax-type contaminants.

5.2.1.2 Burn Area (TP-28)

Backhoe test pits were excavated to delineate the extent of contamination by visual inspection and organic vapor monitoring. Eight soil borings were completed inside, and on the perimeter of, the suspected area of contamination as defined by test pit activities. Thirty-two soil samples were collected at specific depths to quantitatively verify the horizontal and vertical extent of contaminants, such as fuels and solvents associated with burn area activities.

5.2.1.3 Building 35A/38A

Soil samples were collected at shallow depths for laboratory analysis using a hand auger to determine the vertical extent of suspected heavy metal surface contamination previously identified during Phase I sampling.

5.2.2 Groundwater Sampling

Groundwater samples were collected for laboratory analysis from monitor wells MW-7, MW-8, MW-9, and MW-12 to confirm the analytical results obtained during Phase I efforts. To establish typical groundwater flow conditions, three complete rounds of surface and groundwater elevation measurements were collected.

5.2.3 Literature Review

5.2.3.1 Organic Compounds

A literature review was completed of organic compounds typically associated with coal storage areas that might have impacted the soils at the Taylor Chemical area. This literature review is presented in Subsection 7.3.

5.2.3.2 River Elevations

A literature review on the historic Detroit River elevations was completed to determine what seasonal fluctuations could impact the groundwater flow regimes at the site. This review is presented in Subsection 7.1.

SECTION 6

PHASE II FIELD INVESTIGATION

The Phase II field investigation of the East Plant site was performed between 15 September 1986 through 9 October 1986, as specified in the Technical Operation Plan (Appendix J). All drilling and backhoe activities were subcontracted to McDowell and Associates of Ferndale, Michigan, and were performed under the direct supervision of on-site WESTON field personnel. Prior to the start of the field investigation, WESTON personnel conducted a site visit to stake test pit locations and to obtain underground utility clearances from Pennwalt's Plant Engineer.

6.1 HALOWAX PRODUCTION AREA

6.1.1 Test Pits and Soil Profile

To estimate the extent of the suspected area of soil contamination, WESTON performed extensive backhoe test pit screening activities in the Halowax area.

As shown in Figure 6-1, five rows (traverses) of test pits were excavated in the Halowax area. The number of test pits in each traverse ranges from two, at traverse 50, to nine at traverse 53. In addition, one extra test pit (TPH-55) was excavated to collect data to the west of the Halowax area. Typically, when the Halowax-type material was encountered, it had a black oily sheen. This material usually was observed in test pits below the water table in a porous slag fill and above a peat and silt layer that was the top of the native soils. Traverses 52 and 53 were extended in a southwesterly direction until no material was observed, and organic vapors, as measured on field detector instruments, were low to not detectable.

All the test pits in traverses 50, 51, and 54 were observed to contain Halowax-type material. These traverses could not be extended further away from the suspected sources than shown in Figure 6-1 because of obstructions such as buildings, building foundations, railroad tracks, and underground utilities. No test pit or soil boring activities were performed outside the perimeter of the Pennwalt property.

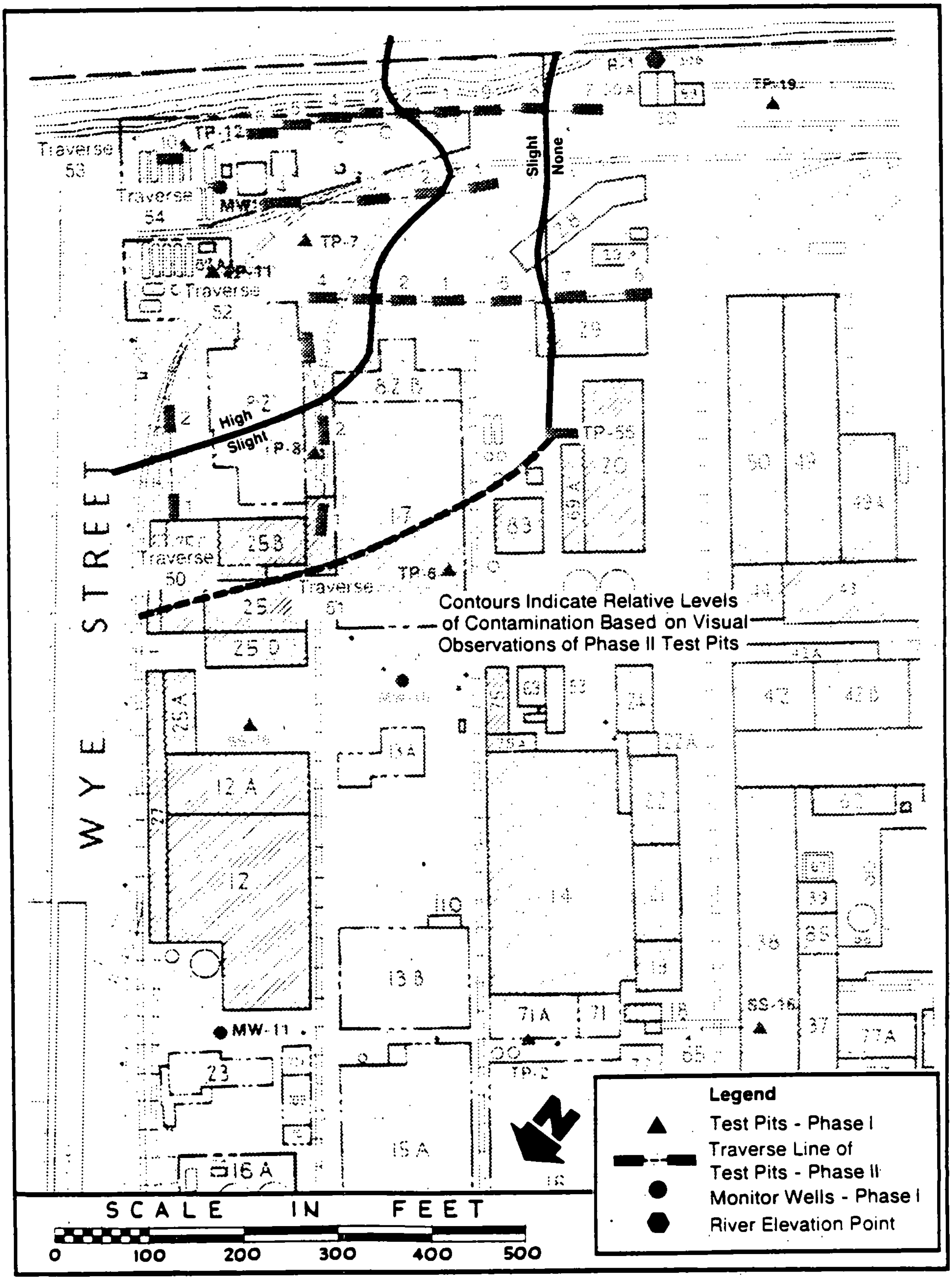


FIGURE 6-1 VISUAL EXTENT OF ORGANIC-CONTAMINATED SOILS (BASED ON PHASE II TEST PIT SCREENING)

6.1.2 Test Borings

Following the conclusion of the test pit activities conducted in the Halowax area, WESTON field personnel mapped the approximate boundary between the visibly contaminated and noncontaminated soils. This boundary is shown with contour lines in Figure 6-1. To quantify the horizontal and vertical extent of contamination in the Halowax area, WESTON drilled and sampled 13 soil borings (BH-1 through BH-13). Borings were located both inside the visibly contaminated area, and outside the perimeter of the visibly contaminated area. Soil boring locations are shown in Figure 6-2.

Soil samples were obtained by using a Diedrich D-50 drilling rig with a hollow stem auger, split spoon, and 5-foot continuous sampling capabilities. Typically, four samples per boring were collected for analysis of HSL semi-volatile organic compounds. Air monitoring was performed using an HNu photoionization detector or an OVA flame ionization detector. Site safety guidelines required termination of soil boring activities if organic vapors in the work space continuously exceeded 15 ppm. Split-spoon activities at BH-10 were terminated at 6 feet when concentrations of organic vapors in the work space exceeded 50 ppm. Two borings, BH-10 and BH-13, were sampled for HSL volatile organic compounds. All samples were carefully packed in metal coolers and shipped for next-day delivery at WESTON's laboratory in Stockton, California.

Table 6-1 summarizes the number of samples, depth, soil type, and analysis parameters for each sample obtained in the Halowax production area. In addition, chain-of-custody forms for sample handling are included in Appendix M.

Soil samples of the fill and native soils overlying the clay stratum were collected from the split-spoon samples. Each split-spoon soil sample was physically described and monitored for organic vapors. Selected split-spoon samples were collected for analysis using stainless steel trowels and scoopulas. Once the boring had been advanced to the depth that split-spoons penetrated approximately 1 to 3 feet into the clay unit, split-spoon activities ceased, and a 5-foot continuous core clay sample was obtained as follows:

- The hollow stem auger penetrated into clay to a depth slightly lower than was previously penetrated by the last split spoon.
- The inside of the hollow stem auger was flushed using a tricone bit and potable water to remove any soil from the overlying fill.

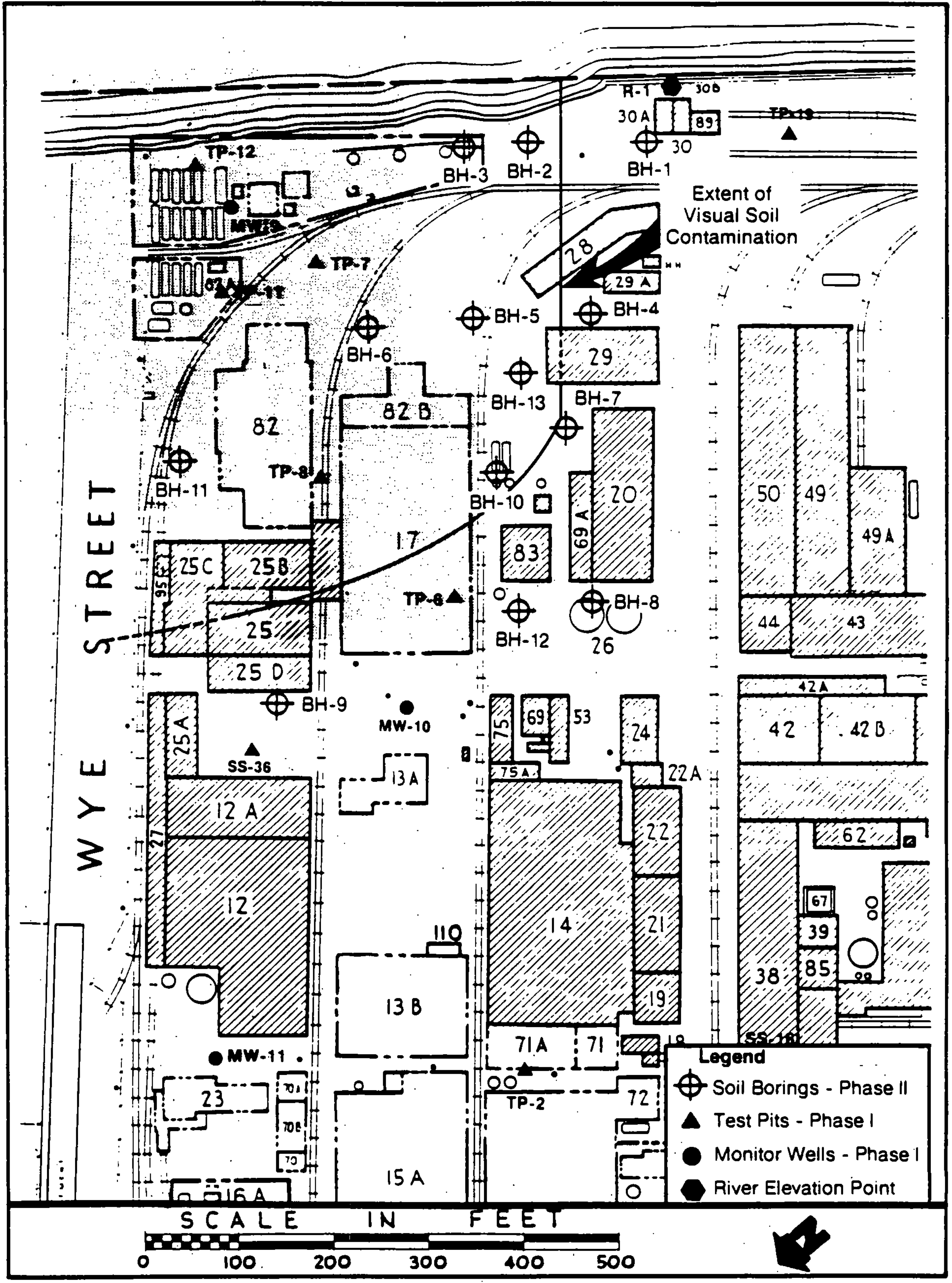


FIGURE 6-2 SOIL BORING LOCATIONS IN HALOWAX AREA

Table 6-1

Summary of Laboratory Soil Analyses Performed in Halowax Area During Phase II

Boring Location	Sample	Depth (feet)	General Description	HSL Parameter
BH-1	S-1	4-6	Coarse-grained fill	BNA's
	S-2	16-18	Fine sand	BNA's
	S-3	19.6-20.6	Clay	BNA's
	S-4	22-24	Clay	BNA's
	S-4 (duplicate)	22-24	Clay	BNA's
BH-2	S-1	4-6	Coarse-grained fill/ fine sand	BNA's
	S-2	8-10	Sandy silt	BNA's
	S-3	16-17	Clay	BNA's
	S-4	19-21	Clay	BNA's
BH-3	S-1	4-6	Sandy silt fill	BNA's
		10-12	Silty sand	PCB
	S-2	14-16	Clay	BNA's
	S-3	19-20	Clay	BNA's
	S-4	23-24	Clay	BNA's
BH-4	S-1	4-6	Coarse-grained fill	BNA's
	S-2	10-12	Silty sand	BNA's
	S-3	14-15	Clay	BNA's
	S-4	18-19	Clay	BNA's
BH-5	S-1	0-2	Coarse-grained fill	BNA's
	S-2	6-8	Coarse-grained fill/ silty sand	BNA's
	S-3	10-12	Silty sand	BNA's
	S-4	15-16	Clay	BNA's
BH-6	S-1	6-8	Coarse-grained fill	BNA's, PCB
	S-2	12-14	Silty sand-clay interface	BNA's
	S-3	14-15	Clay	BNA's
	S-4	17.5-18.5	Clay	BNA's

Table 6-1
(continued)

Boring Location	Sample	Depth (feet)	General Description	HSL Parameter
BH-7	S-1	0-2	Coarse-grained fill	BNA's
	S-1 (duplicate)	0-2	Coarse-grained fill	BNA's
	S-2	10-12	Silty sand	BNA's
	S-3	15-16.5	Clay	BNA's
	S-4	17.5-18.5	Clay	BNA's
BH-8	S-1	4-6	Silty sand	BNA's
	S-2	10-12	Coarse gravel hardpan	BNA's
	S-3	15-16	Clay	BNA's
	S-4	17.5-18.5	Clay	BNA's
BH-9	S-1	4-6	Coarse-grained fill	BNA's
	S-2	8-10	Silty sand	BNA's
	S-3	15-16	Clay	BNA's
	S-4	18-19	Clay	BNA's
BH-10	S-1	4-6	Coarse-grained fill/ silty sand	BNA's, VOA
BH-11	S-1	4-6	Peat	BNA's
	S-2	10-12	Silty sand	BNA's
	S-3	15-16	Clay	BNA's
	S-4	17.5-18	Clay	PCB
		18-19	Clay	BNA's
BH-12	S-1	4-6	Coarse-grained fill	BNA's
	S-2	8-10	Sandy silt	BNA's
	S-2A	10-12	Clay	VOA
	S-3	14.5-16	Clay	BNA
	S-3 (duplicate)	14.5-16	Clay	BNA
	S-4	18-18.5	Clay	BNA

Table 6-1
(continued)

Boring Location	Sample	Depth (feet)	General Description	HSL Parameter
BH-13	S-1	4-6	Sand/peat	BNA's
	S-2	10-12	Silty clay	BNA's
	S-3	14-14.5	Clay	BNA's
	S-4	17-17.5	Clay	BNA's
		Date		
Field Blank		9-24-86	Water	BNA's
Field Blank		9-26-86	Water	BNA's

- The 5-foot continuous sample core barrel was fitted into the hollow stem auger to a depth slightly ahead of the lead auger.
- The augers were advanced 5 feet, which allowed the sampler to obtain a 5-foot, continuous, undisturbed soil sample.
- The core barrel sampler was retrieved from the inside of the hollow stem auger and opened in a manner similar to conventional split spoons.

The sample obtained from the 5-foot continuous core barrel was physically described and monitored for organic vapors. Two discrete sections of the continuous sample were collected for analyses using a stainless steel trowel and scoopula. To minimize any potential for cross-contamination, each sample was extracted from clay that was not in contact with the sampler barrels.

Prior to removing the augers from the borehole, a cement/ bentonite grout was poured inside the augers to seal off the top of the clay.

Logs for soil borings completed in the Halowax production area are contained in Appendix K.

6.2 BURN AREA (TP-28)

6.2.1 Test Pits and Soil Profiles

Figure 6-3 locates traverse rows of test pits and organic vapor auger profiles that were completed in the burn area to estimate the extent of the suspected area of contamination associated with the past burning of fuels and solvents. These soils had a distinctive oily stained appearance (which provided visual identification of contamination) as did the soils in the Halowax area. Thus, the concentration of organic vapors in the test pits, as measured by field instruments, was used to determine the approximate extent of soil contamination.

In addition to the test pits, four organic soil vapor profile borings were conducted in this area to help delineate the estimated contamination boundary.

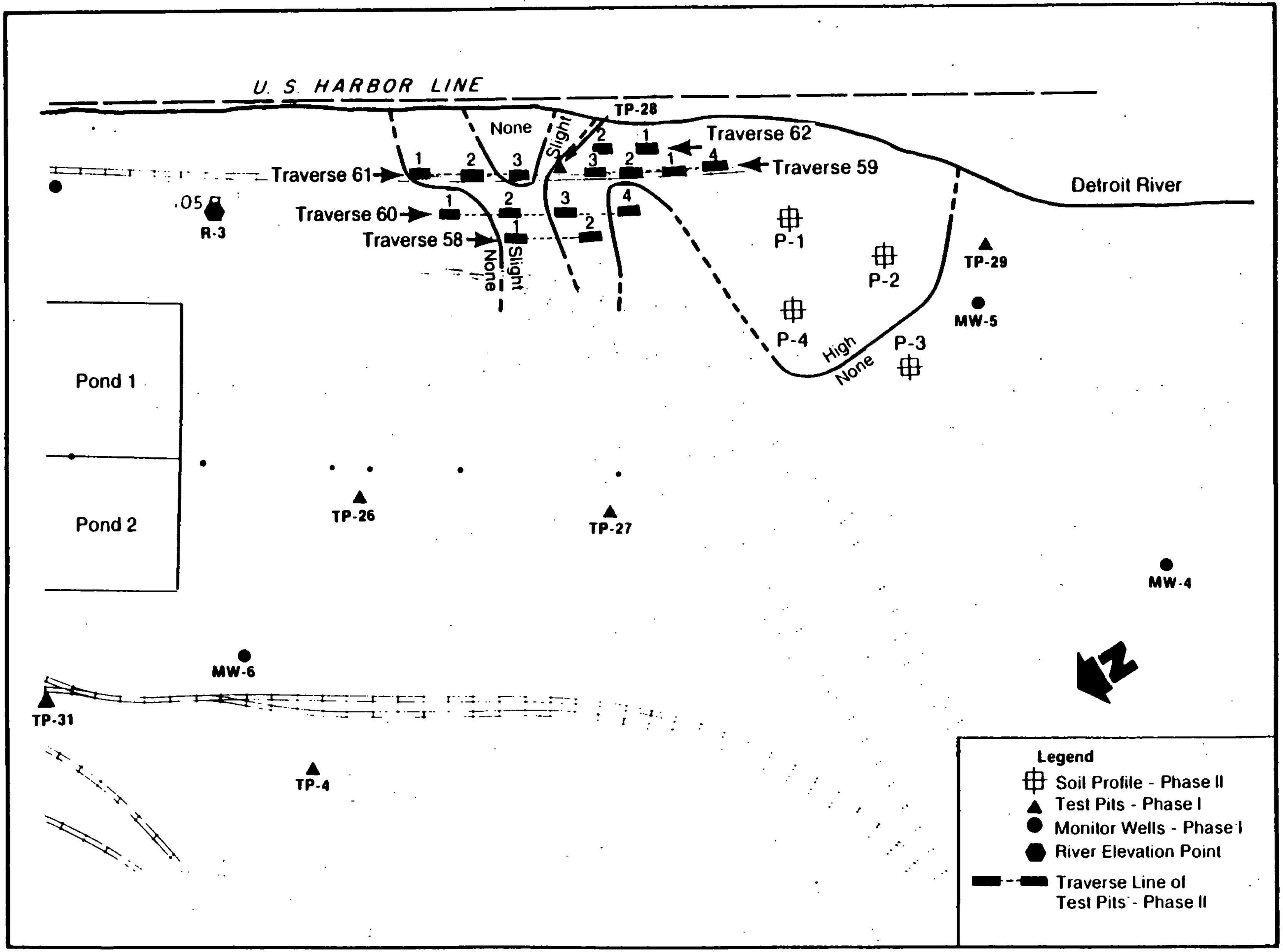


FIGURE 6-3 VISUAL EXTENT OF ORGANIC-CONTAMINATED SOILS (BASED ON PHASE II TEST PIT SCREENING)

During profiling, a section of auger was advanced to a specified depth, such as 3 feet. The auger was removed from the borehole to allow downhole organic vapor monitoring using the OVA and HNu. The auger was then reinserted into the same borehole and advanced to successively lower depths to obtain a vertical stratification of organic vapor measurements.

The logs from all soil test pits and organic vapor profiles conducted in the burn area are contained in Appendix K. A summary of profile borehole stratigraphy, based on auger cuttings and in-field organic vapor measurements, is shown on Table 6-2.

6.2.2 Test Borings

Following the conclusion of the test pit and organic vapor profile boring activities in the burn area, a WESTON soil scientist mapped the approximate areal extent of contamination using data obtained from field observations and organic vapor instrument readings, as shown in Figure 6-3. To quantify the horizontal and vertical extent of contamination in the burn area, eight soil borings (BB-14 through BB-21) were located as shown in Figure 6-4.

Soil samples collected for chemical analyses were obtained by using a hollow stem auger with split-spoon and continuous sampling capabilities, as previously explained in Subsection 6.1.2. Following collection, all samples were carefully packed in metal coolers and shipped to WESTON's Stockton, California laboratory for next-day delivery.

Two soil samples per boring were collected for analysis of HSL volatile organic compounds, and four samples per boring were collected for HSL semi-volatile organic compounds. Table 6-3 summarizes the number of samples, sample depth, soil type, and parameters analyzed for each soil sample in the burn area. All samples were collected, shipped, and analyzed under strict chain-of-custody procedures. The chain-of-custody forms are included in Appendix M.

6.3 BUILDING 35A/38A AREA

6.3.1 Hand Auger Borings

In this area, soil samples were collected from three shallow hand-auger borings at locations identified as SS-16, SS-17, and SS-18 in Figure 6-5. During Phase I activities each of these locations was sampled at 2 to 4 inches and analyzed for HSL metals. During the Phase II effort, soil samples SS-17 and SS-18 were collected at 6 to 12 inches and at 12 to 18 inches. Location SS-16 had a sample collected at 6 to 12 inches only. Hand-auger refusal prohibited a deeper sample at this location. All soil samples obtained in this area were analyzed for HSL metals.

Table 6-2

Soil Profiles
9/30/86

	Depth (in.)	Description	OVA (ppm)	HNu (ppm)
P-1	0-96	White sludge saturated at 36 inches	1-2	0
	96-108	Brown peat	1,000+	1-2
	108-156	Gray sand	1,000+	10
P-2	0-48	Brown to black gravelly fill	1,000+	0
	48-96	Black, very oily fill	1,000+	0
	96+	Gray sand	1,000+	0
P-3	0-84	Brown to black ash fill	1-3	0
	84-108	Gray sand	1-3	0
P-4	0-48	Black ash fill	1,000	High humidity, no measurement
	48-84	Black, oil-stained sludge	1,000	High humidity, no measurement
	84+	Gray sand	1,000	

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[1] The OVA's sensitivity to methane is the probable reason for the differences in the readings between these two instruments.

[2] High humidity adversely affects the HNu reading.

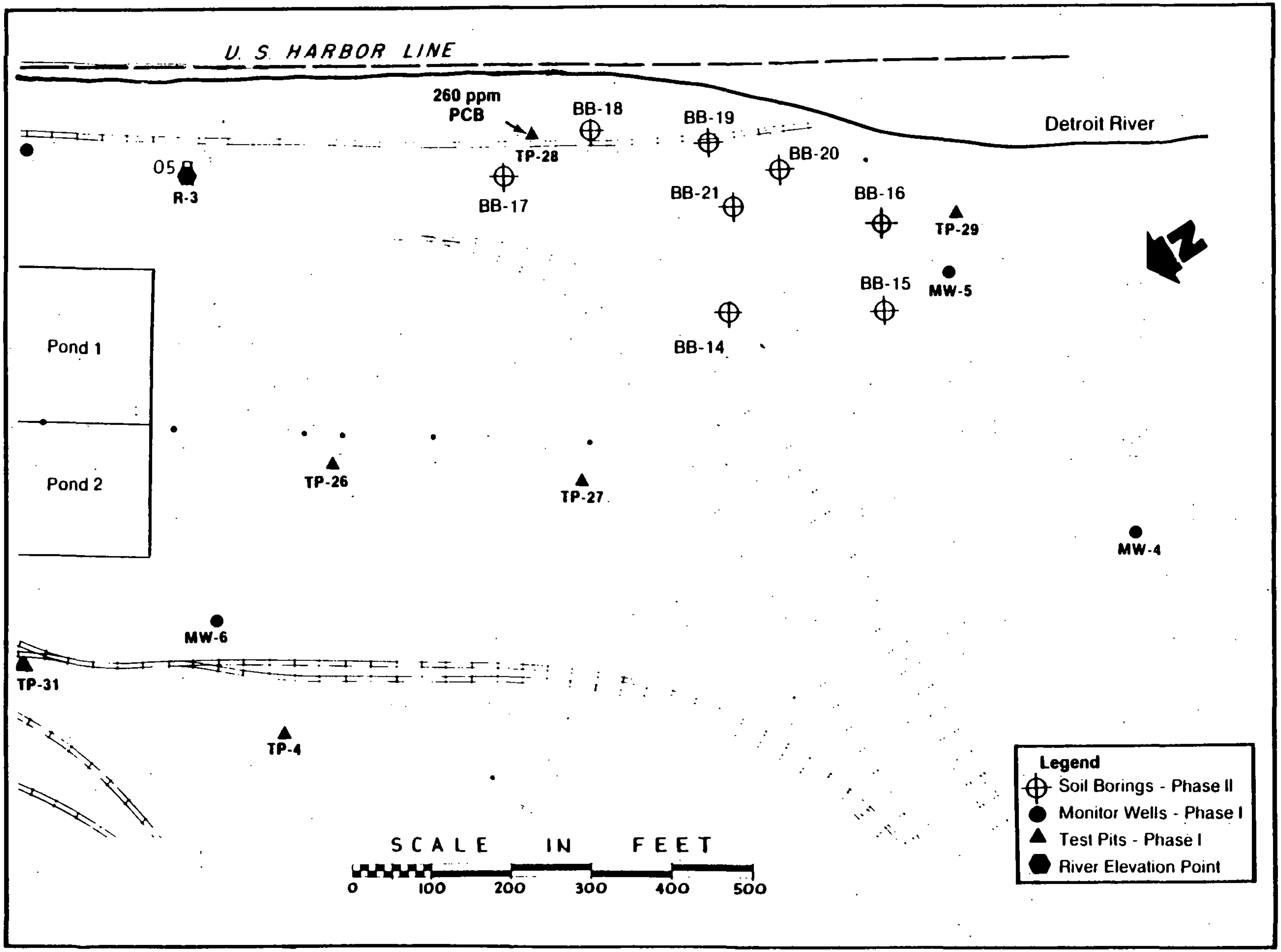

FIGURE 6-4 BURN AREA SOIL BORING LOCATIONS

Table 6-3

Summary of Laboratory Soil Analyses Performed in Burn Area (TP-28) During Phase II

Boring Location	Sample	Depth (feet)	General Description	HSL Parameter
BB-14	S-1	0-2	Coarse-grained fill	BNA's
	S-2	8-10	Sandy silt/peat	BNA's, Pest/PCB, VOA
	S-3	13.5-14	Clay	BNA's, Pest/PCB, VOA, VOA duplicate
	S-4	16-17	Clay	BNA's
BB-15	S-1	4-6	Sandy silt/peat	BNA's
	S-2	12-14	Peat-clay	BNA's, Pest/PCB, VOA
	S-3	14-15	Clay	BNA's, Pest/PCB, VOA
	S-3 (duplicate)	14-15	Clay	BNA's, Pest/PCB, VOA
	S-4	18-18.5	Clay	BNA's
BB-16	S-1	4-6	Coarse-grained fill	BNA's, Pest/PCB
	S-2	8-10	Silty sand	BNA's, VOA
	S-3	13-13.5	Silty clay	BNA's, Pest/PCB, VOA
	S-4	15-16	Clay	BNA's
BB-17	S-1	6-10	Coarse-grained fill/ silty sand	BNA's, Pest/PCB
	S-2	10-12	Silty clay	BNA's
	S-3	15.5-16	Clay	BNA's, Pest/PCB
	S-4	16-17	Clay	BNA's
	S-4 (duplicate)	16-17	Clay	BNA's
BB-18	S-1	6-8	Coarse-grained fill	BNA's, Pest/PCB, VOA
	S-2	12-14	Silty sand	BNA's
	S-3	16-17	Clay	BNA's, Pest/PCB, VOA
	S-4	19-20	Clay	BNA's
BB-19	S-1	2-4	Coarse-grained fill	BNA's
	S-2	8-10	Silty sand	BNA's, Pest/PCB
	S-3	14-15	Clay	BNA's, Pest/PCB, VOA
	S-3 (duplicate)	14-15	Clay	BNA's, Pest/PCB, VOA
	S-4	15.5-16.5	Clay	BNA's

Table 6-3
(continued)

Boring Location	Sample	Depth (feet)	General Description	HSL Parameter
BB-20	S-1	4-6	Coarse-grained fill/ white paste	BNA's
	S-2	8-10	Silty sand	BNA's, Pest/PCB, VOA
	S-3	16-16.5	Clay	BNA's, Pest/PCB, VOA
	S-4	17-19	Clay	BNA's
BB-21	S-1	8-10	Coarse-grained fill/ silty clay	BNA's, Pest/PCB, VOA
	S-2	10-12	Silty sand	BNA's
	S-3	17-17.5	Clay	BNA's, Pest/PCB, VOA
	S-4	21-21.6	Clay	BNA's
		Date		
Field Blank		10-7-86	Water	BNA's, Pest/PCB, VOA
Trip Blank		10-7-86	Water	VOA

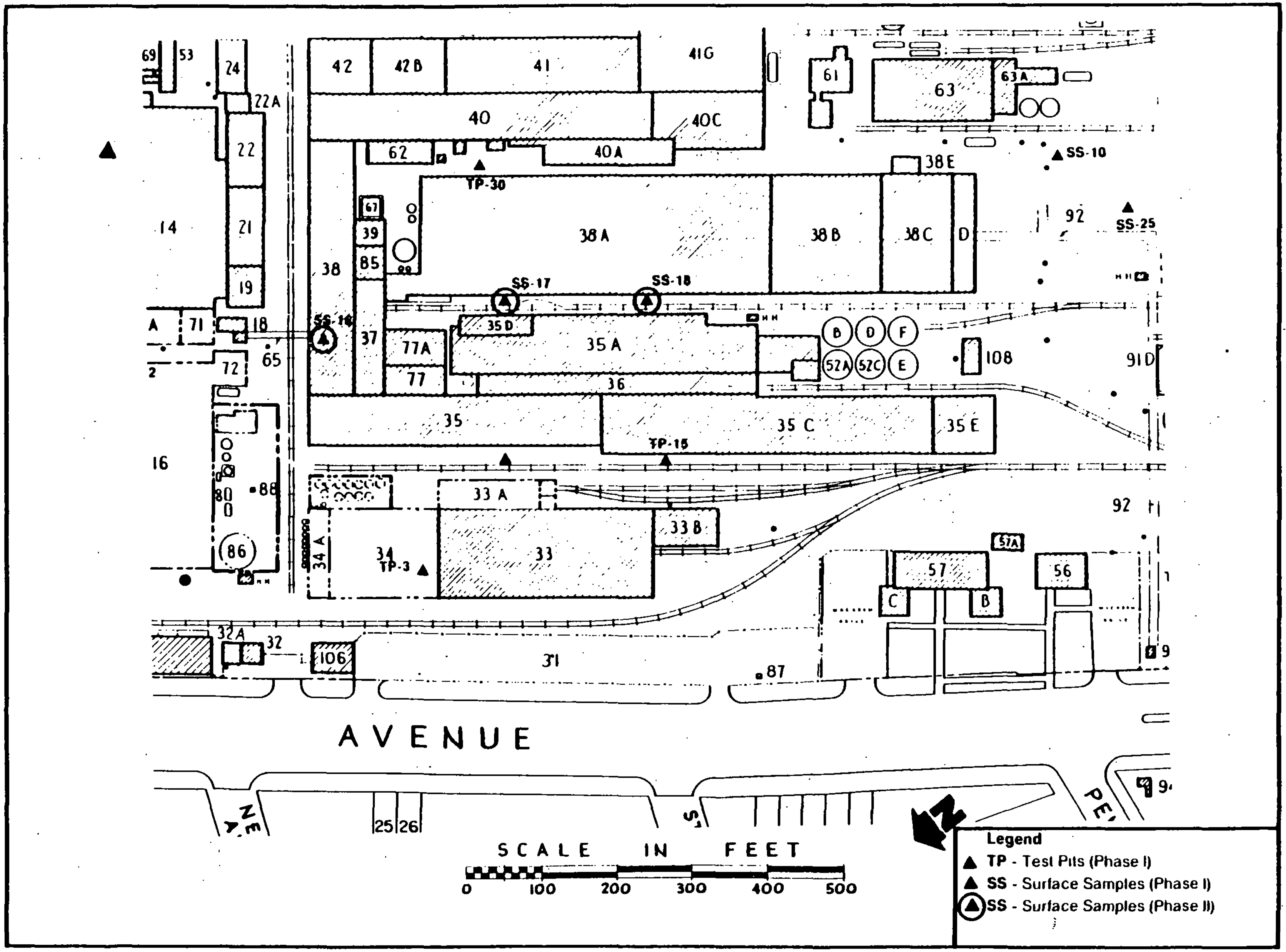

FIGURE 6-5 PHASE II SURFACE SAMPLE LOCATIONS IN BUILDING 35A/38A AREA

All samples were extracted from the bucket of the hand auger using a stainless steel trowel or scoopula. A description of each shallow boring is presented in Appendix K of this report.

6.4 SOIL SAMPLING DECONTAMINATION PROCEDURES

Prior to the soil sampling program, the drill rig rods, bits, augers, split spoons, continuous-core sampler, and accessory tools were steam cleaned with a nonphosphate-type detergent wash and steamed with a potable-water rinse. Between boreholes all equipment that was used or was contaminated during the soil boring procedure was again steam cleaned as specified above.

The stainless steel trowels, scoopulas, and the hand auger used to collect soil samples for analyses were decontaminated between samples using the procedures detailed in the Technical Operations Plan contained in Appendix J.

Prior to the demobilization of drilling and sampling equipment, all equipment was thoroughly decontaminated.

6.5 GROUNDWATER

6.5.1 Groundwater Sampling

Groundwater samples were collected from four of the 12 Phase I monitor wells at the East Plant on 29 September 1986 and 30 September 1986. Prior to sampling, the depth to water in each well was measured, and the volume of standing water in the casing was calculated. Three volumes of standing water were removed from each well and discarded, using a Teflon bailer and dedicated polypropylene rope. Groundwater samples from each well were then obtained and placed in laboratory-prepared bottles. Table 6-4 lists the analyses planned for each monitor well sample. After collection, samples for soluble metals were filtered through a 0.45-micron filter and the filtrate was preserved with HNO_3.

The Teflon bailer was decontaminated between wells using a solution of Alconox detergent and potable water with a deionized water rinse. Chain-of-custody records were completed, and all samples were carefully packed in coolers for overnight shipment to WESTON's Stockton, California laboratory.

6.5.2 Groundwater Elevations

During the Phase II field program, three complete sets of surface-water and groundwater depth measurements were obtained from the three Detroit River staff gauges, 12 monitor wells, and two piezometers installed during the Phase I effort.

Table 6-5 summarizes groundwater elevations that were calculated using the three rounds of measurements. The results of these measurements are discussed in Section 7.

Table 6-4

Summary of Laboratory Water Analyses from Monitor Wells

Monitor Well	HSL Parameters
MW-7	BNA's, metals, CN
MW-8	VOA
MW-9	BNA's, VOA
MW-12	Pesticides/PCB's
Trip blank	VOA
Field blank	Metals

Table 6-5

Phase II Groundwater and River Water Measurements/Elevations

Well Number	Elevation at Top of PVC Casing (ft)	Depth to Groundwater (ft)			Groundwater Elevations (ft)		
		9-22-86	9-30-86	10-9-86	9-22-86	9-30-86	10-9-86
MW-1	579.72	5.56	2.88	3.09	574.16	576.84	576.63
MW-2	579.32	5.04	1.93	2.37	574.28	577.39	576.95
MW-3	579.10	4.68	2.97	2.88	574.42	576.13	576.22
MW-4	580.64	5.02	3.33	3.47	575.62	577.31	577.17
MW-5	579.64	3.37	3.18	3.12	576.27	576.46	576.52
MW-6	580.06	3.55	2.72	2.87	576.51	577.34	577.19
MW-7	582.00	5.75	4.75	5.37	576.25	577.25	576.63
MW-8	580.95	5.04	4.63	4.34	575.91	576.32	576.61
MW-9	579.80	3.22	4.31	3.43	576.58	575.49	576.37
MW-10	580.09	3.77	3.55	3.63	576.32	576.54	576.46
MW-11	580.27	3.00	2.64	2.91	577.27	577.63	577.36
MW-12	580.04	2.83	2.21	3.23	577.21	577.83	576.81
Piezo 13	580.83	5.20	3.07	3.35	575.63	577.76	577.48
Piezo 14	580.76	4.70	3.90	4.18	576.06	576.86	576.56

Table 6-5
(continued)

Detroit River Gauging Station	Elevation at Gauging Station (ft)	Depth to Water Surface (ft)			Surface Water Elevations (ft, IGLD)*		
		9-22-86	9-30-86	10-9-86	9-22-86	9-30-86	10-9-86
R-1	577.85	1.90	0.23	1.09	575.95	577.62	576.76
R-2	577.63	1.83	0.11	0.90	575.80	577.52	576.73
R-3	579.00	3.21	2.63	2.49	574.32	576.37	576.51

*International Great Lakes Datum

SECTION 7

PHASE II RESULTS

7.1 SITE GROUNDWATER CONDITIONS

Groundwater occurs at the East Plant under unconfined conditions in the relatively porous fill and natural soils that directly underlie the property. The clay that occurs 10-15 feet below ground surface is also saturated, but relatively low permeability restricts the movement of groundwater in that zone. The saturated sediments that underlie the property are of principal concern in this investigation for two reasons:

- The saturated sediments are directly exposed to chemical constituents in the unsaturated soils.
- Groundwater potential in the shallow water-table aquifer provides a migration pathway for these chemical constituents off-site.

7.1.1 Results of Site Investigation

Three rounds of surface-water and groundwater level measurements were collected during the months of September and October 1986 from the Phase I monitor wells, piezometers, and Detroit River elevation monitoring points. Table 6-5 in Section 6 is a summary of these data. The three rounds of measurements show an overall difference of less than 3 feet in water-table elevation and a difference of less than 1 foot between the river and the highest groundwater level during the last two measurements.

Figure 7-1 is a groundwater surface elevation contour map for the East Plant site developed from surface-water and groundwater elevations measured on 9 October 1986.

The groundwater elevation contours in this figure represent lines of constant water head; in the case of unconfined conditions, these are equal to water-table elevations. Horizontal groundwater flow direction is perpendicular to these contours and toward the lower head value. The contours in Figure 7-1 indicate that the area of highest head is located near the middle of the site and is approximately parallel to the Detroit River and Biddle Avenue. From this area, shallow groundwater flows primarily west and southeast-northwest toward Biddle Avenue and a small component flows east toward the Detroit River.

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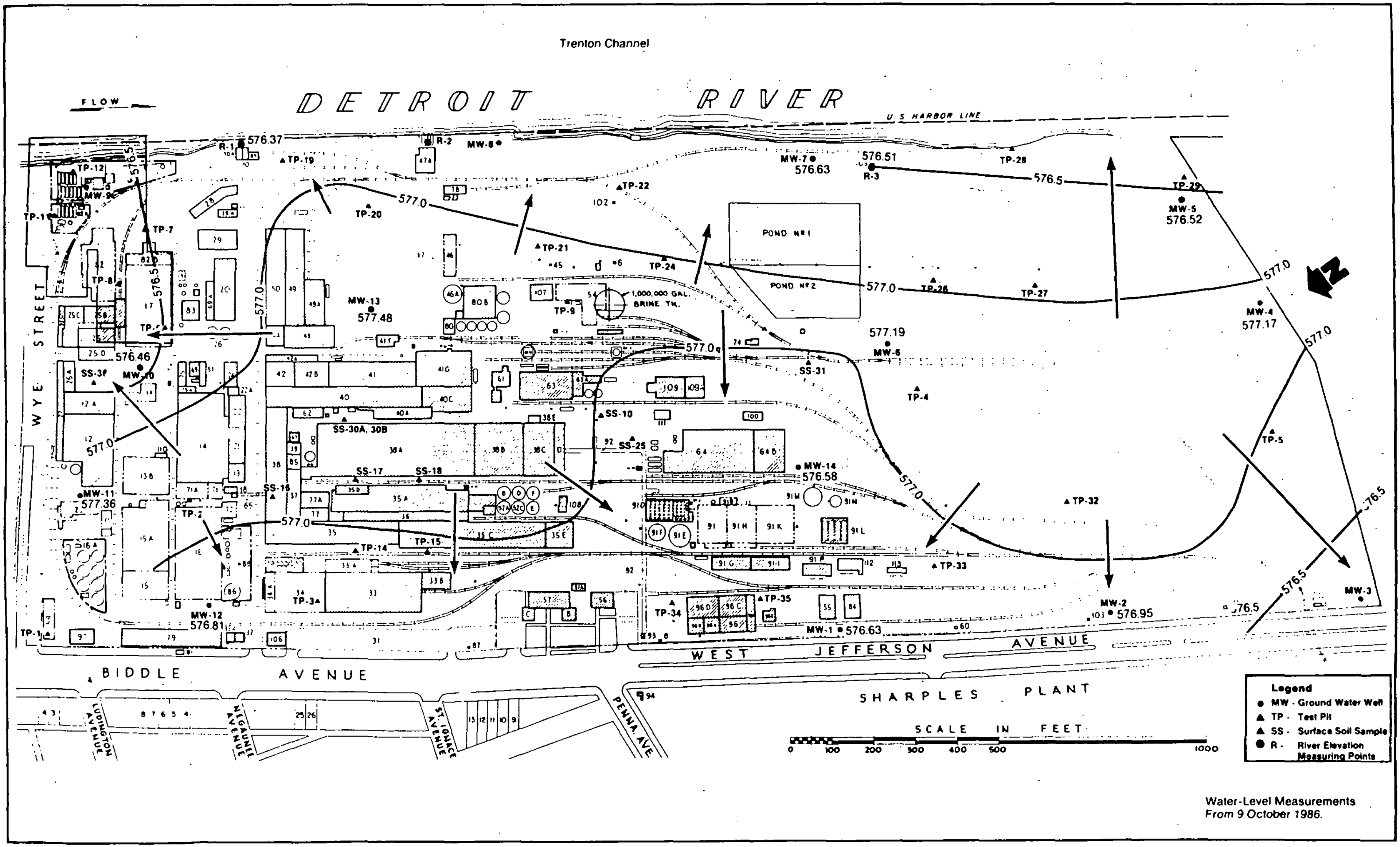


Water-Level Measurements
From 9 October 1986.

FIGURE 7-1 SHALLOW GROUNDWATER ELEVATION CONTOUR MAP

As discussed in Subsection 2.2.3, the surface-water hydraulics of the Great Lakes affect the Detroit River and produce local fluctuations in groundwater flow. This phenomenon was observed at the East Plant site. During time intervals when the Detroit River is at a high elevation, surface water from the river discharges into the shallow groundwater system at the site, and during time periods when the Detroit River is at a low elevation, the shallow groundwater would be expected to discharge to the Detroit River.

7.1.2 Historic Detroit River Elevation Fluctuation and the Effects on Shallow Groundwater Flow

Detroit River elevation data were collected to assist in understanding the surface-water and groundwater interactions at the East Plant site.

The National Oceanic and Atmospheric Administration (NOAA) water elevation data from survey station 4030, located on the Detroit River in Wyandotte, Michigan, were obtained by WESTON as part of the Phase II literature review. Monthly and annual average elevations have been collected from 1960 through 1985. In addition, mean daily and average monthly water elevations were available from January 1986 through September 1986. These data are included in Appendix N.

Figure 7-2 illustrates the fluctuations of the annual average water elevation of the Detroit River during the past 15 years. The lowest river level occurred during 1964 when the annual average was 570.25 feet, based on the International Great Lakes Datum (IGLD). The highest annual average occurred during 1985 with the river elevation peaking at 574.20 feet IGLD.

The data collected during the past 15 years have shown a general increasing trend in the elevation of the Detroit River. Figure 7-3, based on the average monthly river elevations for 1986, illustrates that the rising trend has continued. During the 1960's and early 1970's the average annual river elevations ranged between 570.25 and 572.30 feet IGLD. During this time, base flow conditions at the East Plant site probably resulted in discharge of the shallow groundwater into the Detroit River.

Since 1971, however, increased average annual river elevations have resulted in a reversal of flow directions, causing the Detroit River to periodically contribute water to the shallow water-table aquifer at the East Plant site. The Phase II water-table data indicate that as little as a 1-foot elevation change in river level could result in a reversal of groundwater flow direction in the eastern portion of the East Plant site.

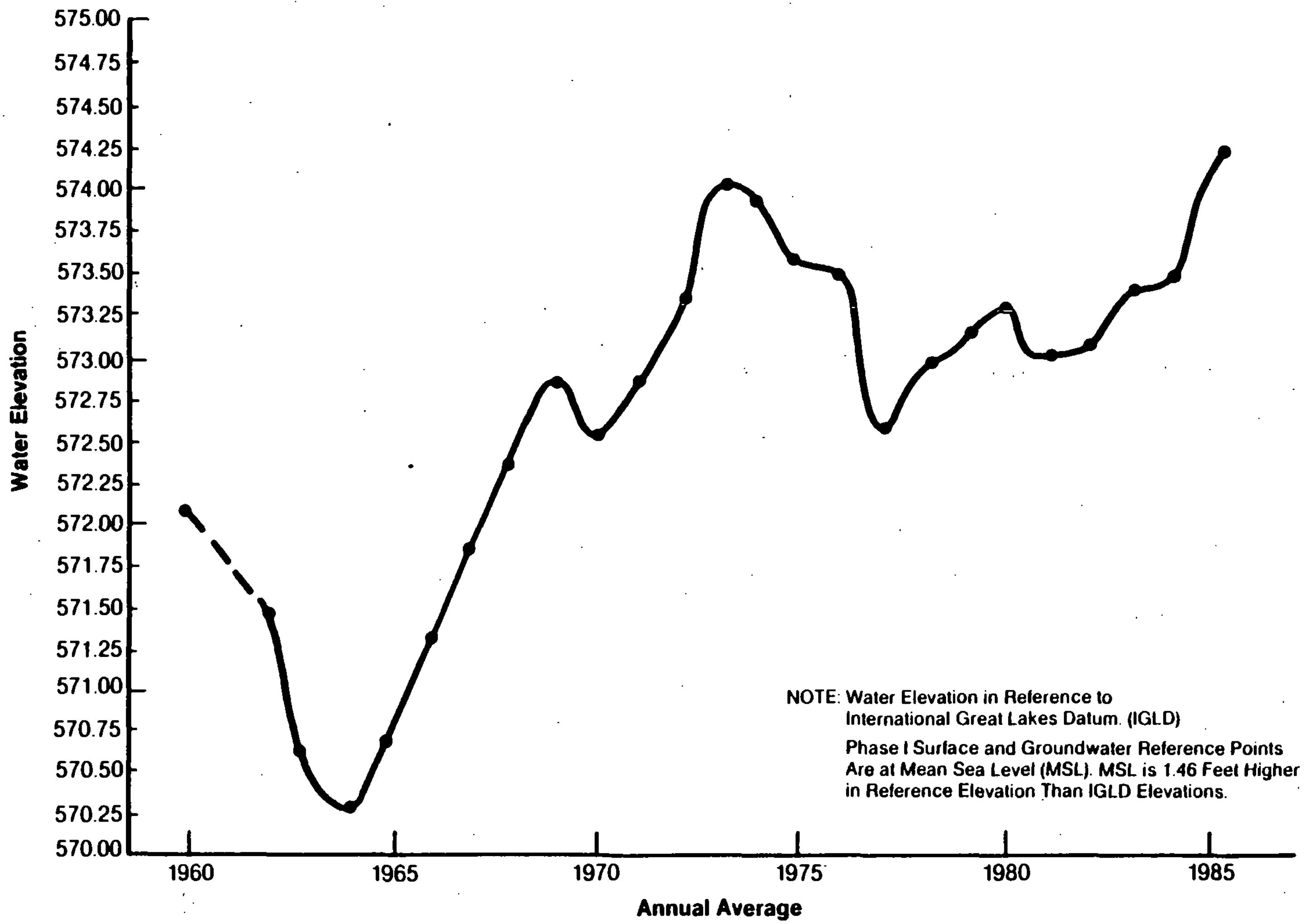
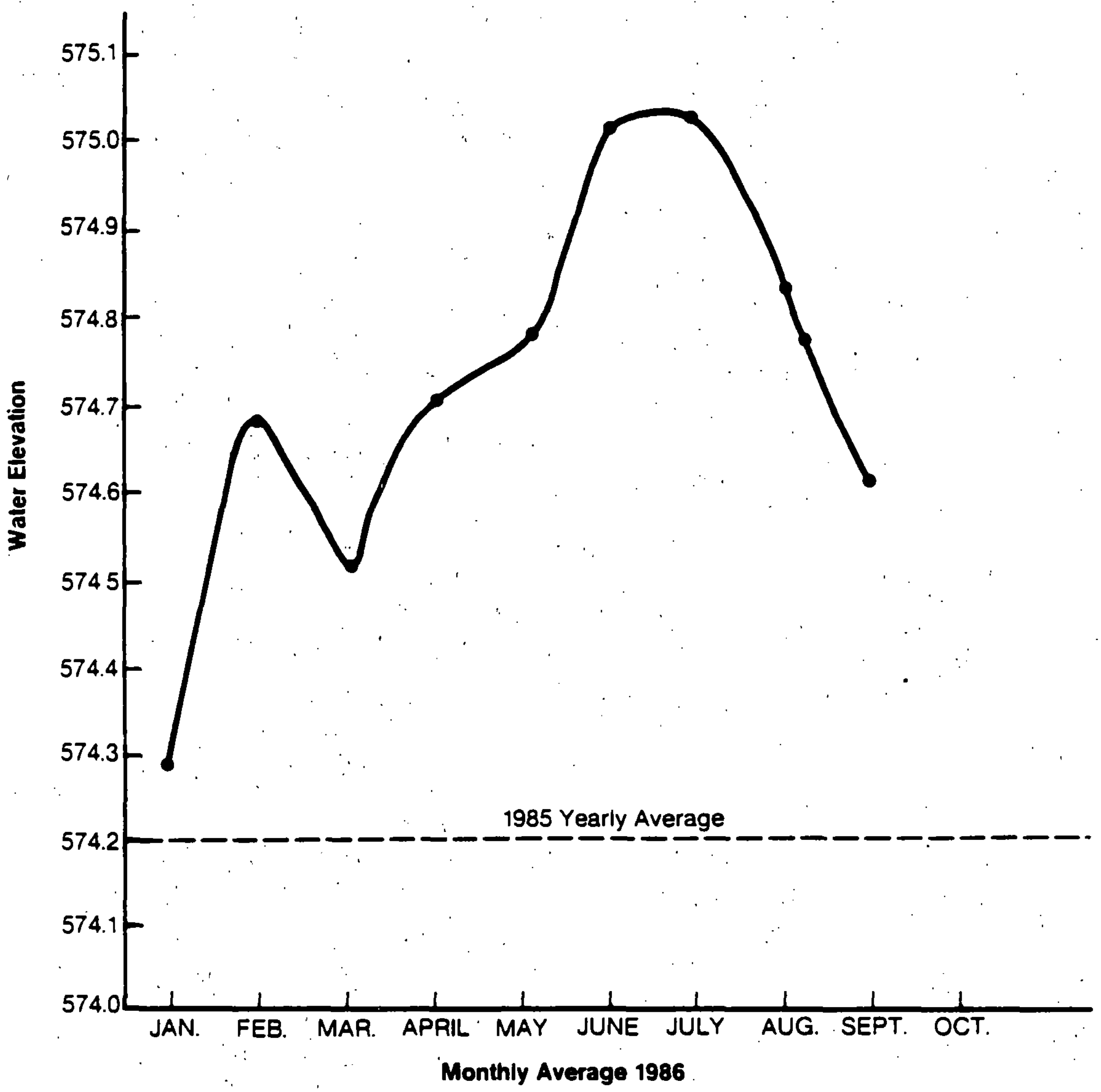


FIGURE 7-2 DETROIT RIVER ANNUAL AVERAGE WATER ELEVATIONS AT STATION 4030, WYANDOTTE, MI



NOTE: Water Elevation in IGLD

FIGURE 7-3 DETROIT RIVER WATER ELEVATIONS
1986 MONTHLY AVERAGES
STATION 4030, WYANDOTTE, MI

As expected, the trend of annual increasing water elevations in the Detroit River is also occurring in the adjacent Great Lakes. The U.S. Army Corps of Engineers (USACE) states that "new record high monthly levels for August were set on Lakes Michigan, Huron, St. Clair, and Erie" (U.S. Army Corps of Engineers, 4 September 1986). The USACE additionally stated "all the Great Lakes except Lake Ontario are predicted to remain extremely high through the end of February 1987."

Based on the data, the Detroit River will probably continue to discharge sporadically to the shallow-water table at the East Plant site at least until February 1987.

7.1.3 Results of the Groundwater Quality Analyses

Based on data collected in Phase I, four existing monitor wells were resampled to confirm the presence of key compounds identified in the Phase I study. A sample from well MW-7 was analyzed for the United States Environmental Protection Agency (USEPA) Hazardous Substance List (HSL) semivolatile organic compounds and inorganic compounds. Groundwater from MW-8 was analyzed for HSL volatile organic compounds, MW-9 was analyzed for HSL volatile organic and semivolatile organic compounds, and MW-12 was analyzed for the HSL pesticide/PCB fraction.

A comparison of the results of groundwater analyses from Phase I and Phase II with applicable EPA Maximum Values for Protection of Aquatic life is shown on Table 7-1 and Table 7-2. Laboratory analytical data are contained in Appendix L.

Semivolatile analyses of groundwater from MW-7 showed 18 ug/L phenol in the Phase II sampling round, but phenol was not detected in the sample collected during Phase I. Approximately 150 ug/L polynuclear aromatics (PNA's) suspected to be associated with the former burn area and coal piles were also detected in MW-7.

Groundwater from MW-8 contained 11 ug/L chloroform in the Phase I analysis. It was sampled for volatile organic compounds during Phase II and was found to contain 22 ug/L of acetone; chloroform was not detected.

MW-9, located in the Halowax production area, was resampled for volatile and semi-volatile organic compounds to confirm the Phase I results. The Phase II analysis showed combined naphthalene and 2-chloronaphthalene concentrations of 25,000 ug/L, and chloroform concentrations of 4,620 ug/L. Vinyl chloride was detected at a level of 28 ug/L, chlorobenzene was detected at 312 ug/L, and several additional organic compounds were present, as shown on Table 7-1.

Table 7-1

Phase I/Phase II Groundwater Results Compared to Applicable EPA Guidelines for Monitoring Wells 7 and 12

Parameter	MW-7		MW-12		Maximum Values of Protection of Aquatic Life (ug/L)
	May 26 (ug/L)	Sept. 86 (ug/L)	May 86 (ug/L)	Sept. 86 (ug/L)	
Semivolatiles					
Phenanthrene	1,100	34	ND	NA	NC
Fluoranthene	1,400	37	ND	NA	3,980
Pyrene	700	28	ND	NA	NC
Benzo(a) anthracene	550	18	ND	NA	NC
Benzo(b) fluoranthene	500	22	ND	NA	NC
Phenol	150 J	18	ND	NA	2,560
4-Methyl-phenol	200 J	28	ND	NA	NC
2,4-Dimethyl phenol	250 J	28	ND	NA	NC
Benzoic acid (2)	700 J	ND			
Naphthalene	100 J	6 J	ND	NA	620
2-Methyl-napthalene	150 J	4 J	ND	NA	NC
Acenaphthylene	150 J	5 J	ND	NA	NC
Acenaphthene	100 J	3 J	ND	NA	1,700
Dibenzofuran	150 J	5 J	ND	NA	NC
Fluorene	350 J	9 J	ND	NA	NC
Anthracene	400 J	12 J	ND	NA	NC
Chrysene	400 J	13 J	ND	NA	NC
Benzo(a)pyrene	250 J	12 J	ND	NA	NC
Indeno (1,2,3-cd) pyrene	200 J	9 J	ND	NA	NC
Dibenzo (a,h) anthracene	50 J	3 J	ND	NA	NC
Benzo (g,h,i) perylene	150 J	ND	ND	NA	NC
bis(2-ethyl hexyl) phthalate	ND	13 J	5 J	NA	
di-n-butyl phthalate	ND	3 J			
Pest/PCB					
Aroclor-1254	ND	NA	32.0	28.0	0.79[2]

Table 7-1
(continued)

Parameter	MW-7		MW-12		Maximum Values of Protection of Aquatic Life (mg/L)
	May 26 (mg/L)	Sept. 86 (mg/L)	May 86 (mg/L)	Sept. 86 (mg/L)	
Inorganics					
Ag	ND	0.14	ND	NA	0.0012
Al	6.9	1.10	6.0	NA	NC
As	0.19	0.04	0.01	NA	0.19[2]
Be	0.01	0.02	ND	NA	0.0053
Ca	23.0	56.9	148	NA	NC
Cd	0.007	ND	ND	NA	0.00066[2,3]
Co	0.12	ND	ND	NA	NC
Cu	0.03	ND	ND	NA	0.0065[2,3]
Fe	0.2	4.68	ND	NA	NC
Hg	0.005	0.0002	ND	NA	0.000012[2]
K	123.0	106.0	ND	NA	NC
Mg	ND	1.4			
Mn	0.07	0.04	1.39	NA	NC
Na	36,900	23,200	147	NA	NC
Ni	0.16	ND	0.01	NA	0.056[2,3]
Se	0.1	ND	ND	NA	0.035[1,4]
Tl	ND	2.1	ND	NA	NC
Va	0.35	ND	ND	NA	NC
Zn	ND	0.02	ND	NA	0.047[1]

J = Compound present below detection level. Value is estimated.
ND = None detected.
NA = Not analyzed.
NC = No water quality criteria for this parameter.

References

Water Quality Criteria for organic compounds: Federal Register, Vol. 45, No. 231, 28 November 1980.
Water Quality Criteria for inorganic compounds: Federal Register, Vol. 50, No. 145, 29 July 1985, p. 30784-30796.

[1] 24-hour average concentration.
[2] 4-day average concentration.
[3] At hardness of 50 mg/L $CaCO_3$.
[4] As selenite.

Table 7-2

Phase I/Phase II Groundwater Results Compared to Applicable EPA Guidelines for Monitoring Wells 8 and 9

	MW-8		MW-9		EPA Maximum Values for Protection of Aquatic Life (ug/L)
Parameter	May 86 (ug/L)	Sept. 86 (ug/L)	May 86 (ug/L)	Sept. 86 (ug/L)	
<u>Semivolatiles</u>	ND	NA			
2-Chlorophenol			200	ND	4,380
1,3-Dichlorobenzene			86	ND	763[1]
1,4-Dichlorobenzene			860	ND	763[1]
1,2-Dichlorobenzene			320	ND	763[1]
4-Methylphenol			45	ND	NC
2,4-Dimethylphenol			12	ND	NC
Naphthalene			3,400	950	620
Benzo(k) fluoranthene			14	25 J	NC
2-Chloronaphthalene			71,700	14,400	NC
2-methylnaphthalene			6 J	ND	NC
Phenanthrene			10 J	75 J	NC
Fluoranthene			9 J	50 J	3,980
Pyrene			4 J	50 J	NC
Butyl benzyl phthalate			3 J	ND	NC
Benzo(b) fluoranthene			11 J	75 J	NC
Benzo(a)pyrene			4 J	50 J	NC
Anthracene			ND	25 J	NC
di-n-butyl phthalate			ND	225 J	NC
Benzo(a) anthracene			ND	25 J	NC
Cyrsene			ND	25 J	NC

NC = No water quality criteria for this compound.
ND = None detected.
NA = Not analyzed.
J = Compound present below detection level. Value is estimated.

[1] Total value for compounds noted.

Table 7-2
(continued)

	MW-8		MW-9		EPA Maximum Values for Protection of Aquatic Life (ug/L)
Parameter	May 86 (ug/L)	Sept. 86 (ug/L)	May 86 (ug/L)	Sept. 86 (ug/L)	
VOA's					
Chloroform	11	ND	8,500	4,620	28,900
Acetone	ND	22	ND	15	
Methylene chloride	6 J	6	1,700	1,180	NC
Chlorobenzene	ND	ND	1,000	312	250
Vinylchloride	ND	ND	ND	28	
Trans-1,2-dichloroethene	ND	ND	70 J	97	11,600
1,2-Dichloroethane	ND	ND	ND	59	20,000
Trichloroethene	ND	ND	ND	60	5,300
1,1,2-Trichloroethane	ND	ND	ND	8	9,400
Benzene	ND	ND	130 J	75	5,300
Tetrachloroethene	ND	ND	ND	39	840
Toluene	ND	ND	74 J	46	17,500
1,1-Dichloroethene	ND	ND	ND	1 J	11,600[2]
1,1-Dichloroethane	ND	ND	ND	4 J	NC
1,2-Dichloropropane	ND	ND	ND	26	5,700
trans-1,3-Dichloropropene	ND	ND	ND	2 J	244
1,1,2,2-Tetrachloroethane	ND	ND	ND	3 J	2,400
Total xylenes	ND	ND	ND	3 J	NC

NC = No Water Quality Criteria for this compound.
ND = None detected.
NA = Not analyzed.
J = compound detected below detection level. Value is estimated.

[2] Value is limit on combination of trans-1,2-dichloroethene and 1,1-dichloroethene.

In MW-12 the presence of PCB Aroclor 1254 was confirmed in the Phase II round of sampling at a concentration of 28 ug/L. The source of the PCB contamination is unknown at this time, since MW-12 is located in an area where no soil contamination has been reported or observed. Since the mobility of PCB's in groundwater is relatively low, the presence of PCB's at MW-12 probably indicates that the source is not far from the well location.

7.2 RESULTS OF THE SOILS INVESTIGATION

7.2.1 Halowax Area

7.2.1.1 Results of the Laboratory Analyses

As a result of the Phase I investigations at the East Plant site, the Halowax production area was identified as a target area for Phase II activities. The soils investigation performed in Phase II is presented in Section 6 of this report. Table 6-1 summarizes the soil boring, sampling, and analysis activities and Figure 7-4 illustrates the locations of all test pits in the Halowax area. Each soil sample was analyzed for the presence of the organic compound group listed in Table 6-1. Raw analytical data are contained in Appendix L.

A review of the analytical data in Appendix L indicates that the most common contaminant compound groups are the semi-volatiles, primarily, naphthalenes, and chlorinated naphthalenes. Table 7-3 summarizes the total combined naphthalene and 2-chloronaphthalene soil concentrations in each pit.

Also of significance are the benzene and chlorinated benzenes. These compounds were found only in borings BH-3 (S-1), BH-10 (S-1), and BH-11 (S-1). The concentrations detected in these samples are summarized on Table 7-4.

7.2.1.2 Halowax/PCB Separation and Analysis

Soil samples from the Halowax area collected during the Phase I study contained high levels of chlorinated naphthalenes, which interfered analytically with the detection of PCB's in those samples. In order to obtain accurate soil PCB concentrations, a specialized chromium trioxide separation method (Holmes and Wallen, 1972) was utilized to destroy the chlorinated naphthalenes in the soil sample, leaving the PCB's which could then be quantified.

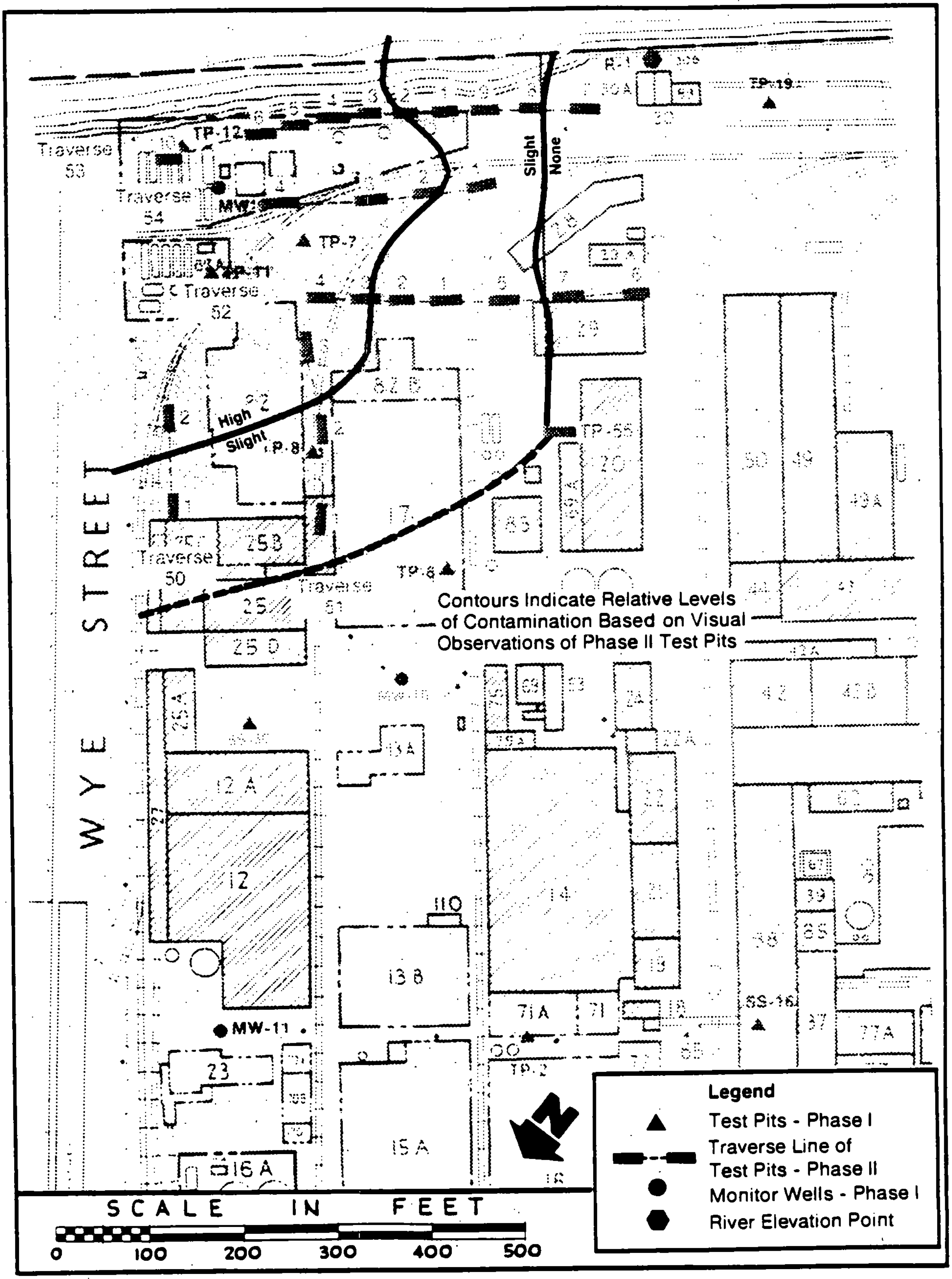


FIGURE 7-4 VISUAL EXTENT OF ORGANIC-CONTAMINATED SOILS (BASED ON PHASE II TEST PIT SCREENING)

Table 7-3

Naphthalene and Chlorinated Naphthalene Concentrations in Soil Borings - Halowax Area

Boring Number	Sample Number	Naphthalene (mg/kg)	2-Chloronaphthalene (mg/kg)
BH-1	S-1	18	212
BH-3	S-1	ND	228
BH-5	S-2	ND	20
	S-3	10	269
BH-6	S-1	3	11
	S-2	23	171
	S-3	23	132
	S-4	8.6	78
BH-7	S-1	2.9	5
BH-8	S-2	2	9.2
BH-10	S-1	600	5,100
BH-11	S-2	17	144

Table 7-4

Benzene and Chlorinated Benzene Concentrations in Soil Borings - Halowax Area

Boring Number	Sample Number	Benzene (mg/kg)	Total Chlorinated Benzenes (mg/kg)
BH-3	S-1	ND	526
BH-10	S-1	1,100	43.8
BH-11	S-1	ND	189

The separation method was initially tested on combined standards containing both PCB's and chlorinated naphthalenes to calibrate the method. This separation method successfully removed the identified chloronaphthalene constituents from soils in the presence of PCB Aroclor 1260. Approximately 25 percent of the total Aroclor in the sample is lost during the separation procedure.

After standards had been tested, five Phase I soil samples containing a range of 65 to 4,200 mg/kg of Halowax 1000 were treated using the chromium trioxide separation method. After the separation, the portion of sample remaining was analyzed for Halowax 1000 and Aroclor 1260.

The results of this analysis, summarized in Table 7-5, indicated that Aroclor 1260 was quantified in soil samples from the Halowax area at concentrations of 5 to 8 mg/kg.

During Phase II, three additional soil samples were collected from the Halowax area and analyzed for PCB's using the chromium trioxide separation method. None of these samples were found to contain concentrations of PCB's above the 4.0 mg/kg detection limit. Based on both Phase I and Phase II samples, PCB concentrations in the Halowax area are considered insignificant. Therefore, it was decided not to include PCB's in a remediation plan for the Halowax area.

7.2.1.3 Extent of Suspected Soil Contamination

To determine the vertical and horizontal extent of contamination in the Halowax area, two sets of collected data were used: the initial visual screening of contamination in the test pits and the laboratory analytical data discussed above.

The primary contaminant in the Halowax area distinctly discolors the subsurface materials. Observations of this discoloration were made during test pit excavation and were used to construct a map showing the horizontal extent and degree of visible soil contamination, as discussed in Subsection 6.1. Figure 7-4, which is a duplicate of Figure 6-1, illustrates these data and indicates both the limit of observable soil contamination and the area of highest apparent concentrations, based on observed soil discoloration. This served to initially identify an approximate horizontal extent of contamination, so that soil borings for the collection of analytical data could be more accurately located.

Table 7-5

Results of Chromium Trioxide Separation of Halowax 1000 and Aroclor 1260

Phase I Soil Sample Location	Analysis Prior to Separation		Analysis After Chromium Trioxide Separation of Halowax 1000 and Aroclor 1260	
	Aroclor 1260 (mg/kg)	Halowax 1000 (mg/kg)	Aroclor 1260 (mg/kg)	Halowax 1000 (mg/kg)
TP-6	0.03J	sulfur interference	0.02J	ND
TP-7	<1.6	65	0.1J	1.6
TP-8	<160	3,600	5	3.1
TP-11	<16	680	<8	4.3
TP-12	<160	4,200	<8	6.4

Note: J = Below the detection limit. The reported value is an estimate.

The laboratory analytical data from the soil boring samples were also used to develop a map of contamination extent. Since these data provide information on chemical concentrations from several depths at each location, they can be used to define and illustrate the horizontal and vertical extent of contaminated soils. Prior to developing this map, a working definition of what chemical concentration represents significant contamination must be adopted. Review of the data indicates that the total combined naphthalene and 2-chloronaphthalene concentrations generally fall into two groups. The first is in the low range of several tenths to several mg/kg, and the second is from nearly 100 mg/kg to above 1,000 mg/kg.

Since the detection limits of the analytical procedure do not allow determination of zero concentration levels, an alternate value must be selected to represent a significant level of contamination. The data suggest a level of 100 mg/kg as a concentration below which only trace levels of contaminants were detected.

Although this value does not represent the lowest identified soil concentration, it delineates an area that includes the majority of the soil boring locations and is outside the boundaries of visually contaminated soils observed during the Phase II test pit screening. The 100 mg/kg level is also consistent with Phase I test pit sampling; therefore, this boundary includes the majority of the soil contamination in the Halowax area. Figure 7-5 was developed using 100 mg/kg as the significant value for the sum concentration of naphthalene and 2-chloronaphthalene in soil sample analysis. The contours on Figure 7-5 indicate the minimum depth at which a concentration sum of approximately 100 mg/kg or higher was observed.

Those contours also describe a surface that is a representation of the vertical extent of significant soil contamination. In addition, the outermost contour indicates that no concentration sums greater than 100 mg/kg were detected, and is, therefore, interpreted as the approximate horizontal limit of significant contamination.

In addition to the chlorinated naphthalenes, chlorinated benzenes were detected in three locations within the Halowax area impacted by previous activities. Review of regulatory guidelines and aquatic toxicity data indicates a concentration of 6 mg/kg as a preliminary concentration of concern for chlorinated benzenes in soils. As such, these constituents also become an additional concern within the Halowax area.

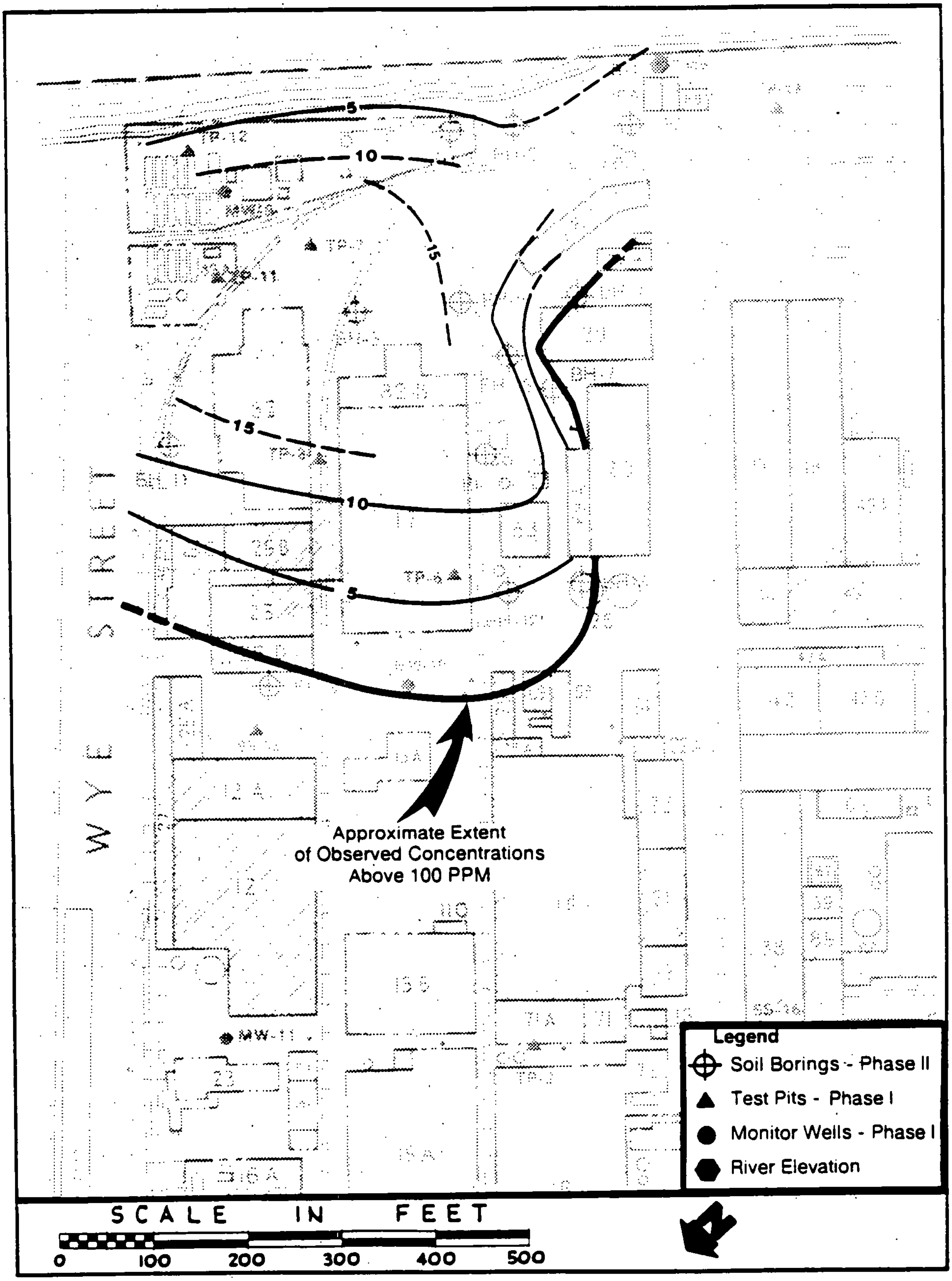


FIGURE 7-5 HALOWAX AREA: CONTOUR LINES INDICATE DEPTH (IN FEET) OF SOIL CONTAINING OVER 100 MG/KG COMBINED NAPHTHALENE AND 2-CHLORONAPHTHALENE

7.2.2 Burn Area

7.2.2.1 Results of Laboratory Analysis

The Phase I investigations also identified the former burn area as an area of concern for inclusion in the Phase II work scope as a result of detected PCB Aroclor 1260 at a concentration of 260 mg/kg in the TP-28 soil composite. Subsection 6.2 of this report contains a detailed description of the Phase II investigation in the burn area. Figure 7-6 illustrates the locations of the Phase II test pits and organic soil vapor profiles that were completed as an initial screening in the burn area. Based on visual observations during the initial screening, eight soil borings were drilled and sampled at locations indicated in Figure 7-7. The sample depths and chemical parameters analyzed at these borings are summarized in Table 6-3, and Appendix L contains the laboratory analysis results for the samples selected.

The most common and consistently elevated compound detected in the Phase II soil samples is acetone. Table 7-6 summarizes the acetone concentrations for the soil boring samples.

Although no specific guidelines for aquatic toxicity of acetone have been published by EPA, studies published in the literature indicate that acetone concentrations would have to exceed 1 mg/L in the aqueous phase before adverse effects to aquatic life would be observed. Assuming a factor of 100 parts in soil to 1 part in the contacting water, an acetone concentration of 100 mg/kg is required to affect aquatic life. Analysis of burn area soils indicates soil concentrations below 364 ug/kg; therefore, this constituent should not be of concern.

PCB's were not detected in this area during the Phase II sampling. This indicates that PCB's detected in the Phase I sampling at TP-28 is likely localized in that specific test pit area.

It should be noted that analytical data did not confirm elevated organic levels detected by the OVA, which was used to monitor soil gas. This may be attributed to the OVA's sensitivity to methane, which may be generated from backfill decomposition in the burn area.

7.2.3 Building 35A/38A Area

7.2.3.1 Results of Laboratory Analysis

The area between Buildings 35A and 38A was identified in Phase I as a target area for collection of additional information during the Phase II investigation. Subsection 6.3 presents the details of the Phase II work scope in this area and Figure 7-8 illustrates the locations of all hand-auger borings. The samples collected were analyzed for HSL metals and the laboratory results are contained in Appendix L.

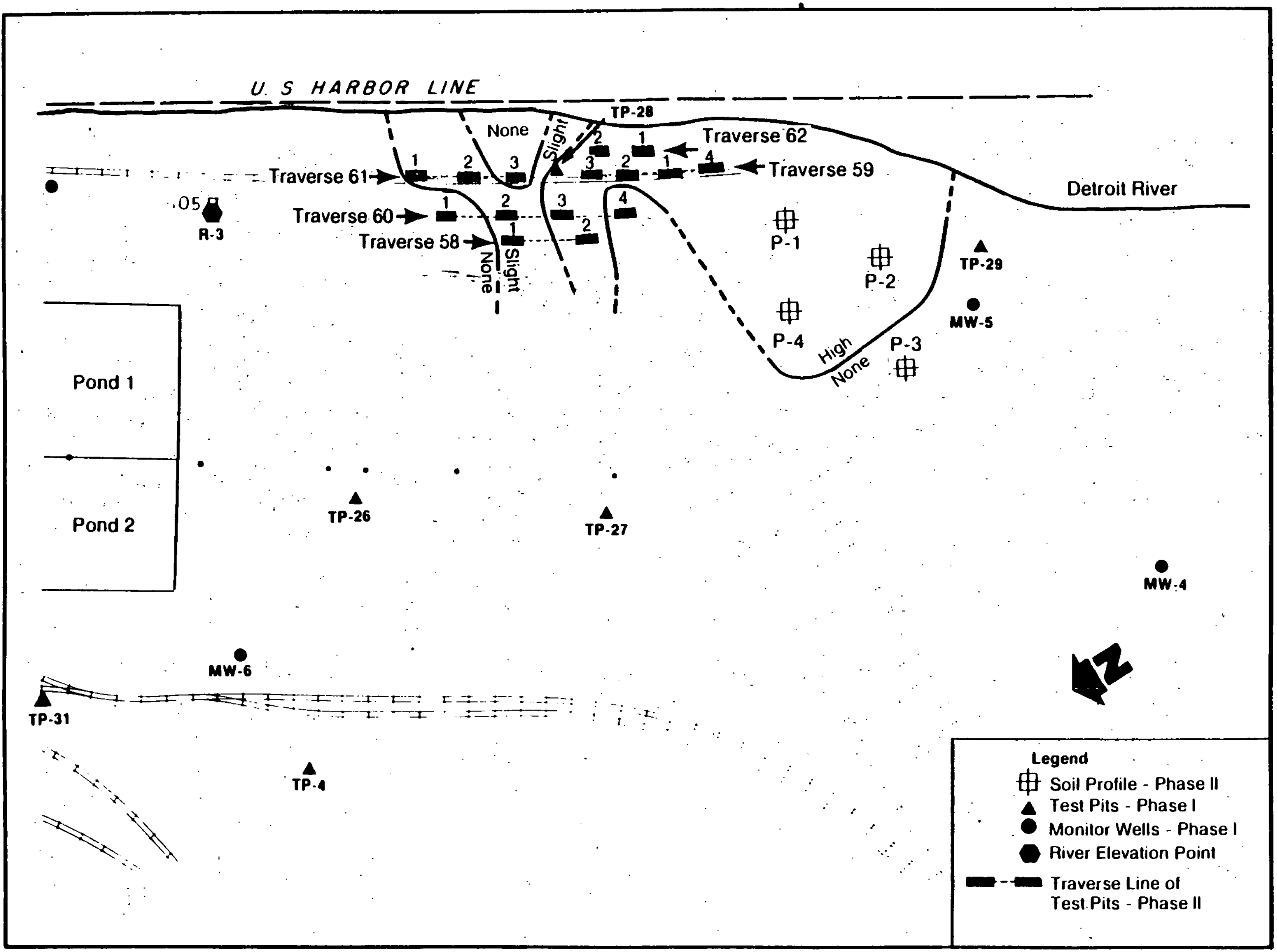


FIGURE 7-6 EXTENT OF ORGANIC-CONTAMINATED SOILS (BASED ON PHASE II TEST PIT SCREENING)

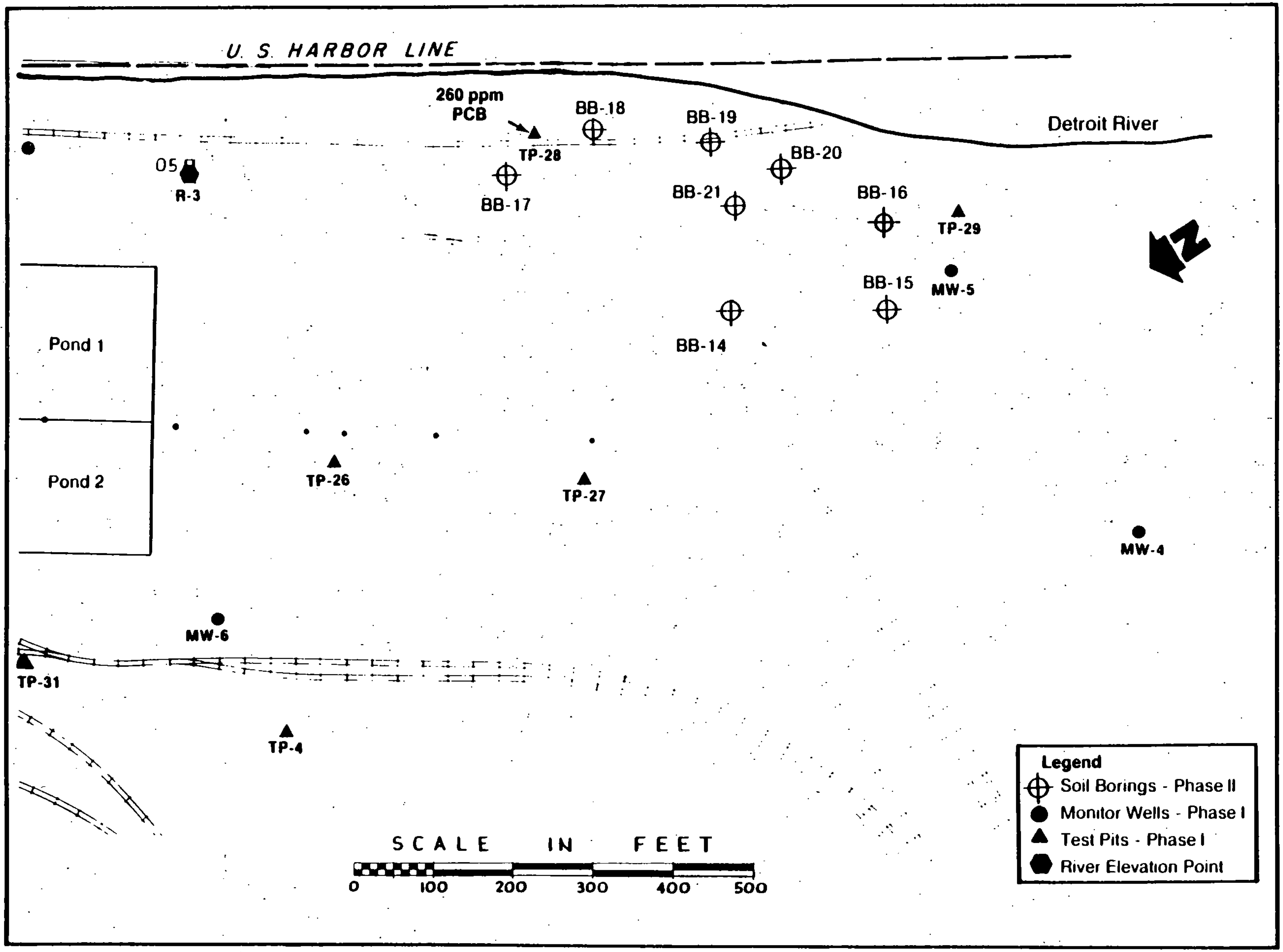


FIGURE 7-7 BURN AREA SOIL BORING LOCATIONS

Table 7-6

Acetone Concentrations in Soil Borings: Burn Area

Boring No.	Sample No.	Acetone[1] (ug/kg)
BB-14	S-2	364
BB-14	S-3	79
BB-15	S-2	81
	S-3	76
BB-16	S-2	134
	S-3	39
BB-18	S-1	96
	S-3	91
BB-19	S-3	30
BB-20	S-2	123
	S-3	19
BB-21	S-1	60
	S-3	36

[1] Preliminary maximum value for protection of freshwater aquatic life is 100 mg/kg in soils based on acetone toxicity data reported in Handbook of Environmental Data on Organic Chemicals, Karel Verschueren, Editor.

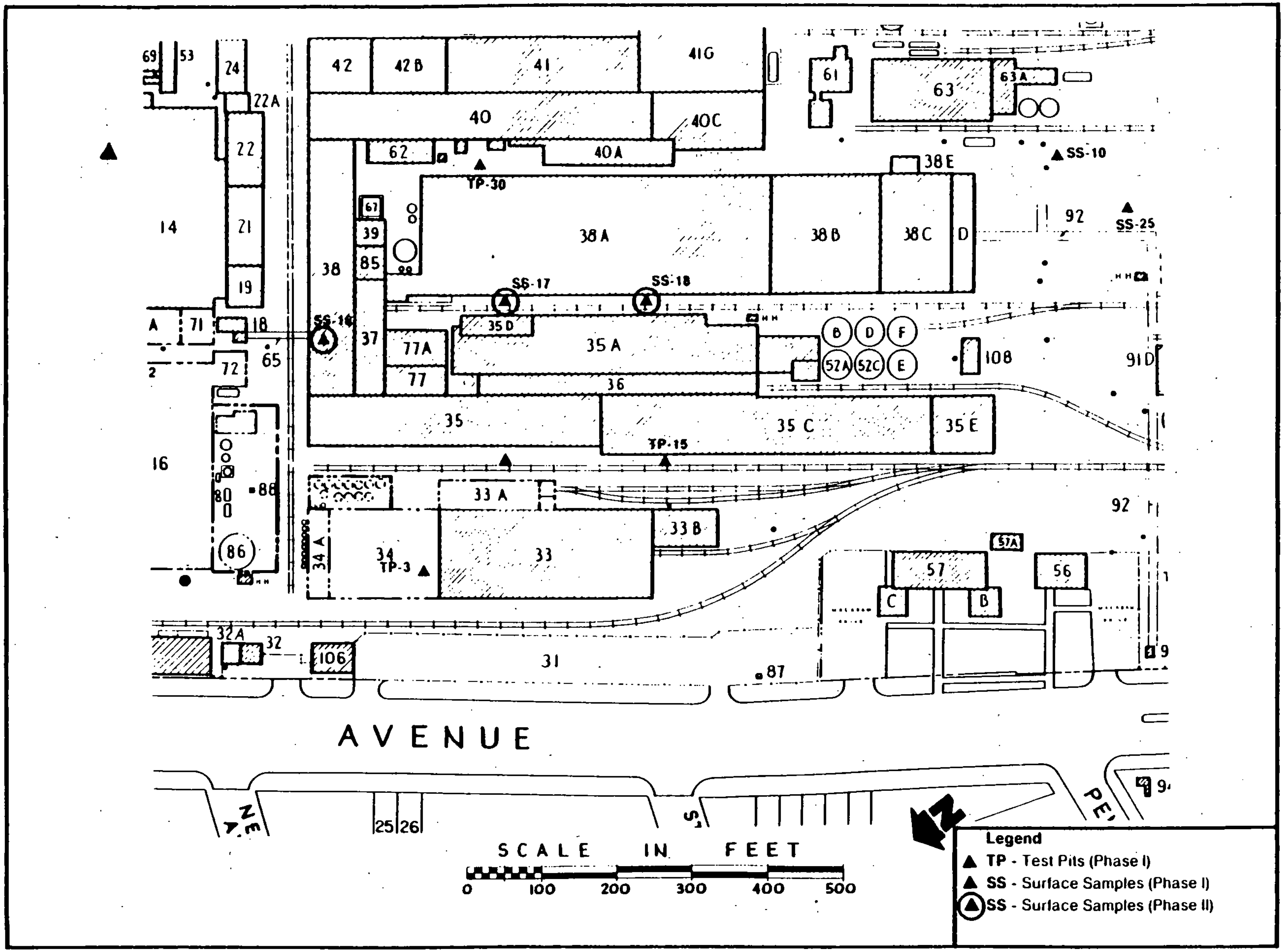


FIGURE 7-8 PHASE II SURFACE SAMPLE LOCATIONS IN BUILDING 35A/38A AREA

7.2.3.2 Extent of Soil Contamination

Based on a review of the data in Appendix L, the only metal identified at levels above average background soil concentration is lead. Background concentrations are estimated to be 10 to 20 ppm (mg/kg) (Allaway, W. H., 1968). Slightly elevated lead concentrations of 60 to 105 mg/kg were detected in auger borings SS-17 and SS-18. These locations do not, however, provide adequate data to determine the extent of the above average concentrations accurately.

7.2.4 Building 34 Area

A pesticide (DDT) repackaging process was reportedly carried out in the vicinity of Building 34 in the northern corner of the East Plant. During Phase I, test pits TP-2 and TP-3 were excavated in this area. Organic vapor measurements and an organic odor were detected at these locations during excavation.

As part of the Phase II scope of work, soil samples collected from these test pits were analyzed for the HSL pesticide/PCB fraction.

The results of this analysis showed no pesticides or PCB's were present in the sample from TP-2 (detection limit 1 ug/g). The sample from TP-3 contained 18 ug/g Halowax, but no DDT was detected.

7.3 COAL PILE AREA

7.3.1 Introduction

A coal-fired power station with extensive coal storage piles was operated for many years on the plant site. Polynuclear aromatic hydrocarbons (PAH) are present in coal and are associated with many coal processes. A question was raised concerning whether or not the PAH's found at the East Plant could be attributed solely to the coal storage piles or to other factors. This subsection addresses that question.

7.3.2 Summary

A records search of past operations at the Pennwalt Wyandotte East Plant site was made. Also, a literature search was made to determine which PAH levels could be attributable to coal storage piles and related processes. See Table 7-7 for a list of coal-derived PAH compounds that are on the U.S. EPA Hazardous Substance List.

The presence of PAH compounds at this site could be attributed to the following former facilities and past practices:

- Coal storage.
- Coal-fired power plant emissions and residues.
- Coal gasification plant (Mond process).
- Asphalt plant (operated approximately 60 years ago).
- Open burning of wastes at the former burn area located in the vicinity of TP-28.

Table 7-7

Hazardous Substance List of Coal-Derived PAH Compounds

Naphthalene[1]

2-Methylnaphthalene

Acenaphthylene

Acenaphthene

Fluorene

Phenanthrene

Anthracene

Fluoranthene

Pyrene

Benzo(a)anthracene

Chrysene

Benzo(b)fluoranthene

Benzo(k)fluoranthene

Benzo(a)pyrene

Indeno(1,2,3-cd)pyrene

Dibenzo(a,h)anthracene

Benzo(g,h,i)perylene

Dibenzofuran

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[1] Presence of naphthalene in certain samples is due to Halowax manufacture, not coal or coal processing residues. See Subsection 7.3.3.2.

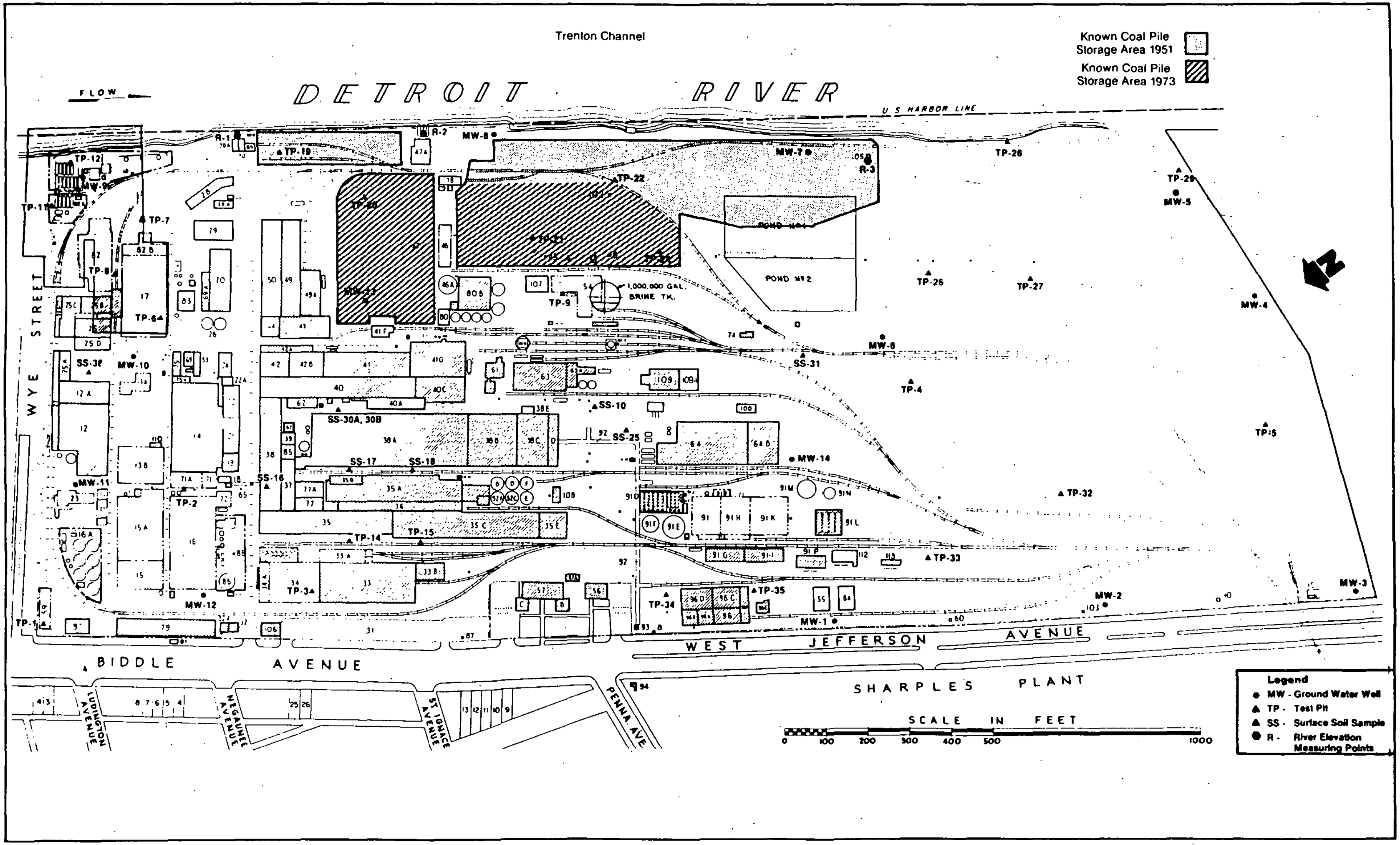

FIGURE 7-9 LOCATION OF SOIL TEST PITS, SURFACE SOIL SAMPLES, AND MONITOR WELLS AT THE EAST PLANT

Table 7-8

Occurrence of Coal-Derived PAH's in Soil Samples

Location	Level of Occurrence						
	Elevated	Low	Very Low	Trace	N.D.	Not Tested	Remarks
TP-1						X	
TP-2						X	
TP-3						X	
TP-4					X		
TP-5			X				
TP-6					X		
TP-7				X			
TP-8				X			
TP-9			X				
SS-10						X	
TP-11				X			Only 2 PAH's detected
TP-12	X						One PAH over 100 ppm
TP-14					X		
TP-15						X	
SS-16				X			
SS-17						X	
SS-18						X	
TP-19						X	
TP-20			X				
TP-21 (composite, 0-12 ft)	X				X		N.D. at 9-9-1/2 ft
TP-22			X				
TP-24			X				
SS-25						X	

Scale:
Elevated: >100 ppm of individual compounds
Low: 10-100 ppm
Very Low: 1-10 ppm
Trace: <1 ppm
N.D.: Not detected

Legend:
TP: Test pit
SS: Surface soil sample
MW: Monitor well

Table 7-8
(continued)

Location	Level of Occurrence						Remarks
	Elevated	Low	Very Low	Trace	N.D.	Not Tested	
TP-26			X				
TP-27						X	
TP-28		X					Full list of coal PAH's
TP-29				X			
SS-30A						X	
SS-30B						X	
SS-31						X	
TP-32				X			
TP-33				X			
TP-34			X				
TP-35				X			
SS-36						X	
MW 9 (soil)				X			
MW 10 (soil)					X		

Scale: Elevated: >100 ppm of any individual compound
Low: 10-100 ppm
Very Low: 1-10 ppm
Trace: <1 ppm
N.D.: Not detected

Legend: TP: Test pit
SS: Surface soil sample
MW: Monitor well

Table 7-9

Occurrence of Coal-Derived PAH's in Groundwater Samples

Location	Level of Occurrence						
	Elevated	Low	Very Low	Trace	N.D.	Not Tested	Remarks
MW-1					X		
MW-2					X		
MW-3		X					
MW-4					X		
MW-5				X			
MW-5 (duplicate)			X				
MW-6				X			
MW-7	X						Should be resampled
MW-8					X		
MW-9			X				
MW-10					X		
MW-11			X				
MW-12					X		

Scale: Elevated: >100 ppb of any individual compound
Low: 10-100 ppb
Very Low: 1-10 ppb
Trace: <1 ppb
N.D.: Not detected
Legend: MW: Monitor well

upper soil levels, i.e., less than 6 to 10 feet below the surface, as visual inspection logs and the result of TP-21 sampling indicate. No PAH's were detected at the 9 to 9-1/2-foot depth at TP-21.

7.3.3.2 Other Past Facility Operations

The aforementioned coal storage, combined with other past operations at the site, can account for the findings regarding PAH occurrence. High temperatures are associated with PAH formation. This fact, along with the knowledge that the fly ash and slag residues from the coal-fired power plant operation were used as construction fill materials throughout the site, can more easily account for the presence of PAH compounds. It is of particular significance that fly ash was used as part of the fill material used to recover marsh land along the eastern half of the property. PAH's associated with coal combustion were thereby spread over wide areas of the facility. Slag was also used as fill and as railroad bed material. Railroad trackbeds run across the entire site.

In addition to the use of the power plant residues, it was found that very early in the plant's history (turn of the century) a coal gasification plant was operated to generate power. The plant was located near TP-21 somewhere east of the 1,000,000-gallon brine tank and former Building 54. An asphalt plant was operated as well during the early 1900's. The details on these two units are very limited, but knowledge of the typical operations of gasification plants of that era (see Appendix I) leads to the conclusion that the gas may potentially be a major contributor of PAH compounds at this site. Tars produced by coal gasification were major sources of PAH's for production purposes for many years in the U.S. These tars were probably used in the asphalt plant to make paving material. The referenced literature items (Appendix I) provide substantiation of the greater magnitude of PAH compound formation associated with coal combustion (i.e., power plant) and conversion (i.e., gasification) processes as opposed to levels associated with coal storage and handling.

One last factor needs to be considered. In an area along the river north of TP-28, open burning of wastes was carried out. This practice may have contributed to PAH occurrence in that area of the facility. The extent of that contribution cannot be determined at this time because further sampling and analysis would be required. The levels of PAH's in the TP-28 area and possibly MW-7 may have been affected by this practice.

It should be noted that the presence of naphthalene in samples from TP-7, 8, 11, 12, and MW-9 is considered to be due to past operations associated with Halowax (chlorinated naphthalenes) manufacturing and not from coal storage or processing. Therefore, the presence of naphthalene in the aforementioned samples was not considered in this report in relating the relative occurrence of PAH's due to coal and coal derivatives.

7.3.4 Data Summary

The analytical data associated with the locations where PAH's were detected are reported in Appendix G. These data were organized in Tables 7-8 and 7-9 for soil and groundwater samples, respectively.

The levels indicated on those tables, i.e., trace, very low, low, and elevated, were set arbitrarily. They do not relate to any specific published levels of concern but instead were made to serve as a measurement of relative PAH occurrence across the site itself. It should be noted that a study conducted by K. W. Brown and Associates in 1983 concluded that CPAH levels in forest soils range from 0.02 to 0.26 mg/kg and that 100 to 125 mg/kg represents a typical urban background. CPAH's are those PAH's that have shown evidence of carcinogenicity in animals.

Table 7-8 lists the occurrence and relative degree of coal-derived PAH's that were found in the site's soil samples. Of 23 soil samples tested for hazardous substance list organic compounds (which include PAH compounds), only three contained levels greater than 10 ppm of any individual PAH. The highest levels were found in TP-21. No PAH's were detected at TP-21 at the 9- to 9.5-foot level. This is consistent with the visual logs of the test pits, which indicated cinders and slag in the upper 6 feet in almost every test pit location and tends to verify that PAH's are in the upper soil layers only.

Table 7-9 indicates the occurrence and relative degree of coal-derived PAH compounds found in the groundwater samples. It is notable that these samples are in parts per billion levels and as such are very low. Only the MW-7 sample contained relatively significant levels of PAH compounds. While it is not possible to make a definitive statement regarding the source and level of PAH's in this sample, it is probably due to a combination of factors:

- The two ponds may be hydraulically connected to MW-7, which is located 200 feet east of the ponds. These ponds were not sampled for HSL organics or PAH's.
- The sample from MW-7 may possibly have contained some solids when it was retrieved, accounting for the higher levels of PAH's detected.

Sources of the PAH's at MW-7 are probably coal processing residues and possibly the open burning of wastes, which was reported to be a past practice, and which was carried out along the river south of MW-7 toward TP-28. Since this sample contained reported concentrations one to two orders of magnitude higher than all other water samples, it was resampled and reanalyzed in September 1986. Results from this analysis indicated lower PAH concentrations as compared to their initial sampling in May 1986.

SECTION 8

CONCLUSIONS

8.1 HYDROLOGY

The following conclusions were reached concerning hydrology:

- Based on evaluation of three rounds of groundwater and Detroit River water elevation measurements and on historic Detroit River water-level information, groundwater at the East Plant is expected to intermittently discharge to, and be recharged by, the Detroit River.

- Water levels in the Detroit River and in the entire Great Lakes basin are presently at record highs and are expected to remain elevated at least through February 1987.

8.2 GROUNDWATER QUALITY

The following conclusions were reached concerning groundwater quality:

- The elevated levels of organic compounds detected in groundwater samples from monitor wells 7, 8, 9, and 12 during Phase I were confirmed during the Phase II investigation.

- Groundwater in the vicinity of the East Plant is not used for industrial or human consumption purposes.

- Volatile organic compounds (chloroform and benzene) were detected in wells MW-8 and MW-9. The impact of these compounds on aquatic life in the Detroit River is expected to be negligible.

- Groundwater collected from MW-12 during Phase II contained PCB Aroclor 1254 at a concentration of 28 ug/L. This confirmed a Phase I study finding. The source of this contaminant is unknown at this time, but is likely in the vicinity of MW-12 since Aroclor 1254 has demonstrated low mobility in the saturated and unsaturated zones.

- The primary receptor for constituents present in groundwater at the East Plant is the Detroit River; the impact on aquatic life is the main consideration.

8.3 SOIL

8.3.1 Halowax Area

The following conclusions were reached concerning the Halowax area:

- Soils in the Halowax area contain above-background levels of naphthalene, chlorinated naphthalenes, benzene, and chlorinated benzene compounds.
- A laboratory separation method (using chromium trioxidation) for differentiating between chlorinated naphthalene compounds (Halowaxes) and polychlorinated biphenyls (PCB's) was tested on analytical standards for the compounds and was found to destroy the Halowaxes effectively, while retaining PCB's in the sample for subsequent quantification.
- Selected Phase I and Phase II soil samples from the Halowax area were analyzed for PCB's after treatment with the chromium trioxide oxidation separation method. The Phase I soil samples contained less than 8 mg/kg of Aroclor 1260. The Phase II soil samples contained less than 4 mg/kg of HSL PCB's. PCB's are not considered compounds of concern in the Halowax area.
- Soils in the Halowax area below the water table have apparently been impacted by past operations.

8.3.2 Burn Area

The following conclusions were reached concerning the burn area:

- During Phase I, 260 mg/kg of PCB Aroclor 1260 was detected in a 0 to 72-inch composite soil sample from TP-28, located in the burn area. Soil samples from Phase II borings (surrounding TP-28) in the burn area did not contain PCB's. Soils containing PCB's are considered to be localized at TP-28.

- Phase II soil samples collected from borings in the burn area contained acetone at concentrations up to 364 ug/kg, and low levels (1 to 50 ug/kg) of other volatile organic compounds. Since the soil concentrations are below EPA Maximum Values for Protection of Freshwater Aquatic Life, and toxicity data reported in the literature, then levels in soil of volatile organic compounds are not considered to be of concern.

8.3.3 Building 35A/38A

The following conclusions were reached concerning Building 35A/38A:

- Lead concentrations of 60 to 105 mg/kg were detected in soil samples from locations SS-17 and SS-18 at depths of 0.5 to 1.0 feet and 1.0 to 1.5 feet. These levels are low in comparison to surface soil lead values (600 mg/kg) found in the Phase I study.

8.3.4 Building 34

The following conclusions were reached concerning Building 34:

- A DDT-repackaging operation was reportedly conducted in the vicinity of Building 34. Phase I composite soil samples from TP-2 and TP-3 were analyzed for the HSL pesticide/PCB fraction. No pesticides or PCB's were detected in these samples, and no further sampling was done in this area.

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ENVIRONMENTAL STUDY
PENNWALT EAST PLANT
WYANDOTTE, MICHIGAN

VOLUME II - APPENDICES

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LIST OF APPENDICES

APPENDIX A

PHASE I
SITE INVESTIGATION AND SAMPLING PLAN

SITE INVESTIGATION
AND
SAMPLING PLAN
FOR
PENNWALT CORPORATION EAST PLANT
WYANDOTTE, MICHIGAN

APRIL, 1986

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1.0 INTRODUCTION

1.1 Purpose

The purpose of this plan is to establish procedures for data collection at the East Plant of Pennwalt located at Wyandotte, Michigan. These procedures will include the following:

- Installation of twelve groundwater monitoring wells.
- Performance of slug tests on the completed wells.
- Excavation of backhoe pits.
- Soil and groundwater sampling.
- Analysis of groundwater and soil samples.

The objective of the sampling plan is to determine the presence or absence of contamination beneath Pennwalt's East Plant site. This plan outlines procedure for sampling and data collection, site safety and specifications for monitor well installations.

1.2 Scope of Work

The major tasks addressed in this plan include:

- Monitoring well installation.
- Excavation of backhoe pits.
- Aquifer test.
- Groundwater and soil sampling.
- Surveying of Well Elevations.

2.0 MONITORING WELL INSTALLATION AND CONSTRUCTION

The purpose of the monitoring well installation is to determine the ground water quality beneath the site. The site is underlain by man-made fill ranging in thickness from 5 to 15 feet. Beneath the fill is a thin layer of blue clay which is underlain by glacial deposits of Pleistocene age. The average thickness of the glacial deposit is reported to be 30-40 feet at the site. Limestone bedrock of Denovian age underlies the glacial deposits. Groundwater occurs within the fill in a perched condition.

The underlying clay and glacial deposits are reported to be relatively impermeable and would be expected to retard vertical migration of contaminants from the perched zone into the bedrock aquifer. The monitoring wells will be installed only in the shallow perched saturated zone. Borings will be extended 3 feet into the underlying clay layer to obtain soil samples which will be screened for volatile organic compounds. If volatiles are detected or if visible contaminants are observed, a joint Pennwalt/WESTON decision will be made to analyze the sample to determine the presence or absence of contamination within the clay.

2.1 Well Drilling

The monitoring wells will be drilled using hollow stem augers. Continuous split spoon samples will be obtained for physical description of the soil at all locations. Each boring will be extended 3 feet into the underlying clay layer. None of the wells are expected to exceed 20 feet deep.

2.2 Monitoring Well Construction

Locations of the proposed monitoring wells are shown on Figure 1, the East Plant Base Map contained with this sampling plan. Figure 2 presents a generalized diagram of the well construction. All monitoring wells will be installed with a 2-inch diameter PVC casing (Schedule 40). Well screens will be set at approximately five feet below the water table. A plug will be set at the bottom of the screen, and the joints of all the PVC casings will be threaded or screw type. No solvents will be used as jointing compound.

The annulus around the PVC well screen will be filled with a clean uniform gravel pack to approximately 2 feet above the screen. From the top of the gravel pack to ground surface elevation, the annular space will be grouted with a cement/bentonite grout tremied in place to prevent vertical migration of contaminants. As the grout is emplaced, the hollow-stem auger will be withdrawn slowly to avoid damage to the PVC casing and excessive caving.

A 5 foot long 4-inch diameter steel casing with a lockable cap will be installed over each of the completed wells and cemented approximately two feet into the ground.

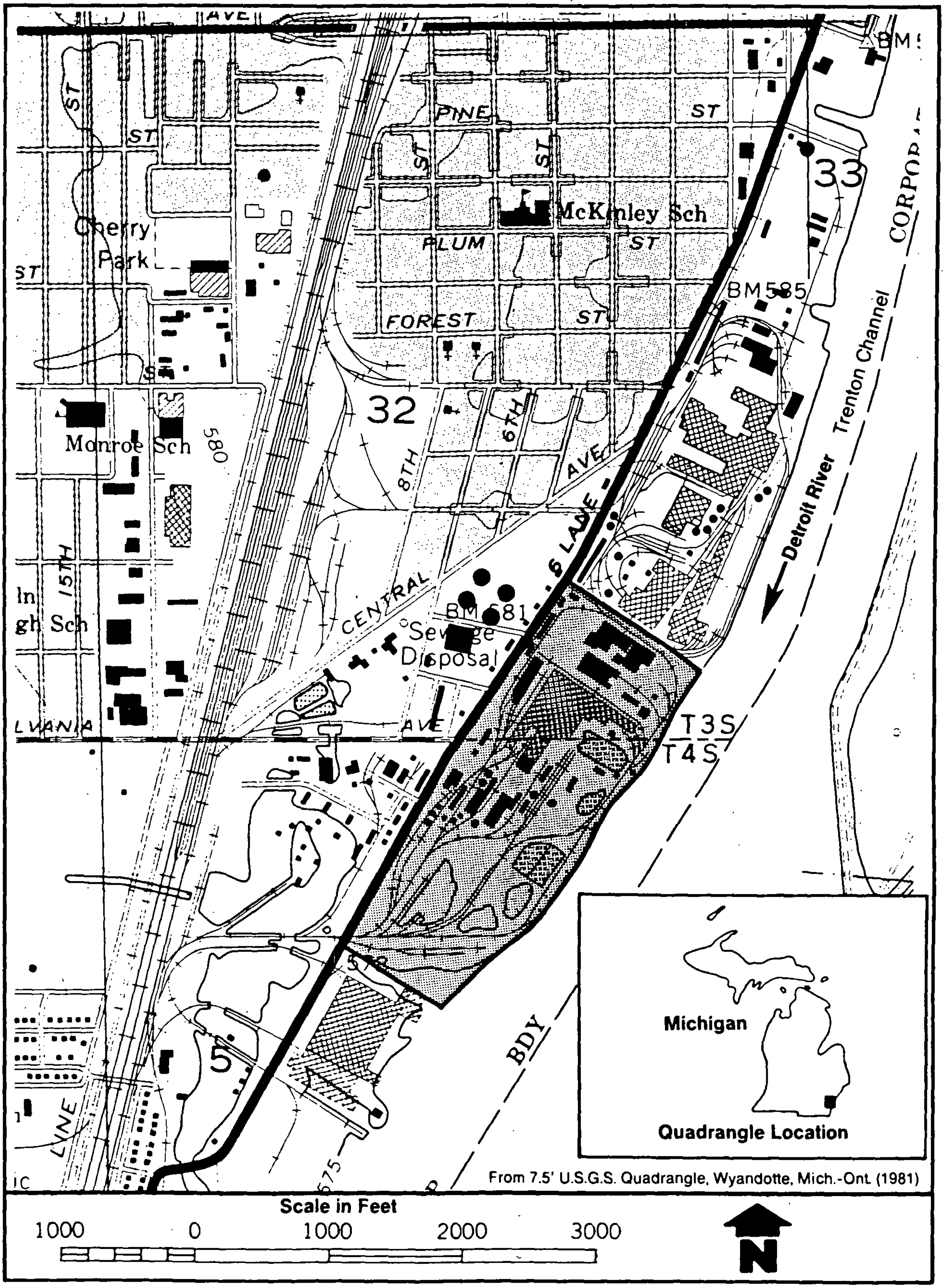


FIGURE 1 PENNWALT EAST PLANT LOCATION MAP

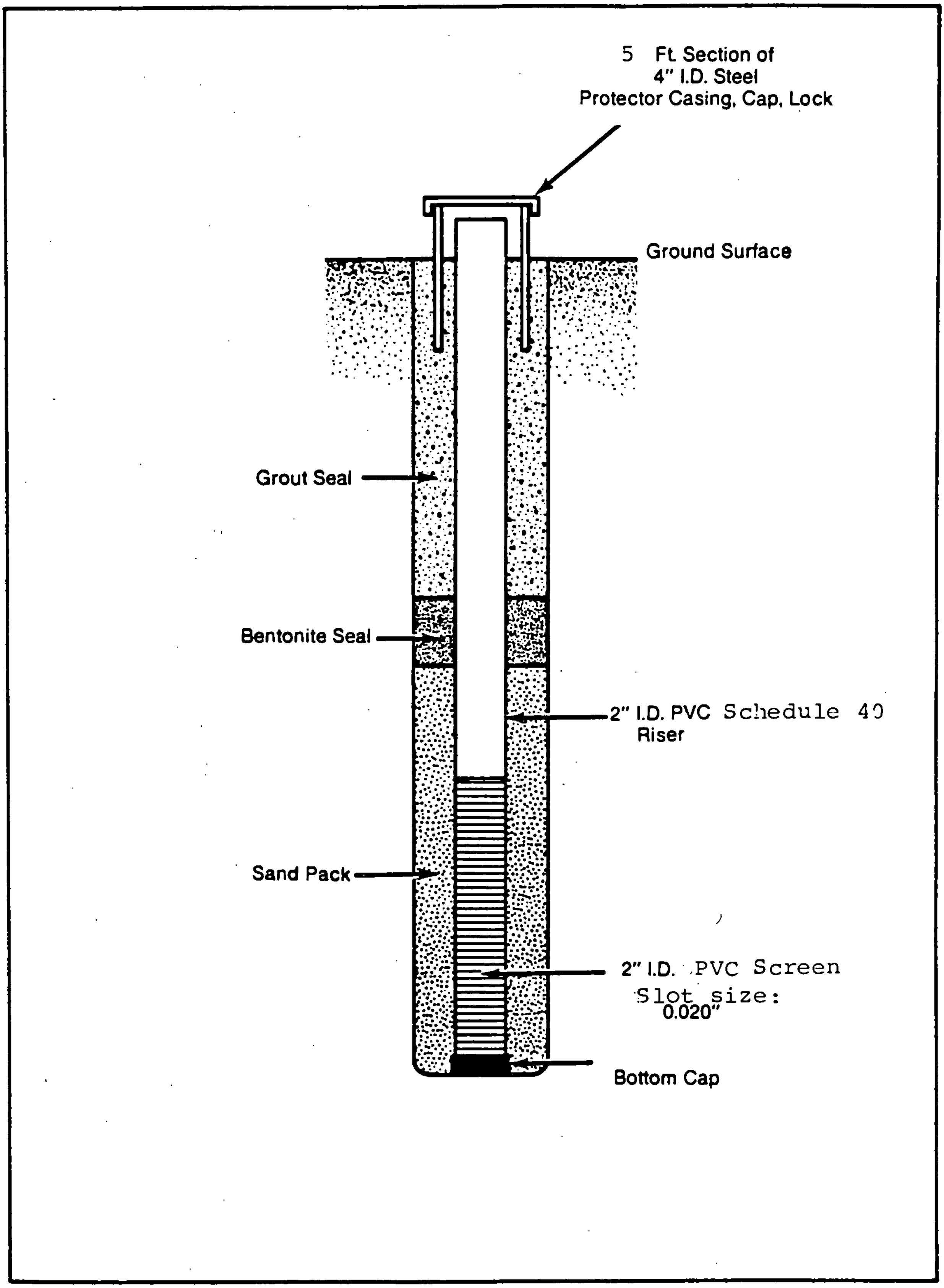


Figure 2 Typical Monitor Well Construction

2.3 Well Development

The completed monitoring wells will be developed with a suction pump or bailer to ensure their ability to provide representative aquifer samples. Development will continue until the water discharged from each of the wells is clean and free of sand. If a pump is used, the pump hose will initially be set at the bottom of the well, then later moved towards the top of the screen to ensure water is drawn through all portions of the screen.

2.4 Slug Test

Slug tests will be conducted on the completed wells to determine the hydraulic conductivity (K) of the water bearing sediments beneath the site. Transmissivity of this zone will be calculated from this data and from soil boring information, and calculations of groundwater velocity will be made.

2.5 Decontamination Procedures

The drilling rig, backhoe equipment and materials will arrive on site in clean condition. Prior to the start of the drilling, all drill rods, augers, bits, tools, split-spoons and backhoe bucket will be steam cleaned at an area on site set up for this purpose. Augers, tools, and drill rods will be inspected to ensure that all residue such as machine oils have been removed. Similar decontamination procedures will be implemented between each bore hole to prevent cross-contamination and ensure the integrity of the samples.

3.0 SOIL SAMPLING

Approximately 30 backhoe test pits will be excavated at locations shown on Figure 1 (Contained at the end of this sampling plan). Soil samples will be described by a WESTON soil scientist. An HNu photoionization detector or an OVA flame ionization detector will be used to monitor soil organic vapors during excavation. Soil samples will be collected for laboratory analysis based on proximity to past manufacturing areas, visual observations (e.g., soil discoloration) and organic vapor readings. Proposed analyses for each of the soil test pits are tabulated on Figure 1.

It is estimated that 18 soil samples from the pits will be collected for chemical analysis. Twelve additional soil samples will be collected by split spoon during the monitoring well installations. One sample will be collected and retained for analysis in each boring from approximately 3 feet into the clay layer. Representative soil samples from backhoe pits and split spoons will be placed in appropriate sample bottles and sealed with teflon lined screw tops. Each sample container will be labeled to identify: boring number, depth, and date of collection. Collected samples will be packed with ice in an insulated cooler following chain-of-custody procedures and will be shipped to WESTON's Lionville, Pennsylvania laboratory. All pertinent field data will also be recorded in the field log by the project scientist.

4.0 GROUNDWATER SAMPLING

Ground water samples will be collected from each of the 12 wells and analyzed for HSL organic and inorganic parameters. All groundwater sampling will be accomplished after the wells have been properly developed. Because drilling and well construction disturb the natural groundwater system, the wells will be developed and then left undisturbed to allow the groundwater system to return to chemical equilibrium. Groundwater sampling will occur no earlier than 7 days after well development has been completed.

Procedures for sampling wells are as follows:

1. Measure and record the depth to water from the top of the PVC casing. All measuring devices used in the well must be thoroughly rinsed with distilled water prior to use.

2. Subtract the depth to top of the water from the depth to the bottom of the casing to determine the height and volume of standing water in the casing.

3. Using a pump or bailer, remove a quantity of water from the well equal three to five times the calculated volume of water in the well. If well recharge is found to be excessively slow following the removal of the first volume, the well will be allowed to recharge and this second volume of water will be collected for analysis.

4. Using a bailer, obtain a sample for chemical analyses after pumping or bailing is complete.

5. All sampling equipment will be decontaminated after sampling to prevent cross contamination between sampling wells. Materials incidental to sampling such as bailer ropes and tubing will also be flushed with distilled water or discarded between wells. Sampling equipment will be protected from the ground surface by clean plastic sheeting.

6. All samples for chemical analyses will be placed in specially prepared bottles. The bottles will be filled to the top and capped securely. Each filled sample bottle will be placed in an insulated ice chest immediately after sampling and delivered to WESTON's laboratory.

Equipment for sampling wells includes the following:

- Well measuring apparatus

- Suction pump and tubing

- Teflon bailer

- Sample bottles and ice coolers
- Preservatives
- Decontamination equipment
- Field log book, chain-of-custody forms, sample log sheets.

4.1 Quality Assurance Samples

The quality assurance effort for a sampling program is developed to demonstrate that sampling procedures, sample storage and sample transport do not alter the composition of the sample in a way that would effect the concentration on the identification of the analyte being determined.

An additional purpose of the quality assurance effort is to determine that contaminants are not introduced into the sample during the sampling process.

The types of quality assurance samples that are included in the sampling quality assurance program at the Pennwalt site will include:

- Field Blanks - A field blank is collected after the equipment has been decontaminated. The blank sample is obtained by "collecting" a sample of DI water using the same sampling procedures that are used for the actual samples.

- Trip Blanks - The purpose of the trip blank is to document that the integrity of samples is maintained through transportation of the samples. Trip blanks consist of appropriately prepared sample bottles that are filled with DI water prior to leaving for the field. The blanks are carried to the field. Following sampling, the blanks are packed with the samples and returned to the laboratory for analysis. The trip blank sample bottles should not be opened after filling and prior to analysis. Trip blanks will be obtained for VOA samples only.

- Field Duplicates - The purpose of a field duplicate is to document the reproducibility of the results and the representativeness of the samples collected. Field duplicates of groundwater samples are not split or replicate samples. Collection of a field duplicate sample requires re-collection of the sample using the same procedures as used for collection of the first sample. The duplicate should be collected immediately after the first sample.

4.2 Equipment Decontamination

The pump and bailer used for sampling, as well as other miscellaneous sampling equipment, shall be decontaminated between wells. If a pump is used, it will be decontaminated by submerging the intake of the pump first in a washing solution (Alconox-type detergent) and then in clean potable water, and pumping these solutions through the pump system.

The procedure for decontaminating the sampling equipment is as follows:

a. Place used equipment (i.e., bailers, pumps, buckets, etc.) on plastic ground sheet at the head of the "decon line."

b. Rinse equipment in tub of potable water to remove surface dirt and mud, if necessary.

c. Scrub equipment with a bristle brush in a basin filled with detergent and potable water.

d. Rinse soap off in a tub of potable water.

e. Final rinse with distilled water.

f. Place decontaminated equipment on clean plastic ground sheet for transport.

4.3 Analytical Parameters

All samples will be sent to WESTON's laboratory in Lionville, Pennsylvania for analysis. Parameters to be analyzed for are listed in Table 1. WESTON's laboratory is USEPA certified and all analytical work will be done according to acceptable ERA protocols.

5.0 GROUNDWATER ELEVATION SURVEY

The purpose of the elevation survey is to determine the direction of groundwater flow. All monitoring wells will be level surveyed and the elevations of the top of the well casings will be determined in feet and referenced to the Mean Sea Level (MSL) or to an assumed elevation.

5.1 Water Level Measurements

Static water levels in all the monitoring wells will be measured. The purpose of these measurements is to define the water table levels in the aquifer at a single point in time. Measurements will be completed within two hours. Water levels will be measured to the nearest 0.01 foot with an electric tape and referenced to the top of the inner casing. All data will be recorded in a log book.

6.0 Site Safety

All the proposed borings may encounter soil or groundwater contamination, but not at levels which pose an imminent health threat. Therefore, level D safety protection will be in effect with continuous air monitoring with an organic vapor detector (HNu or OVA). Respiratory (Level C) protection will be immediately available should air monitoring show the presence of vapor levels in the working space at levels exceeding pre-determined action levels. A complete safety plan will be prepared prior to the start of field activities and will be available on site. The preliminary Safety Plan for this project is attached at the end of this Sampling Plan. It will be finalized and approved by WESTON's Corporate Health and Safety Director before field work is started.

Level D Safety Equipment

- Steel-Toe Safety Boots
- Cotton Work Gloves
- Cotton Coveralls
- Hard Hats

- Disposable Booties

Level C Safety Equipment

- Steel-Toe Safety Boots
- Neoprene Gloves over Surgical Gloves
- Respiratory Protection (Full Face Respirator with Organic Vapor Cartridges)
- Tyvek Coveralls)
- Hard Hats
- Disposable Booties

APPENDIX B

PHASE I
SITE SAFETY PLAN

WESTON

WORK LOCATION PERSONNEL PROTECTION AND SAFETY EVALUATION FORM

Attach Pertinent Documents/Data

Fill in Blanks As Appropriate

WO # 0603-10-01

Division DCMD

Office West Chester

Prepared by M. A. Turco

Date

Reviewed by

Date

Approved by

Date

A. Work Location Description

1. Name Pennwalt

2. Location East Plant
Wyandotte, MI

3. Type: HW Site ( ) Industrial (X)
Spill ( ) Construction ( )
( ) Existing WESTON Work Location
(X) Existing Client Work Location
Other ( ) Describe
Property to be sold.

4. Status Inactive except for ferric chloride plant.

5. Anticipated activities: Excavate shallow (4-6 ft) soil test pits using backhoe; drill monitor wells and collect split spoon samples; sample ground water from wells.

6. Size Approximately 44 acres

7. Surrounding Population Industrial

8. Buildings/Homes/Industry -

9. **Topography** Very flat, adjacent to Detroit River (less than one foot elevation difference across plant property).

10. **Anticipated Weather** Typical of April in the Detroit area.

11. **Unusual Features** None

12. **Site History** Over 100 years of chemical manufacture by owner and various tenants. In a decommissioning mode. Only a few operations still on-going.

B. **Hazard Description**

1. **Background Review:** Complete (X) Partial ( )

If partial, why?

2. **Hazard Level:** A ( ) B ( )

Unknown ( ) C ( ) D (X) with C as backu

Justification

3. **Types of Hazards:** (Attach additional sheets as necessary)

A. **Chemical** (X) **Inhalation** ( ) **Explosive** ( )

Biological ( ) **Ingestion** ( ) O_2 **Def.** ( )

Skin Contact ( ) **Toxic** (X)

Describe Small or trace quantities of chemicals from previous manufacturing operations. May be caustic or acids (inorg.), heavy metals, CCl_4, CS_2, chlorinated dielectic compounds, benzines or naphthalenes. Expect contact or inhallation the only routes of exposure.

B. **Physical** ( ) **Cold Stress** ( ) **Noise** ( )

Heat Stress ( ) **Other** ( )

Describe None expected

C. **Radiation** ( )

Describe N/A

4. **Nature of Hazards:**

Air (X) **Describe** VOA's emitted from contaminated soil or groundwater, Hnu /OVA will be used in field for screening.

Soil (X) **Describe** Contact with acids or bases if present. Gloves, boots should protect.

Surface Water ( ) **Describe** -

Groundwater ( ) **Describe**

Other ( ) **Describe**

5. Chemical Contaminants of Concern ( ) N/A

Contaminant	TLV (PPM)	I.D.L.H. (PPM)	Source/Quantity Characteristics	Route of Exposure	Symptoms of Acute Exposure	Instruments Used to Monitor Contaminant
Caustics			Soils	1,2,3	Skin irritation	
Acids (inorganic)			Soils	1,2,3,4	Skin irritation resp. irritation	
Metals			Soils	1,2,3	Resp. irritation	
CCl_4	5 ppm	300 ppm	Soils/vapors	1,2,3,4	CNS repressant	U.7 Ip
CS_2	10 ppm	500 ppm	Soils/vapors	1,2	Dizziness, headache GI, ocular changes	10.1 IP
Chlorinated Dielectric Compounds			Soils	1,2,3		
Benzenes	10 ppm	2000	Soils/vapors	1,2,3,4	Irritate eyes, nose abdominal pain	9.2 Ip
Natthalense	10	500	Soils/vapors	1,2,3,4	Irritate nose, resp., cough, nausea, vomit	8.1 Ip

* Routes of Exposure: 1) skin, 2) inhalation, 3) ingestion, 4) absorption

6. Physical Hazards of Concern ( ) N/A

Hazard	Description	Location	Procedures Used to Monitor Hazard

Working around heavy equipment, during excavation and drilling operations. Hard hats, eye protection and steel toe boots will be worn at all times.

Heavy equipment: head protection required.
eye protection required.
toe protection required.

7. **Work Location Instrument Readings ( ) N/A** - All work locations will be monitored with an OVA or PID.

Location____________________

% O_2____________________ **% LEL**________________

Radioactivity________________ **PID**________________

FID____________________ **Other**________________

Other____________________ **Other**________________

Location____________________

% O_2____________________ **% LEL**________________

Radioactivity________________ **PID**________________

FID____________________ **Other**________________

Other____________________ **Other**________________

Location____________________

% O_2____________________ **% LEL**________________

Radioactivity________________ **PID**________________

FID____________________ **Other**________________

Other____________________ **Other**________________

Location____________________

% O_2____________________ **% LEL**________________

Radioactivity________________ **PID**________________

FID____________________ **Other**________________

Other____________________ **Other**________________

8. **Hazards expected in preparation for work assignment. ( ) N/A**

Describe: Some of the areas potentially contain volatile organics.

C. Personnel Protective Equipment

1. Level of Protection

A ( ) B ( ) C ( ) D (x) Location/Activity:

Drilling and Test Pit Excavation

A ( ) B ( ) C (x) D ( ) Location/Activity:

If monitoring in the breathing zone indicates organic vapor levels exceeding 2 units. Site work will stop if ambient conditions in the breathing zone exceed 100 ppm.

2. Protective Equipment (specify probable quantity required)

Respiratory ( ) N/A

( ) SCBA, Airline

(x) Full Face Respirator (Cart. Pest/Dust)

( ) Escape Mask

( ) None

( ) Other ____________

( ) Other ____________

Clothing ( ) N/A

( ) Fully Encapsulating Suit

( ) Chemically Resistant Splash Suit

( ) Apron, Specify ____________

(X) Tyvek Coverall

( ) Saranex Coverall

( ) Coverall, Specify ____________

( ) Other Disposable boots.

( ) Other ____________

Head & Eye ( ) N/A

(x) Hard Hat

( ) Goggles

( ) Face Shield

( ) Chemical Eyeglasses

( ) None

( ) Other ____________

Hand Protection ( ) N/A

( ) Undergloves PVC/Latex Type

( ) Gloves Butyl/Neoprene Type

( ) Overgloves As above Type

( ) None

(X) Other Vitons undergloves in stored transformer area

Foot Protection ☐ N/A

☒ Safety Boots

☒ Disposable Overboots

☐ Other ______

3. Monitoring Equipment ☐ N/A

☐ CGI

☐ O_2 Meter

☐ Rad Survey

☐ Detector Tubes

Type: ______

☒ PID

☒ FID (OVA)

☐ Other ______

☐ Other ______

D. **Personnel Decontamination** (Attach Diagram)

Required ☐ Not Required ☐

Equipment Decontamination (Attach Diagram)

Required ☒ Not Required ☐

If required, describe and list equipment

Decontamination procedures are listed in attached sampling plan.

Personnel decontamination will be performed in areas where the hazard level is upgraded to Level C. A decontamination zone will be established adjacent to the hot zone. Containers lined with trash bags will be set up to minimize skin contact with site contaminants. A potable wash and rinse station will be available following the removal of contaminated clothes.

E. Personnel

	NAME	WORK LOCATION TITLE/TASK	MEDICAL CURRENT	FIT TEST CURRENT	CERTIFICATION LEVEL
1.	Dzedzy, Marian	Field Team Leader	(X)	(X)	(B-T)
2.	Benyish, Bruce	Project Geologist Site Safety Officer	(X)	(X)	(B-S)
3.			( )	( )	( )
4.			( )	( )	( )
5.			( )	( )	( )
6.			( )	( )	( )
7.			( )	( )	( )
8.			( )	( )	( )
9.			( )	( )	( )
10.			( )	( )	( )

Site Safety Coordinator Martin O'Neill, Weston Health & Safety Dept.

F. Activities Covered Under this Plan

Task No.	Description	Preliminary Schedule
	Soil test pit excavation (40 pits)	5 days, starting 4/21/86
	Monitor well installation (12 wells) with collection of split spoon samples	10 days, starting 4/21/86
	Monitor well sampling (ground water) 12 wells	5 days, starting 5/9/86

G. Subcontractor's Health and Safety Program Evaluation ( ) N/A

Name and Address of Subcontractor: McDowell and Associates
10659 Galaxie
Ferndale, MI 48220

Activities to be Conducted by Subcontractor: Backhoe excavation of test pits; monitor well drilling and installation.

EVALUATION CRITERIA

Item	Adequate	Inadequate	Comments
Medical Surveillance Program	(x)	( )	
Personal Protective Equipment Availability	(x)	( )	
On-Site Monitoring Equipment Availability	( )	( )	RFW will have Hnu if needed.
Safe Working Procedures Specification	( )	( )	
Training Protocols	(x)	( )	RFW
Ancillary Support Procedures (if needed)	( )	( )	RFW HASP
Emergency Procedures	( )	( )	RFW HASP
Evacuation Procedures Contingency Plan	( )	( )	See site sampling plan.
Decontamination Procedures Equipment	( )	( )	As specified on page 10.
Decontamination Procedures Personnel	( )	( )	

GENERAL HEALTH AND SAFETY PROGRAM EVALUATION: ADEQUATE ( ) INADEQUATE ( )

ADDITIONAL COMMENTS:

EVALUATION CONDUCTED BY: DATE:

Will be completed on 14 April 1986 during site visit.

H. Contingency Contacts

Agency	Contact	Phone Number
Fire Department	Wyandotte Fire Dept.	284-4400
Police Department	Wyandotte Police Dept.	284-1100
Health Department		
Poison Control Center		
State Environmental Agency	Michigan DNR	(313) 459-4464
EPA-Regional Office	N/A	
EPA-ERT. ICOM	N/A	
Spill Contractor	N/A	
State Police	Detroit	(313) 256-9639
F.A.A.	N/A	
Civil Defense	N/A	
On Site Contact	Robert Heineman	285-9200 x365
Site Telephone	As Above	
Nearest Telephone	As Above (Location)	
Other		

I. Contingency Plans

Spill, Accidental Release; Describe On-site coordinator will have walkie-talkie to relay any emergency message to on-site contact.

Fire Explosion; Describe ______________________

Other; Describe ______________________

Exit Routes, Communication Systems; Describe ______________________

MEDICAL EMERGENCY

Name of Hospital Wyandotte General Hospital

Address: 2333 Biddle Avenue **Phone No.** (313) 284-2400

Name of Contact Emergency extention

Address: **Phone No.**

Route to Hospital: (Attach Map) From plant exit left (north) on Biddle Avenue for approximately 1.5 miles; at Walnut Street turn right (east) for one block; hospital on left (north). See attached map.

Travel Time From Site (Minutes) 10 minutes **Distance to Hospital (Miles)** 1.5 miles

Name/Number of 24 Hr. Ambulance Service Wyandotte Rescue Squad
284-4400

HEALTH AND SAFETY PLAN
APPROVAL/SIGN OFF FORMAT

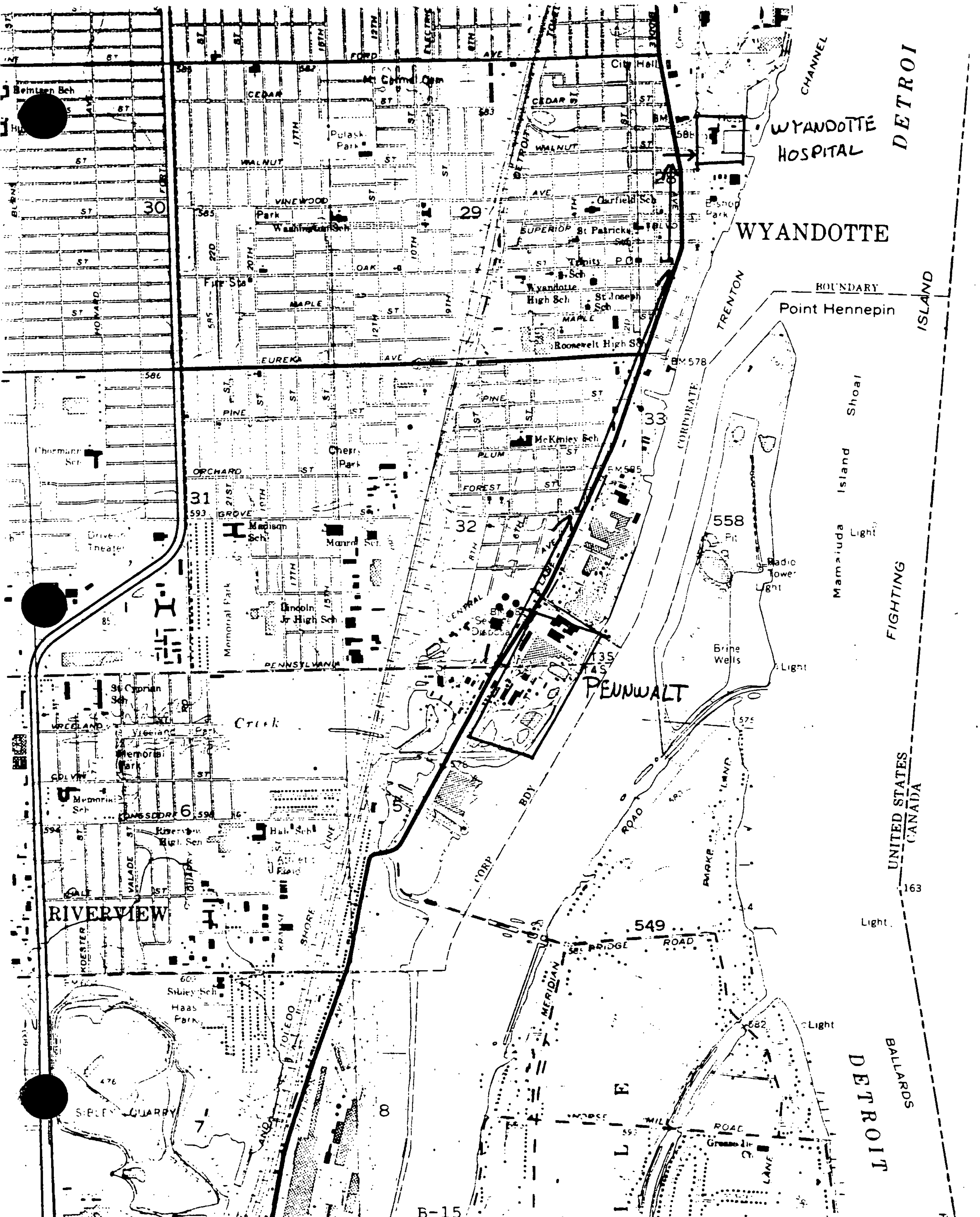
I have read, understood, and agreed with the information set forth in this Health and Safety Plan (and attachments) and discussed in the Personnel Health and Safety briefing.

John P. Perzanell Name	Signature	4-22-86 Date
MARC ZEMAN Name	Signature	4-22-86 Date
Anthony C. Nichols Name	Anthony C. Nichols Signature	4-22-86 Date
MARIAN R. DZEDZY Name	Marian R. Dzedzy Signature	4-22-86 Date
Name	Signature	Date
Bruce W Benyish Site Safety Co-ordinator	Bruce W Benyish Signature	4-18-86 Date
MARTIN J. O'NEILL FOR BME Director, Corporate Health and Safety	Martin J. O'Neill for BMC Signature *Roy F. Weston	4-18-~~85~~ 86 Date
M. A. Turco Project Manager	Michael A. Turco Signature	4/18/86 Date
M. N. BHATLA Project Director/ Department Manager	NBh Signature	4/18/86 Date

4-2 6
BWB

Personnel Health and Safety Briefing Conducted By:

Bruce W Benyish Name	Bruce W Benyish Signature	4/22/4 Date


WYANDOTTE HOSPITAL
PENNWALT
WYANDOTTE
RIVERVIEW
DETROIT
DETROIT CHANNEL
TRENTON
BOUNDARY
Point Hennepin
FIGHTING ISLAND
Mamajuda Island Shoal
CORPORATE BDY
UNITED STATES
CANADA
BALLARDS
City Hall
Pulaski Park
Garfield Sch
St Patricks Sch
Trinity P.O
Wyandotte High Sch
St Joseph Sch
Roosevelt High Sch
McKinley Sch
Madison Sch
Monroe Sch
Lincoln Jr High Sch
Memorial Park
Cherry Park
Washington Sch
Fire Sta
Bishop Park
Drive-in Theater
St Cyprian Sch
Vreeland Park
Memorial Park
Memorial Sch
Riverview High Sch
Hale Sch
Athletic Field
Sibley Sch
Haas Park
SIBLEY QUARRY
Sewage Disposal
Brine Wells
Radio Tower
Light
Pit
FORD AVE
EUREKA AVE
PENNSYLVANIA
GROVE
ORCHARD
PINE
PLUM
FOREST
MAPLE
OAK
VINEWOOD
WALNUT
CEDAR
SUPERIOR BLVD
BIDDLE AVE
CENTRAL
SIBLEY ROAD
TOLEDO
SHORE LINE
FORT ST
VREELAND
COLVIN
KINGSDORF
KOESTER
VALADE
KRAUSE
HOWARD
BURNS
MERIDIAN
PARKE LANE ROAD
HORSE MILL ROAD
BRIDGE ROAD
Grosse Ile
30
29
31
32
33
5
6
7
8
549
558
163
BM 578
BM 585
T3S
T4S

Chemical Name and Formula	Synonyms	Permissible Exposure Limit	IDLH Level	Physical Description	Chemical and Physical Properties		Incompatibilities	Measurement Method and Sol (See Table 1)
Carbon tetrachloride CCl_4	Tetrachloromethane	10 ppm 25 ppm ceil 200 ppm/5 min/4 hr peak (NIOSH) 2 ppm/1 hr ceil	300 ppm Ca	Colorless liquid with an ether-like odor	MW 154 BP: 170 F Sol 0.08% Not combustible	VP 91 mm MP: −9 F	Chemically active metals, such as sodium, potassium, magnesium	Char. CS_2; GC; J
Carbon disulfide CS_2	Carbon bisulfide	20 ppm 30 ppm ceil 100 ppm/30 min peak (NIOSH) 1 ppm 10 ppm ceil	500 ppm	Colorless to faintly yellow liquid with a strong, disagreeable or sweetish odor	MW: 76 BP: 115 F Sol: 0.2% Fl.P: −22F	VP: 300 mm MP: −169 F UEL: 50% LEL: 1.3%	Strong oxidizers, chemically active metals (such as sodium, potassium, zinc), azides, organic amines	Char; C_6H_6; GC, R

	Personal Protection and Sanitation (See Table 2)		Respirator Selection		Health Hazards				
			Upper Limit	Devices Permitted (See Table 3)	Route	Symptoms (See Table 4)	First Aid (See Table 5)		Target Organs
CARBON TETRAchloride	Clothing: Goggles: Wash: Change Remove	Repeat prolong Reason prob Promptly upon wet N.A. Promptly contam non imperv	100 ppm: 300 ppm: Escape:	SA/SCBA SAF/SCBAF GMOV/SCBA	Inh Abs Ing Con	CNS depres; nau, vomit; liver, kidney damage, skin irrit	Eye: Skin: Breath: Swallow	Irr immed Soap wash immed Art resp Ipecac, vomit	CNS, eyes, lungs, liver, kidneys, skin
Carbon disulfide	Clothing: Goggles: Wash: Change: Remove:	Reason prob Reason prob Promptly upon contam N.A. [illegible]	200 ppm: 500 ppm: Escape:	CCROV/SA/SCBA CCROV/F/GMOV/SAF/SCBAF/SA PD PP CF GMOV/SCBA	Inh Abs Ing Con	Dizz, head, poor sleep, ftg, ner, anor, low-wgt; psychosis, polyneur, Parkinson-like, ocular changes, CVS, GI, kidney, liver injs, [illegible]	Eye Skin: Breath Swallow	Irr immed Soap wash immed Art resp Water, vomit	CNS, PNS, CVS, eyes, kidneys, liver, skin

APPENDIX C

HAZARDOUS SUBSTANCES LIST

Hazardous Substances List Organic Parameters

Semi-volatiles

Phenol
bis(2-Chloroethyl)Ether
2-Chlorophenol
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Benzyl Alcohol
1,2-Dichlorobenzene
2-Methylphenol
bis(2-Chloroisopropyl)Ether
4-Methylphenol
N-Nitroso-di-n-propylamine
Hexachloroethane
Nitrobenzene
Isophorone
2-Nitrophenol
2,4-Dimethylphenol
Benzoic Acid(2)
bis(2-Chloroethoxy)Methane
2,4-Dichlorophenol
,2,4-Trichlorobenzene
Naphthalene
4-Chloroaniline
Hexachlororbutadiene
4-Chloro-3-methylphenol
2-Methylnaphthalene
Hexachlorocyclopentadiene

2,4,6-Trichlorophenol
2,4,5-Trichlorophenol(2)
2-Chloronaphthalene
2-Nitroaniline(2)
Dimethyl Phthalate
Acenaphthylene

3-Nitroaniline(2)
Acenaphthene
2,4-Dinitrophenol(2)
4-Nitrophenol(2)
Dibenzofuran
2,4-Dinitrotoluene
2,6-Dinitrotoluene
Diethyl Phthalate
4-Chlorophenyl-phenylether
Fluorene
4-Nitroaniline(2)
4,6-Dinitro-2-methylphenol(2)
N-Nitrosodiphenylamine(1)
4-Bromophenyl-phenylether
Hexachlorobenzene
Pentachlorophenol(2)
Phenanthrene
Anthracene
di-n-Butyl Phthalate
Fluoranthene
Pyrene
Butyl Benzyl Phthalate
3,3'-Dichlorobenzidine(3)
Benzo(a)Anthracene
bis(2-Ethylhexyl)Phthalate
Chrysene
di-n-Octyl Phthalate
Benzo(b)Fluoranthene
Benzo(k)Fluoranthene
Benzo(a)Pyrene
Indeno(1,2,3-cd)Pyrene
Dibenz(a,h)Anthracene
Benzo(g,h,i)Perylene

Hazardous Substances List Organic Parameters (continued)

Volatiles

Chloromethane
Bromomethane
Vinyl Chloride
Chloroethane
Methylene Chloride
Acetone
Carbon Disulfide
1,1-Dichloroethene
1,1-Dichloroethane
Trans-1,2-Dichloroethene
Chloroform
1,2-Dichloroethane
2-Butanone
1,1,1-Trichloroethane
Carbon Tetrachloride
Vinyl Acetate
Bromodichloromethane
1,2-Dichloropropane
Trans-1,3-Dichloropropene
Trichloroethene
Dibromochloromethane
1,1,2-Trichloroethane
Benzene
cis-1,3-Dichloropropene
2-Chloroethylvinylether
Bromoform
4-Methyl-2-pentanone
2-Hexanone

Tetrachloroethene
1,1,2,2-Tetrachloroethane
Toluene
Chlorobenzene
Ethylbenzene
Styrene
Total Xylenes
Dichlorobenzenes
Trichlorofluoromethane

Hazardous Substances List Organic Parameters (continued)

Pesticide/PCB's

Alpha-BHC.........................
Beta-BHC..........................
Delta-BHC.........................
Gamma-BHC (Lindane)...............
Heptachlor........................
Aldrin............................
Heptachlor Epoxide................
Endosulfan I......................
Dieldrin..........................
4,4'-DDE..........................
Endrin............................
Endosulfan II.....................
4,4'-DDD..........................
Endrin Aldehyde...................
Endosulfan Sulfate................
4,4'-DDT..........................
Methoxychlor......................
Endrin Ketone.....................
Chlordane.........................
Toxaphene.........................
Aroclor-1016......................
Aroclor-1221......................
Aroclor-1232......................
Aroclor-1242......................
Aroclor-1248......................
Aroclor-1254......................
Aroclor-1260......................

Hazardous Substances List Inorganic Parameters

Ag	Silver
Al	Aluminum
As	Arsenic
Ba	Barium
Be	Beryllium
Ca	Calcium
Cd	Cadmium
Co	Cobalt
Cr	Chromium
Cu	Copper
Fe	Iron
Hg	Mercury
K	Potassium
Mg	Magnesium
Mn	Manganese
Na	Sodium
Ni	Nickel
Pb	Lead
Sb	Antimony
Se	Selenium
Tl	Thallium
V	Vanadium
Zn	Zinc

Cyanide

APPENDIX D

PHASE I
SOIL TEST PIT DESCRIPTIONS
MONITOR WELL LOGS
WELL COMPLETION SUMMARIES

Soil Test Pit Descriptions

Test Pit-1		4-21-86	1440
0-30"	Mixed fill: Black Cinders, Sand, Bricks and slag. Old cement footing at 30". Water poured into pit from 30 inches below ground surface, filling pit to that depth. HNu = 1 ppm (1ppm is background for site area)		

Test Pit-2		4-21-86	1600
0-40"	Black Cinders, Stone, Sand and Gravelly Fill.		
40"	Clay pipe, approximately 8" in diameter (broke); water entered pit, filled to 30" below ground surface HNu = 1 ppm		

Test Pit-3		4-21-86	1510
0-12"	Cinders, sand and stone, parking lot surface.		
12-16"	Concrete slab - operator broke through slab with repeated blows using the borehole bucket.		
16-52"	Black stained sand		
52-72"	Yellow, brown, fine sandy clay loam and sandy clay. Mottled prominently with gray. Stiff not plastic. No water in pit. HNu = 1 ppm		

Test Pit-4 4-22-86 1640

0-108"	Olive brown sand.
108"	Hard, grayish blue sand clay.

HNU - 2 ppm in test pit
1 ppm in breathing zone.

Test Pit-5 4-23-86 0930

0-60"	Mixed sandy and gravelly fill. Upper 24" is rusty orange and olive color.
60-70"	Dark brown fibrous peat.
70-90"	Olive brown fine sandy clay, mottled with gray; grading to a hard stiff moist gray blue silty clay.

HNu = 1 ppm

Test Pit-6 4-21-86 1650

0-48"	Mixed gravelly fill, slag ("foundry sand")
48-57"	Black, fine sand ("foundry sand")
57-70"	Black fibrous peat and organic water filled pit to 24" below ground surface.

HNu = 1 ppm

Test Pit-7 4-22-86 0820

0-48"	Black fill: Cinders, slag, very coarse and porous. Broke 8" clay pipe. Water filled pit to 24" below ground surface.
48-60"	Dark brown, very fibrous peat.
60-72"	Bluish gray, stiff sticky plastic clay.
	HNu = 1 ppm

Test Pit-8 4-22-86 1000

0-48"	Black stained porous fill: Slag, cinders, gravel and sand. Black oily water at 36" below ground surface.
48-54"	Dark brown, fibrous peat.
	HNu = 5 ppm in test pit = 1 ppm in breathing zone.

Test Pit-9 4-24-86 0800

0-8"	Dark gray to black gravel and slag fill.
8-13"	Dark gray sandy clay.
13-36"	Brick and concrete foundation wall.

Surface Soil Sample SS-10

Location was originally marked as test pit.
Pennwalt utilities clearance showed an underground water main in this area.

SS-10	5-13-86	1415

Collected surface soil sample at 0-2" using stainless steel trowel.

Test Pit-11	4-22-86	0915

0-48"	Black coarse cinder/slag fill. Water entering pit at 36" below ground surface, filled pit to this depth.
48-72"	Black, oily water and mixed rubble fill: Bricks, cement, wood and slag.
72-80"	Olive brown fine sandy clay and sticky blue clay.

Pit has chlorinated organic odor.

HNu = 4 ppm in test pit
1 ppm in breathing zone

Test Pit-12	4-21-86	1720

0-48"	Statified fill: Black stained gravelly sand, slag.
48-72"	Black, oily stained gravel fill, bricks, metal strips. Water seeping into pit slowly at 48-55".

Chlorinated organic odor.

HNu = 12 ppm in test pit
2 ppm in breathing zone

Note: No Test pit 13 exists

Test Pit-14 4-23-86 1145

0-60" Stratified layers of coarse gravelly sand and cinder fill.

At 60", a 15-18" diameter clay pipe was encountered running lengthwise in pit (parallel with Bldg. 35).

60"- Wet black oily stained fine silty sand.

HNu = 1 ppm

Test Pit-15 4-23-86 1110

0-50" Black wet cinders, coarse sand and gravel

50-60" Black wet stained clayey find sand.

60" Pipe encountered running parallel with Building 35. Checked surface features. Manholes indicate possible stormwater or sewer pipe.

HNu = 1 ppm

Surface Soil Sample SS-16 5-13-86 1100

(Old Cell Room Floor, Bldg 38)

Used shovel to remove top 2" of soil from five locations inside old cell room. Composited soil from 2-4" at each of these locations by mixing on a plastic (Visqueen) sheet, then using a stainless steel trowel to fill sample jars.

Surface Soil Sample SS-17 5-13-86 1350

(Old Cell Room Floor, Bldg 38)

Used shovel to scrape top 2" of soil off sample site. Collected soil sample with stainless steel trowel from 2-4" depth.

Surface Soil Sample SS-18 5-13-86 1400

(Old Cell Room Floor, Bldg 38)

Used shovel to scrape top 2" of soil off sample site. Collected soil sample with stainless steel trowel from 2-4" depth.

Test Pit-19 4-22-86 1120

0-72" Black stained, mixed granular fill: slag, gravel, coarse sand, bricks and concrete.

Large obstruction at 72", could not be identified. Water filled pit to 36" below ground surface.

HNu = 1 ppm

Test Pit-20 4-22-86 1145

0-48"	Mixed fill: yellowish brown and reddish brown coarse sandy, gravely fill.
48-72"	Black stained slag fill.
72-78"	Dark brown fibrous peat.
78-90"	Dark gray fine sand and; wet.

Water seeped into pit at 72", filled pit slowly.

HNu = 1 ppm

Test Pit-21 4-24-86 1150

0-48"	Black coal fumes and stained black sand.
48-108"	Yellowish brown sand and gravel fill.
108-114"	Dark brown sandy fibrous peat.
114-120"	Dark grayish brown silty fine sand grading into dark gray fine sand.

Water at approximately 84" draining into pit.

HNu = 20 ppm in test pit
= 5-15 ppm on soil removed
= 1 ppm in breathing zone

Test Pit-22 4-22-86 1440

0-48"	Black slag, cinders, bricks and sand.
48-58"	Black, oily slag and cinders. Water entering pit at 58"
58-65"	Stiff, wet grayish brown sandy clay.
65-95"	Stiff, wet bluish gray clay, mottled with yellow brown.

HNu = 1 ppm

Note: No test pit 23 exits

Test Pit-27 4-23-86 0820

0-48"	Dark brown mixed fill: bricks, wood and concrete.
48-60"	Very dark brown fibrous peat.
48"	Thin layer of white pastey sludge and grayish-white coatings on soil.
60-84"	Olive brown, very fine sandy clay; mottled with gray and rust.

HNu = 1 ppm

Test Pit-28 4-22-86 1520

0-45"	Varigated layers of fill: Dark brown-black stained gravel, cinders and slag.
45-72"	Black oily gravel, slag fill, wood, brick. Water seeping in at approximately 50".
72"	White, pastey material, appears to be sludge. The pH of this material slurried in deionized water was 12.5.

HNu = 1 ppm

Test Pit-29 4-23-86 0915

0-4'	Building materials rubble: bricks and wood, with wet, black stained gravel and sand. (90% rubble).
4-5'	Black wet, oily clayey fine sand.
5-6'	Olive brown fine to medium sand--overall grayish color due to staining.

HNu = 1 ppm

Surface Soil Sample SS-30

Outdoor cell liquior sumps (Between Bldgs. 38A and 40).

SS-30A 5-13-86 1015

Soil collected from inside diked area (8" high concrete dike). Three surface soil samples (0-2") were composited on a plastic (Visqueen) sheet, mixed with a stainless steel trowel, and placed in sample jars.

SS-30B 5-13-86 1000

Soil collected from outside diked area. Eight surface soil samples (0-2") were composited on a plastic sheet, mixed with a stainless steel, and placed in sample jars.

Surface Soil Sample SS-31 5-13-86 1445

Used shovel to scrape to 2" of soil from sample location. Collected soil sample with stainless steel trowel from 2-4" depth.

Test Pit-32

0-54" Black gravelly cinders, slag and some sand, wet. Water filling pit at 48".

54-60" Dark brown fibrous peat.

60-72" Black, fine clayey sand, wet.

HNu = 1 ppm

Test Pit-24 4-22-86 1400

0-6"	Dark brown, sandy fill.
6-9"	Yellowish brown, fine sand with some slag and gravel.
9-48"	Black, oily cinders, slag and gravel.
48-68"	Dark brown, wet gravelly fill; water dripped into pit from 60".
68-75"	Dark brown fibrous peat.
75-96"	Soft, wet, olive brown fine sandy clay. Mottled with light gray.

HNu = 1 ppm

Surface Soil Sample SS-25 4-23-86 0810

Used backhoe to dig in parking area. Encountered cement pad several inches below ground surface. Could not break through cement; a surface soil sample will be taken here instead of test pit excavation.

5-13-86 1425

Used shovel to scrape top 2" of soil off sample area. Collected soil sample with stainless steel trowel from 2-4" depth.

Test Pit-26 4-22-86 1700

0-40"	Dark gray stained sand and slag.
40-90"	Black oily, wet cinders, gravel, slag and sand.
90-96"	6" layer of brown fibrous peat.
96"	Blue gray, hard, stiff fine sandy clay.

Water pouring into pit at approximately 80".

HNu = 1 ppm

Test Pit-33 4-23-86 1645

0-54"	Fill: black and yellowish brown cinders, gravel sand and slag. Water entering pit at 24" below ground surface.
54-66"	Dark brown fibrous peat.
6-96"	Dark olive gray stiff clay, mottled with gray.

HNu = 1 ppm

Test Pit-34 4-24-86 0930

0-48"	Dark grayish brown, gravelly sandy fill.
48-90"	Olive-yellow, medium clayey sand grading to stiff olive clay, mottled with gray and brown.

HNu = 1 ppm

Test Pit-33 4-23-86 1645

0-54"	Fill: black and yellowish brown cinders, gravel, sand and slag. Water entering pit at 24" below ground surface.
54-66"	Dark brown fibrous peat.
66-96"	Dark olive gray stiff clay, mottled with gray.
	HNu = 1 ppm

Test Pit-34

0-48"	Dark grayish brown, gravelly sand fill.
48-90"	Olive-yellow, medium clayey sand grading to stiff olive clay mottled with gray and brown.
	HNu = 1 ppm

Test Pit-35	4-24-86	0850

0-24"	Rubble fill: brick, cement (some wire), and gravel. Dark brown sand matrix.
24-42"	Black sand and gravel fill, cinders
42-72"	Wet black fine sand. Water seeping into pit.
72-96"	Dark olive gray stiff clay, moist. Mottled with rusty orange and dark gray.

HNu = 1 ppm

Surface Soil Sample SS-36	5-13-86	1015

Used stainless steel trowel to collect soil from 0-2" depth in area which obviously received surface drainage. Area was a slight depression with surface soil cracks from evaporation of ponded water.

MONITOR WELL LOGS AND WELL COMPLETION SUMMARIES

WESTON

Location

WELL LOG

Page 1 of 1

Well No. 1 Drill Company [illegible] Log By BWB

Client Pennwalt Driller ___ Field Book No. ___

Job No. ___ Date Began 4/[illegible] End [illegible] Log Date ___

Drilling Method Hollow Stem Auger Rig CME 55

Sampling Method 2" split spoon No Samples ___

Casing Size and Type 2" I.D. PVC Screen Size 2" ID PVC Joint Type THREAD Pipe Length ___

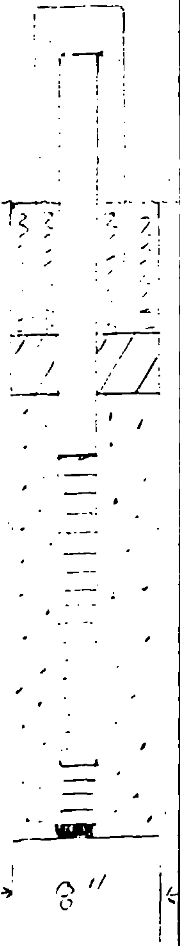
Type of Pack Sand medium coarse Type of Seal bentonite pellets / grout

Emplacement Method gravity Emplacement Method gravity

Interval ___ Interval ___

Development Method B[illegible] - Continuous for 0.5 Hrs Gallons Removed ___

Comments ___

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks HNU
	0	1	0-2'		4 6	6 6	0 – 4.5' Dr Gray gravelly silty Sand FILL, grades damp to saturated, with dr brown fine sand lenses from 2-4.5'	0
	2	2	2-4'		1 1	2 1	OUT OF FILL 4.5'	0
	4	3	4-6'		1 11	6 12	4.5-6.0 Mottled Brown fine sandy CLAY, tr rounded coarse Sand, moist	0
	6	4	6-8'		5 16	10 21	6.0-8.0 Brown silty sandy CLAY, moist, with occasional medium sand lenses	0
	8						END OF BORING - 8.0'	Sample [illegible] 6-

WESTON

Location

WELL LOG

Page 1 of 1

Well No. 2 Drill Company [illegible] Log By BCB

Client Pennwalt Driller ______ Field Book No. ______

Job No: ______ Date Began 4/22/86 End 4/22/86 Log Date ______

Drilling Method Hollow Stem Auger Rig CME55

Sampling Method 2" I.D PVC No Samples ______

Casing Size and Type 2" ID PVC Screen Size 2" ID PVC Joint Type Thread Pipe Length ______

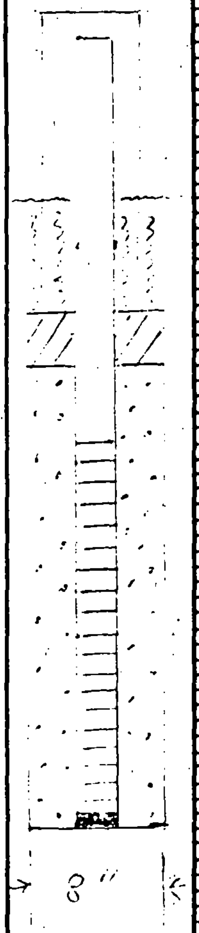
Type of Pack Sand medium to coarse Type of Seal Bentonite pellets / grout

Emplacement Method gravity Emplacement Method gravity

Interval ______ Interval ______

Development Method [illegible] Gallons Removed ______

Comments ______



Lithology and Well Construction	Depth	Sample No	Interval	Recovery	Blow Counts		Description	Remarks
								HNU PPM
	0	1	0-2'		2 5	3 3	0-2.4' Dr Brown sandy gravel and Black fine gravelly slag FILL moist ,OUT OF FILL -2.4'	0
	2	2	2-4'		3 1	2 1	2.4-4.0 Dr Brown silty SAND, wet	0
	4	3	4-6'		1 3	1 9	4.0-5.5' Olive Brown fine sandy SILT, saturated	0
	6	4	6-8'		5 17	10 22	5.5-8.0' Mottled Brown sandy silty CLAY, moist, low to medium plastic, with thin lenses of highly plastic lt gray clay	0 6-8' sampled for HSL organics inorganics
	8						End of Boring 80'	

WELL LOG

Location

Page ___ of ___

Well No. 3 Drill Company Mc[illegible] Log By [illegible]

Client [illegible] Driller [illegible] Field Book No. ___

Job No. ___ Date Began 4[illegible] End [illegible] Log Date ___

Drilling Method [illegible] Rig [illegible]

Sampling Method [illegible] No Samples ___

Casing Size and Type 2" [illegible] Screen Size 2" [illegible] Joint Type [illegible] Pipe Length ___

Type of Pack [illegible] Type of Seal [illegible]

Emplacement Method [illegible] Emplacement Method [illegible]

Interval ___ Interval ___

Development Method [illegible] Gallons Removed ___

Comments ___

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks
					2 3		0-2' [illegible] sand [illegible]	
		1	[illegible]					
					1 1	1/14"	2-3' – Dr brown fine sandy SILT, [illegible]	
		2	[illegible]					
					2 3	2 6	3.5-4' – [illegible] brown [illegible] saturated	
		3	4-[illegible]				4-6' [illegible]	
					4 1		[illegible]	
							6-8' [illegible]	
							End of Hole [illegible]	5-[illegible]

WESTON

Location

WELL LOG

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Well No. 4 Drill Company McDowell Log By BWB

Client Pennwalt Driller ____ Field Book No. ____

Job No. ____ Date Began 4/22/86 End 4/23/86 Log Date ____

Drilling Method Hollow Stem Auger Rig CME 55

Sampling Method Split spoon No Samples ____

Casing Size and Type 2" ID PVC Screen Size 2" ID PVC Joint Type THREAD Pipe Length ____

Type of Pack Sand medium to coarse Type of Seal bentonite pellets/grout

Emplacement Method ____ Emplacement Method ____

Interval ____ Interval ____

Development Method bail - continuous for 0.5 hrs Gallons Removed ____

Comments ____

Lithology and Well Construction	Depth	Sample No	Interval	Recovery	Blow Counts		Description	Remarks
								HNu ppm
	0	1	0-2'		1 2	3 2	0-4' Dr brown gravelly fine sand FILL, saturated @ 3'	0
	2	2	2-4'		1/12" 1	2	4-6' Black fine sandy SILT, wet, low plastic, oily sheen	0
	4	3	4-6'		WOH/12"	1		0
	6	4	6-8'		1/12" 1	1	6-8' Mottled Olive-brown, gray silty SAND, saturated, with organic roots 8-9' Black fine sandy SILT, moist & wet, low plastic, oily sheen	0
	8	5	8-10'		1 2	2 3	9-10' Olive gray silty SAND with organic roots	0
	10							

WELL LOG

Page 2 of 2

Well No. 4 Client PENNWALT Job No. Log By BWG

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks
								HNU (ppm)
	10	6	[illegible]	3 3	4 4		10-11' [illegible]	0
	12	7	[illegible]	[illegible]	[illegible]		[illegible] plastic	0
	14						12-14' Gray [illegible] silty clay [illegible] brown [illegible] fine to medium plastic	[illegible]
							END OF BORING [illegible]	[illegible]

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WESTON

Location

WELL LOG

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Well No. 5 Drill Company McDowell Log By BWJ

Client PENNWALT Driller ______ Field Book No. ______

Job No. ______ Date Began 4/23/88 End 4/23/88 Log Date ______

Drilling Method Hollow Stem Auger Rig CME55

Sampling Method 2" split spoon No Samples ______

Casing Size and Type 2" ID PVC Screen Size 2" I.D. PVC Joint Type Thread Pipe Length ______

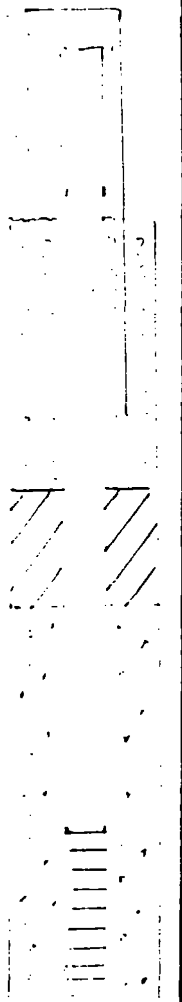
Type of Pack Sand medium - coarse Type of Seal Bentonite pellets / grout

Emplacement Method gravity Emplacement Method gravity

Interval ______ Interval ______

Development Method bailing - continuous for 0.5 hr Gallons Removed ______

Comments ______

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks HNU ppm
	0	1	0-2'		4 5	6 6	0 - 5.0' Brick, Concrete Fill, in a Sand matrix saturated at 2'	0
	2	2	2-4'		9 13	12 17	OUT OF FILL - 5'	0
	4	3	4-6		1 1	1/12"	5.0 - 6.0' Black sandy SILT grades to mottled Olive Brown Sandy SILT wet to saturated.	0
	6	4	6-8		1 2	1 2	6.0 - 7.9 Olive Brown, Gray SILT, SAND, saturated organic fibers	0
	8 10	5	8-10'		2 3	4 2	7.9 - 9.0 Black silty SAND fine to medium, saturated, stain-like appearance.	1

WELL LOG

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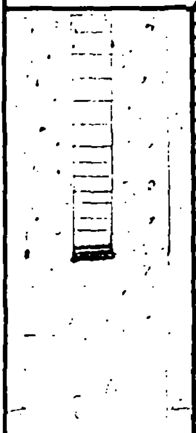
Well No. 5 Client PENNWALT Job No. Log By BWB



Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks HNU
10	6	10-12'		1 2	1 3	10.0-12.0 Olive brown silty SAND saturated	0
12	7	12-14	1	1 1	1 2	12-14 low recovery - appears to be a soft gray SILT	0
14	8	14-16'		6 10	10 17	14-16 Brown sandy CLAY, damp to moist, low to medium plastic, with tr subround fine gravel, tr lt orange mottling	0
16						End of Boring - 16.0'	

WESTON
DESIGNERS CONSULTANTS

Location

WELL LOG

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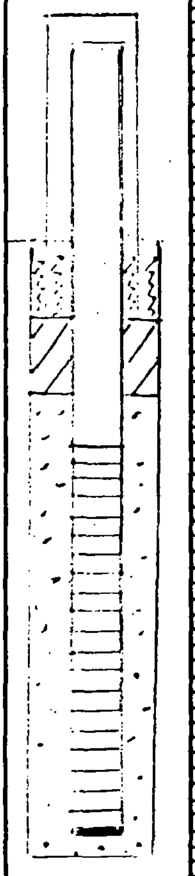
Well No. 6 Drill Company McDowell Log By BWB
Client Pennwalt Driller Field Book No.
Job No. Date Began 4/24/86 End 4/24/86 Log Date
Drilling Method Hollow stem auger Rig CME 55
Sampling Method 2" splitspoon No Samples
Casing Size and Type 2" I.D. PVC Screen Size 2" I.D. PVC Joint Type THREAD Pipe Length
Type of Pack Sand - medium to coarse Type of Seal Bentonite pellets/grout
Emplacement Method gravity Emplacement Method gravity
Interval Interval
Development Method bail - continuous for 0.5 HRS Gallons Removed
Comments

Lithology and Well Construction



Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks Hnu (PPM)
0	1	0-2'		3	8	0-1.5' Dr Gray gravelly silty sand Fill, tr coal frag(1.5-2.0' Olive brown silty sand	0
				7	11		
2	2	2-4'		5	7	2-4' Dr Olive brown silty SAND damp, appears stained ~ 4' out of Fill	0 @ 4' Auger refusal, moved rig 4'S
				7	7		
4	3	4-6'		3	4	4-7.8' Olive brown, gray silty SAND saturated 7.8-8.0 Olive brown Sandy CLAY low to medium plastic, some coarse sand, fine gravel	@ 2' Auger refusal - metal 0 moved rig 4'S, ok to splitspoon
				5	5		
6	4	6-8'		3	4	8.0-10.' Dr gray Sandy CLAY damp medium plastic	0
				6	5		
8	5	8-10'		7	12		Sample at 8-10' for 0 HSL organics inorganics
				13	16		
10						END OF BORING - 10.0'	

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WESTON
DESIGNERS CONSULTANTS

Location

WELL LOG

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Well No. 7 Drill Company McDowell Log By BWB

Client Pennwalt Driller Field Book No.

Job No. Date Began 4/23/86 End 4/23/86 Log Date

Drilling Method Hollow stem auger Rig CME 55

Sampling Method 2" split spoon No Samples

Casing Size and Type 2" ID PVC Screen Size 2" ID PVC Joint Type THREAD Pipe Length

Type of Pack Sand - medium to coarse Type of Seal bentonite pellets / grout

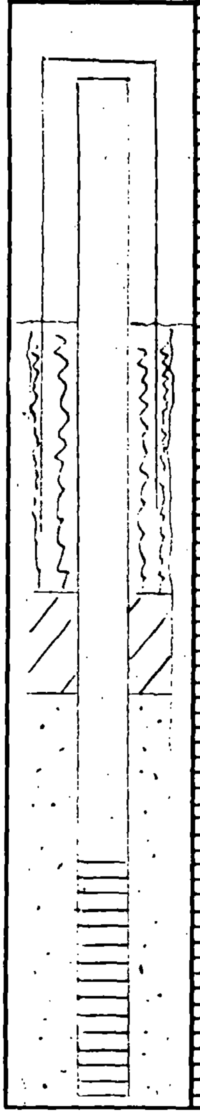
Emplacement Method gravity Emplacement Method gravity

Interval Interval

Development Method bail - continuous for 0.5 hrs Gallons Removed

Comments

Lithology and Well Construction



Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks OVA ppm
0	1	0-2'		3 8	9 7	0-2' Dr Gray sandy silty fine to coarse gravel FILL, moist to wet, 1" lime white material At 1.0', some coal	0
2	2	2-4'		3 4	3 3	2-2.4 - Lime white gravelly Sand FILL, 2.4-5.6 Red, Gray sandy gravel FILL SLAG, tr coal from 4-5.6', wet to saturated	0
4	3	4-6'		3 2	4 5	5.6-6.0 Lime white, gray fine to medium sand FILL, saturated, cakey	0
6	4	6-8'		12 7	7 15	6-8 Red and Brown brick Fill, saturated	0.5
8	5	8-10'		6 2½	4½ 1	8-9.5 Dr gray course gravel Fill, saturated OUT OF FILL 9.5'	0
10							

WESTON

WELL LOG

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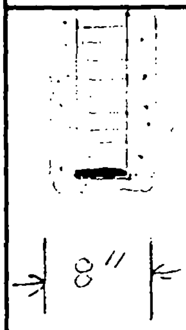
Well No. 7 Client Pennwalt Job No. Log By BWB



Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks HNu (ppm)
	10	6	10-12		1 1	1 3	9.5 – 12 Dr gray Sandy CLAY, saturated, with brown organic fibers	0
	12	7	12-14'	0	2 4	3 5	12-14 No recovery, out side of Spoon has a fine sandy CLAY as from 10-12'	0
	14	8	14-16'	8''	3 4	4 4	14-16 Dr gray fine sandy CLAY, moist	sample from 14-16' sampled for metals only
	16						END OF BORING -16.0'	

WESTON

Location

WELL LOG

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Well No. 8 Drill Company McDowell Log By BWB

Client Pennwalt Driller Field Book No.

Job No. Date Began 4/24/86 End 4/24/86 Log Date

Drilling Method Hollow STEM Auger Rig CME 55

Sampling Method 2" split spoon No Samples

Casing Size and Type 2" I D PVC Screen Size 2" I D PVC Joint Type THREAD Pipe Length

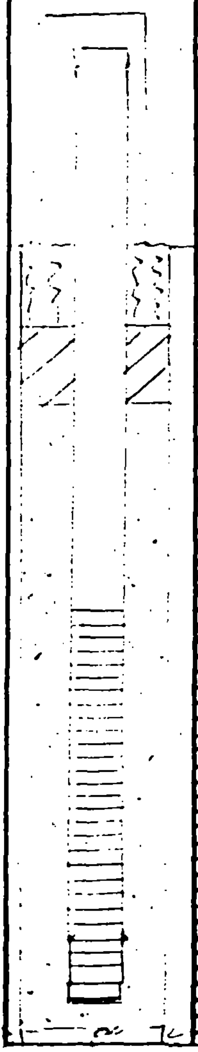
Type of Pack Sand - medium to coarse Type of Seal bentonite pellets / grout

Emplacement Method gravity Emplacement Method gravity

Interval Interval

Development Method Gallons Removed

Comments Bail - continuous for 0.5 Hrs

Lithology and Well Construction	Depth	Sample No	Interval	Recovery	Blow Counts		Description	Remarks HNU (PPM)
	0	1	0-2'		3 12	11 15	0-5' Dr Gray to Black sandy gravel and coal FILL, grades damp @ 2' to saturated at 4'	0
	2	2	2-4'		5 5	7 5	5-8' Olive brown, orange fine gravel, brick FILL, saturated	0
	4	3	4-6'		5 3	3 4	OUT OF FILL - 8'	0
	6	4	6-8'		1 3	2 1	8-12' Dr gray silty fine sandy CLAY, saturated, low to medium plastic, sticky	0
	8 10	5	8-10		1 1	1/12"		0

WESTON

WELL LOG

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Well No. 8 Client PENNWALT Job No. Log By BWB

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks HNU
	10				1	2		From 10-12' @ sample obtained for metals only
		6	10-12'	12"	2	3		
	12						END OF BORING - 12.0'	

WESTON

WELL LOG

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Location

Well No. 9 Drill Company McDowell Log By Bill

Client Pennwalt Driller Field Book No.

Job No. Date Began 4/20/18 End 4/20/18 Log Date

Drilling Method Hollow Stem Auger Rig CME

Sampling Method 2" split spoon No Samples

Casing Size and Type 2" ID PVC Screen Size 2" ID PVC Joint Type Thread Pipe Length

Type of Pack Sand - medium To coarse Type of Seal Bentonite pellet [illegible]

Emplacement Method gravity Emplacement Method gravity

Interval Interval

Development Method Drilled - continuous for 0.5 Hrs Gallons Removed

Comments

Lithology and Well Construction	Depth	Sample No	Interval	Recovery	Blow Counts		Description	Remarks
								HNu [illegible]
	2	1	0-2'		3	3	0-4 Dr gray gravelly silty Sand FILL, damp, stained [illegible], wet @ 4'	0.5
					4	5		
		2	2-4'		3	3		0.5
	4				4	5	4-6 Dr gray [illegible] SAND FILL, wet, oily stained, with [illegible] [illegible]	
		3	4-6'		3	5		3
	6				5	4		
		4	6-8'		3	2	6-7.0 Dr gray [illegible] FILL [illegible]	[illegible]
	8				3	3		[illegible]
		5	8-10'		3	8	7-[illegible] [illegible] SILT [illegible] with Streaks [illegible] 3 [illegible]	1
	10				8	3		10'

WESTON

WELL LOG

Page 2 of [illegible]

Well No. 9 Client Mc Do[illegible] Job No. Log By [illegible]

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks
								HNU ppm
					4	9	10-14' AS [illegible]	3
					[illegible]	4	[illegible]	
					[illegible]	[illegible]		4-6
					[illegible]	[illegible]	[illegible]	
				8'	7	10	[illegible]	3 [illegible]
					5	[illegible]	[illegible]	[illegible]
					5	[illegible]	16-18' AS [illegible]	5
					[illegible]	[illegible]		
							[illegible]	[illegible]

WESTON

WELL LOG

Location

Page 1 of 1

Well No. 10 Drill Company McDowell Log By BWB

Client Pennwalt Driller ______ Field Book No. ______

Job No. ______ Date Began 4/22/86 End 4/22/86 Log Date ______

Drilling Method Hollow Stem Auger Rig CME 55

Sampling Method 2" split spoon No Samples ______

Casing Size and Type 2" I.D. PVC Screen Size 2" I.D. PVC Joint Type Thread Pipe Length ______

Type of Pack Sand medium-coarse Type of Seal bentonite pellets/grout

Emplacement Method gravity Emplacement Method gravity

Interval ______ Interval ______

Development Method ______ Gallons Removed ______

Comments ______

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks OVA (ppm)
	0							0
		1	0-2'	5 5	5 4		0 - 2.5' Gray gravelly, sandy ash FILL; saturated at 1.4' OUT OF FILL 2.5' 2.5-3.0' Black silty clayey SAND, saturated	4
	2	2	2-4'	2 3	2 5		3.0'- 8.5' Olive brown fine SAND, saturating little to some silt, some dark staining from 3-4'	1-2
	4	3	4-6'	2 3	4 4		8.5- 8.7; Varigated fine GRAVEL, saturated 8.7-8.8 Olive brown SILT saturated	2-3
	6	4	6-8'	4 6	6 8		8.8 - 11.5 Dr gray CLAY, some fine sand most fine to medium plastic, some fine rounded gravel	1-2
	8	5	8-9.5'	9 15	11			1-2
	9.5 10 11.5	6	9.5-11.5'	8 14	12 18		End of Boring 11.5'	1 9.5-11.5 sampled for HSL organics/inorganics

WESTON
DESIGNERS CONSULTANTS

Location

WELL LOG

Page 1 of 1

Well No. 11 Drill Company Mc Dwell Log By BWB

Client Pennwalt Driller Field Book No.

Job No. Date Began 4/22/86 End 4/22/86 Log Date

Drilling Method Hollow stem Auger Rig CME55

Sampling Method 2" split spoon No Samples

Casing Size and Type 2" I.D PVC Screen Size 2" I.D. PVC Joint Type THREAD Pipe Length

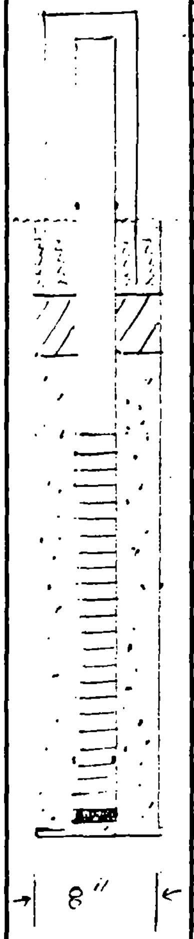
Type of Pack Sand medium - coarse Type of Seal bentonite pellets / grout

Emplacement Method Emplacement Method

Interval Interval

Development Method Gallons Removed

Comments

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks OVA (ppm)
	0	1	0-2'		6 9	9 5	0-4' Gray to Dr gray gravelly sandy ash FILL Saturated at 1.3' with tan, white sludge material. Black silt on bottom of spoon	0
	2	2	2-4'		3 3	3 3½	out of FILL - 4'	0
	4	3	4-6'		1 8	4 8	4-5.5' Olive gray fine SAND, Saturated 5.5-5.8' as above with black stains	1-2
	6	4	6-8'		5 9	6 17	5.8-8.0' Mottled gray, brown sandy CLAY, moist, low to medium plastic, tr coarse subround sand	0 4-6' HSL organics
	8						End of Boring - 8.0'	6-8' sampled for HSL organics, inorganics

WESTON

Location

WELL LOG

Page ____ of ____

Well No. 12 Drill Company ____ Log By RWB

Client PENNWALT Driller ____ Field Book No. ____

Job No. ____ Date Began 4/21/86 End 4/21/86 Log Date ____

Drilling Method Hollowstem auger Rig CME 55

Sampling Method 2" split spoon No Samples ____

Casing Size and Type 2" I.D. PVC Screen Size 2" ID PVC Joint Type THREAD Pipe Length ____

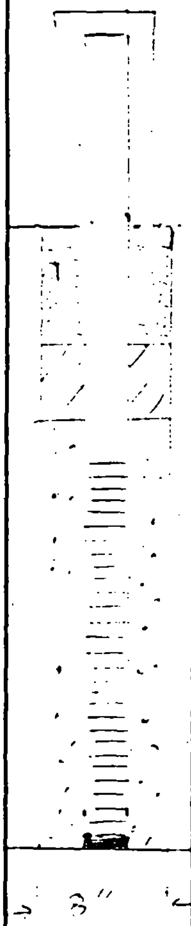
Type of Pack Sand medium-coarse Type of Seal bentonite pellets / grout

Emplacement Method gravity Emplacement Method gravity

Interval ____ Interval ____

Development Method bailed 0.5 hrs Gallons Removed ____

Comments ____

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks
								HNU (ppm)
	0	1	0-2'	15"	3 5	3 9	0-4' Gray to Dr gray Sandy, gravelly ash FILL, Saturated @ 1.5' with wood fibers	0
	2	2	2-4	4"	1 1½	1½ 4	4-5.8' Mottled, lt brown, lt gray, silty sandy CLAY; FILL with a coarse subround sand, moist, tr red brick OUT OF FILL 6.0'	0
	4	3	4-6	12"	3 4	4 13	6-8' Olive brown fine sandy CLAY, damp, highly plastic with tr organic fibers, tr subround coarse sand	½
	6	4	6-8	16"	12 20	12 25		0
→ 8" ←	8						End of Boring - 8.0'	6-8' Sampled for [illegible] metal [illegible]

WESTON

Location

WELL LOG

Page 1 of 1

Well No. 13 Drill Company McDowell Log By BWB

Client Pennwalt Driller Field Book No.

Job No. Date Began 4/24/86 End 4/24/86 Log Date

Drilling Method Hollow stem Auger Rig CME55

Sampling Method Splitspoon No Samples

Casing Size and Type 3/4-inch ID PVC Screen Size 3/4-inch ID PVC Joint Type Thread Pipe Length

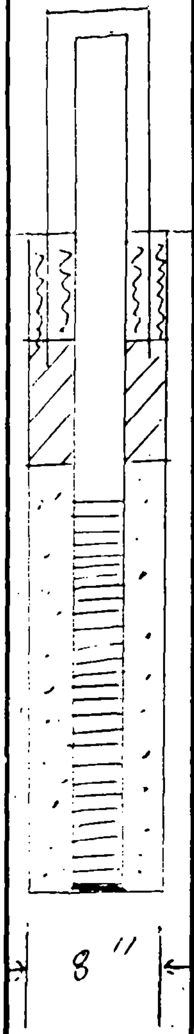
Type of Pack Sand - medium to coarse Type of Seal bentonite / grout

Emplacement Method gravity Emplacement Method gravity

Interval Interval

Development Method None Gallons Removed

Comments



Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks
								Piozo 13 relocated + coal pile
	0						0-5' BLACK COAL logged from auger cuttings	
	2							split spoon obtained to identify were Clay is located No blow counts recorded
	4							
							5-7 Olive silty SAND, sat	Down hole
	6	1	5-7		—	—		HNU 20-25 ppm
					—	—	7-8 - as above	workspace No measurement above 0.1ppm
	8		7-8.5		—	—	8-8.5 Gray sandy CLAY	
					—	—		

WESTON

WELL LOG

Page 1 of 1

Location

Well No. Peg 14 Drill Company McD[illegible] Log By BWB

Client Pennwalt Driller ____ Field Book No. ____

Job No. ____ Date Began 4/23/86 End 4/23/86 Log Date ____

Drilling Method Hollow Stem Auger Rig CME 55

Sampling Method ____ No. Samples ____

Casing Size and Type 5/4" ID PVC Screen Size 3" ID PVC Joint Type Thread Pipe Length ____

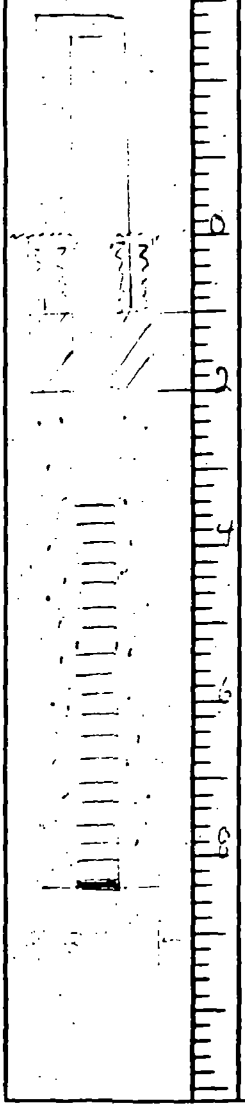
Type of Pack Sand medium coarse Type of Seal Bentonite pellets

Emplacement Method gravity Emplacement Method gravity

Interval ____ Interval ____

Development Method ____ Gallons Removed ____

Comments ____

Lithology and Well Construction	Depth	Sample No	Interval	Recovery	Blow Counts		Description	Remarks
							Augered to clay with out taking split spoon samples 6 - 8.5' Dr. gray CLAY At 2' OVA reading 7ppm in workspace Drilling crew went to Level C At 7' OVA reading ½-1ppm in work space OVA shut down during construction; OVA readings may not be valid	

APPENDIX E

PHASE I
CHAIN-OF-CUSTODY DOCUMENTATION

Custody Transfer Rec[illegible]/Lab Work Request

001

8604-916

Received By V.K. Dunlevo
Date 4/24/86
Assigned to

Client Penn[illegible], Wyandotte, MI
Client Contact
Phone

RFW Contact M.K. Dzedzy ext [illegible]
Date Due 5/15/86
Project Number 0603-10-01

SAMPLE IDENTIFICATION

ANALYSES REQUESTED SEE BELOW!

Sample No.	Client ID No.	Description	Date Collected	Container/Preservative	HSL organic	HSL inorganic	VOA					
0010		TP-3	4-21-86	3 liter glass 2 VOA	HOLD	X	HOLD					
20		TP-2	4-21-86	1	HOLD	X	HOLD					
30		TP-12	4-21-86	1 liter glass VOA	X		X					
40		TP-1	4-21-86	1 liter glass		X						
50		TP-6	4-21-86	1 liter glass 2 VOA	X		X					
60		TP-7	4-22-86	1 liter glass 2 VOA	X		X					
70		TP-11	4-22-86	1 liter glass 2 VOA	X		X					
80		TP-8	4-22-86	1 liter glass 2 VOA	X		X					
90		TP-19	4-22-86	1 liter glass		X						
		~~TP-20~~	~~4-22-86~~	MRD								

SPECIAL INSTRUCTIONS: HSL ORGANICS = BNA, PEST, PCB plus VOA
HSL INORGANICS = HSL METALS, CYANIDE

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
25 bottles	Marvin K. Dzedzy	Federal Express	4-23-86	1800					
Analysis	Fed'l Express	Victoria K. Dunlevo	4/24/86	0930					

RFW 16-23-001/A-2/85

COOLER # 2 of 3

WESTON

Custody Transfer Record/Lab Work Request

Received By
Date
Assigned to

Client Pennwalt, Wyandotte, MI
Client Contact
Phone

RFW Contact M. R. Dzedzy ext 412
Date Due
Project Number 0603-10-01

804-916-

SAMPLE IDENTIFICATION **ANALYSES REQUESTED** SEE BELOW!

Sample No.	Client ID No.	Description	Date Collected	Container/Preservative	HSL organic	HSL inorganic	VOA					
0100		TP-20	4-22-86	2 liter glass	X	X	X					
110		TP-24	4-22-86	2 liter glass 2 VOA	X	X	X					
120		TP-22	4-22-86	2 liter glass 2 VOA	X	X	X					
130		TP-28	4-22-86	2 liter glass 2 VOA	X	X	X					
140		TP-28 72"grab	4-22-86	1 liter glass	X	X						

E-2

SPECIAL INSTRUCTIONS: HSL ORGANICS = BNA, PEST, PCB plus VOA
HSL INORGANICS = HSL METALS, CYANIDE

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
15 bottles	M. Dzedzy	Federal Express	4-23-86	1800					
Analysis	Fed Express	Victoria K. Dodson	4/24/86	0930					

RFW 16-23-00 2/85

WEST[redacted]N

Custody Transfer Rec[redacted]/Lab Work Request

Received By 1-
Date
Assigned to

Client Pe[redacted]alt, Wyandotte, MI
Client Contact
Phone

RFW Contact M. Dzedzy ex[redacted]2
Date Due
Project Number 0603-10-01

8004-916

SAMPLE IDENTIFICATION / **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Date Collected	Container/Preservative	HSL Metals	CN	BNA	Pest/PCB	VOA			
0150		Field Blank (DI water)	4-22-86	2 glass liters; 4 plastic liters; 2 VOA	X	X	X	X	X			
160		TP-4	4-22-86	2 glass liters 2 VOA	X	X	X	X	X			
170		TP-26	4-22-86	2 glass liters 2 VOA	X	X	X	X	X			
180		TP-27	4-23-86	1 glass liter	X	X						
190		TP-29	4-23-86	2 glass liters 2 VOA	X	X	X	X	X			
200		TP-5	4-23-86	2 glass liters 2 VOA	X	X	X	X	X			

SPECIAL INSTRUCTIONS:

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
25 bottles	M.R. Dzedzy	Fed Ex	4-23-86	1800					
Analysis	Fed'l Express	[illegible]	4/24/86	0920					

RFW 16-23-001/A-2/85

LE # 1 OF

WESTON
DESIGNERS CONSULTANTS

002

8604-923-

Custody Transfer Record/Lab Work Request

Received By V K Linden
Date 4/25/86
Assigned to

Client Pennwalt Wyandotte, Mi
Client Contact
Phone

RFW Contact M. Dzedzy Ext. 412
Date Due 5/16/86
Project Number 0603-10-01

SAMPLE IDENTIFICATION					ANALYSES REQUESTED							
Sample No.	Client ID No.	Description	Date Collected	Container/Preservative	HSL Metals	CN	BNA	Pest/PCB	VOA			
0010		TP-15	4-23-86	1 glass liter &	X	X						
20		TP-15 DUP.	"	1 glass liter	X	X						
30		TP-14	"	2 glass liters & 2 VOA	X	X	X	X	X			
40		TP-32	"	"	X	X	X	X	X			
50		TP-33	"	"	X	X	X	X	X			
60		TP-9	4-24-86	1 glass liter & 2 VOA			X	X	X			
70		TP-9 DUP.	"	"			X	X	X			
80		TP-35	"	2 glass liter & 2 VOA	X	X	X	X	X			
90		TP-34	"	"	X	X	X	X	X			

E-4

SPECIAL INSTRUCTIONS:

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
28 bottles	M.R. Dzedzy lama	Fed. Ex.	4-24-86	1800					
Analysis	Fed'l Express	Victoria K. Dinden	4/25/86	0920					

RFW 16-23-001/A-2/85

WESTON

Custody Transfer Record/Lab Work Request

Received By
Date 4/25/86
Assigned to

Client Pennwalt, Wyandotte, Mi
Client Contact
Phone

RFW Contact M. Dzedzy Ext. 412
Date Due
Project Number 0603-10-01

8604-923-

SAMPLE IDENTIFICATION | **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Date Collected	Container/Preservative	HSL Metals	CN	BNA	Pest/PCB	VOA			
0100		TP-21 COMP.	4-24-86	2 glass liters + 2 VOA	X	X	X	X	X			
110		TP-21 9-9.5 FT.	"	1 glass liter + 2 VOA			X	X	X			
120		TP-21 9-9.5 FT. DUP.	"	2 VOA					X			
130		Trip Blank	—	2 VOA					X			

SPECIAL INSTRUCTIONS:

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
11 bottles	M.R. Dzedzy	Fed. Ex.	4-24-86	1800					
Analysis	Fed'l Express		4/25/86	0920					

RFW 16-23-001/A-2/85

COOLER 1 of
COOLER 2 of

WESTON
DESIGNERS CONSULTANTS

003

Custody Transfer Record/Lab Work Request

Received By VK Linden
Date 4/28/86
Assigned to

Client Pennwalt, Wyandotte, MI
Client Contact
Phone

RFW Contact M. R. Dzedzy X412
Date Due 5/19/86
Project Number 0603-10-01

8604-930-

SAMPLE IDENTIFICATION					ANALYSES REQUESTED							
Sample No.	Client ID No.	Description	Date Collected	Container/Preservative	HSL metals	CN-	BNA	PEST/PCB	VOA			
0010		Well 3 5-8'	4-23-86	2 glass liters 2 VOA	HOLD	HOLD	HOLD	HOLD	HOLD			
20		Well 3 dup 5-8'	4-23-86	2 glass liters 2 VOA								
30		Well 2 6-8'	4-22-86	2 glass liters 2 VOA								
40		Well 1 6-8'	4-22-86	2 glass liters 2 VOA								
50		Well 4 12-14'	4-23-86	2 glass liters 2 VOA								
60		Well 5 14-16'	4-23-86	2 glass liters 2 VOA								
70		Well 6 8-10'	4-24-86	2 glass liters 2 VOA								
80		Well 7 14-16'	4-23-86	1 glass liter								
90		Well 8 10-12'	4-24-86	1 glass liter	↓	↓	↓	↓	↓			
100		Well 9 16-18'	4-24-86	2 glass liters 2 VOA	X	X	X	X	X			
110		Well 10 9.5-11.5'	4-22-86	2 glass liter 2 VOA	HOLD							
120		Well 11 4-6'	4-22-86	1 glass liter 2 VOA								
130		Well 11 6-8'	4-22-86	2 glass liters 2 VOA								
140		Well 12 6-8'	4-21-86	2 glass liters 2 VOA	↓	↓	↓	↓	↓			

SPECIAL INSTRUCTIONS:

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
49 bottles	M. Dzedzy	Federal Express	4/25/86	1500					
Analysis	Fed'l Express	Victoria K Linden	4/28/86	0845					

RFW 16-22

[redacted]
001

8605-004-

Custody Transfer Record/Lab Work Request

Received By [illegible]
Date 5/14/86
Assigned to
Client [redacted] [illegible]
Client Contact
Phone
RFW Contact [illegible] [redacted] 412
Date Due 6/4/86
Project Number 0203-10-01

SAMPLE IDENTIFICATION | **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Date Collected	Container/Preservative	HSL	CN-	VOA	BNA	[illegible]			
0010		SS-10 0-2"	5-13-86	1 500 ml glass	X	X						
20		SS-16 1-2"	5-13-86	1 500 ml glass/2 VOA	X	X	X	X	X			
30		SS-17 2-4"	5-13-86	1 500 ml glass	X	X						
40		SS-18 2-4"	5-13-86	|	X	X						
50		SS-25 2-4"	5-13-86	|	X	X						
60		SS-30A 3-4"	5-13-86	|	X	X						
70		SS-30B 3-4"	5-13-86	|	X	X						
80		SS-31 2-4"	5-13-86	|	X	X						
90		SS-36 1-2"	5-13-86	|	X	X						

SPECIAL INSTRUCTIONS: SOIL SAMPLES MAY CONTAIN ELEVATED COPPER LEVELS

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
22 Bottles	M. R. [illegible]	[illegible]	5-13-86	18:30					
Analysis	Fed'l Express	[illegible]	5/14/86	0930					

RFW 16-23-001/A-2/85

WESTON

005

9/15-002

Custody Transfer Record/Lab Work Request

Received By Vi Limano
Date 5/15/86
Assigned to

Client [illegible]
Client Contact
Phone

RFW Contact M. Dzedzy
Date Due 6/5/86
Project Number 0003-20-01

SAMPLE IDENTIFICATION **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Date Collected	Container/Preservative	BNA	Metals	VOA	[illegible]	CN-	NH3	Cl-	TDS
010		Field Blank	5-14-86	as noted below	X	X	X	X	X	X	X	X
20		MW-8	5-14-86	↓	X	X	X	X	X	X	X	X
30		MW-7	5-14-86	Except for metals	X	X	X		X	X	X	X

SPECIAL INSTRUCTIONS: 9 Bottles per well: 2 brown glass liters, unpreserved; 1 plastic liter, NaOH; 1 plastic liter, HN
2 VOA vials; 1 500 ml, unpreserved; 2 250 ml, H_2SO_4.

NOTE: HIGH PH (12.0) in MW-7 METALS SAMPLE WILL BE SENT IN NEXT SHIPMENT.

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
26 bottles	M.R. Dzedzy	Federal Express	5-14-86	2000					

RFW 16-23-001/A-2/85

B-8

WE[illegible]ON

006

Custody Transfer Re[illegible]rd/Lab Work Request

Received By V K Weller
Date 5/16/86
Assigned to

Client [illegible] Mernutt
Client Contact
Phone

RFW Contact [illegible] x 412
Date Due 6/16/86
Project Number [illegible]

805-016

SAMPLE IDENTIFICATION / **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Date Collected	Container/Preservative	[illegible]	CN	BNA	P/PCB	VOA	TDS	[illegible]	Cl^-
0010		MW-10	5-15-86	as noted below	X	X	X	X	X	X	X	X
20		MW-11	5-15-86	|	X	X	X	X	X	X	X	X
30		MW-12	5-15-86	|	X	X	X	X	X	X	X	X
40		MW-7	5-14-86	only 1 liter HNO3	X							
50		MW-6	5-15-86	as noted below	X	X	X	X	X	X	X	X

SPECIAL INSTRUCTIONS: FOR each well: 2 amber glass liters, unpreserved; 1 plastic liter, Na-OH; 1 plastic liter, HNO_3; 1 plastic 500ml, unpreserved; 2 250ml plastic, H_2SO_4; 2 VOA vials.

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
	M.R. Diedin	Federal Express	5-15-86	2115					
Analysis	Fed'l Express	Victoria K. Weller	5/16/86	0925					

RFW 16-23-001/A-2/85

WESTON

006

9005-176-

Custody Transfer Record/Lab Work Request

Received By V K [illegible]
Date 5/16/86
Assigned to
Client Pennwalt
Client Contact
Phone
RFW Contact M. R. Dzedzy x 412
Date Due 6/6/86
Project Number 0603-10-01

SAMPLE IDENTIFICATION | **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Date Collected	Container/Preservative	[illegible]	BNA	Pest/PCB	VOA	CN⁻	Cl	TDS	NH_3
00060		MW-1	5-15-86	as noted below	X	X	X	X	X	X	X	X
70		MW-4	5-15-86		X	X	X	X	X	X	X	X
80		MW-5	5-15-86		X	X	X	X	X	X	X	X
90		MW-5A	5-15-86		X	X	X	X	X	X	X	X

SPECIAL INSTRUCTIONS: For each well: 2 amber glass liters, unpreserved; 1 plastic liter, HNO_3; 1 plastic liter, NaOH; 1 500 ml, unpreserved; 2 250 ml H_2SO_4; 2 VOA vials.

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
-	M.R. [illegible]	Federal Express	5-15-86	2115					
All [illegible]	Fed. Express	Victoria K. [illegible]	5/16/86	0925					

WESTON [redacted]

004

Custody Transfer Record/Lab Work Re

Received By [illegible]
Date 5/17/86
Assigned to

Client [redacted]
Client Co [redacted]
Phone

RFW Contact Marian [illegible]
Date Due 6/17/86
Project Number 0605-10 [redacted]

8605-075-

SAMPLE IDENTIFICATION

ANALYSES REQUESTED

Sample No.	Client ID No.	Description	Date Collected	Container/Preservative	BNA	Pst/Pcb	VOA	[illegible]	CN-	NH3	[illegible]	[illegible]
0010		MW-2	5-16-86	as noted below	X	X	X	X	X	✓	X	✓
20		MW-3	5-16-86	|	X	X	X	X	X	X	X	X
30		MW-4	5-16-86	|	X	X	X	X	X	X	X	X
40		Trip Blank	5-7-86	2 VOA VIALS			X					

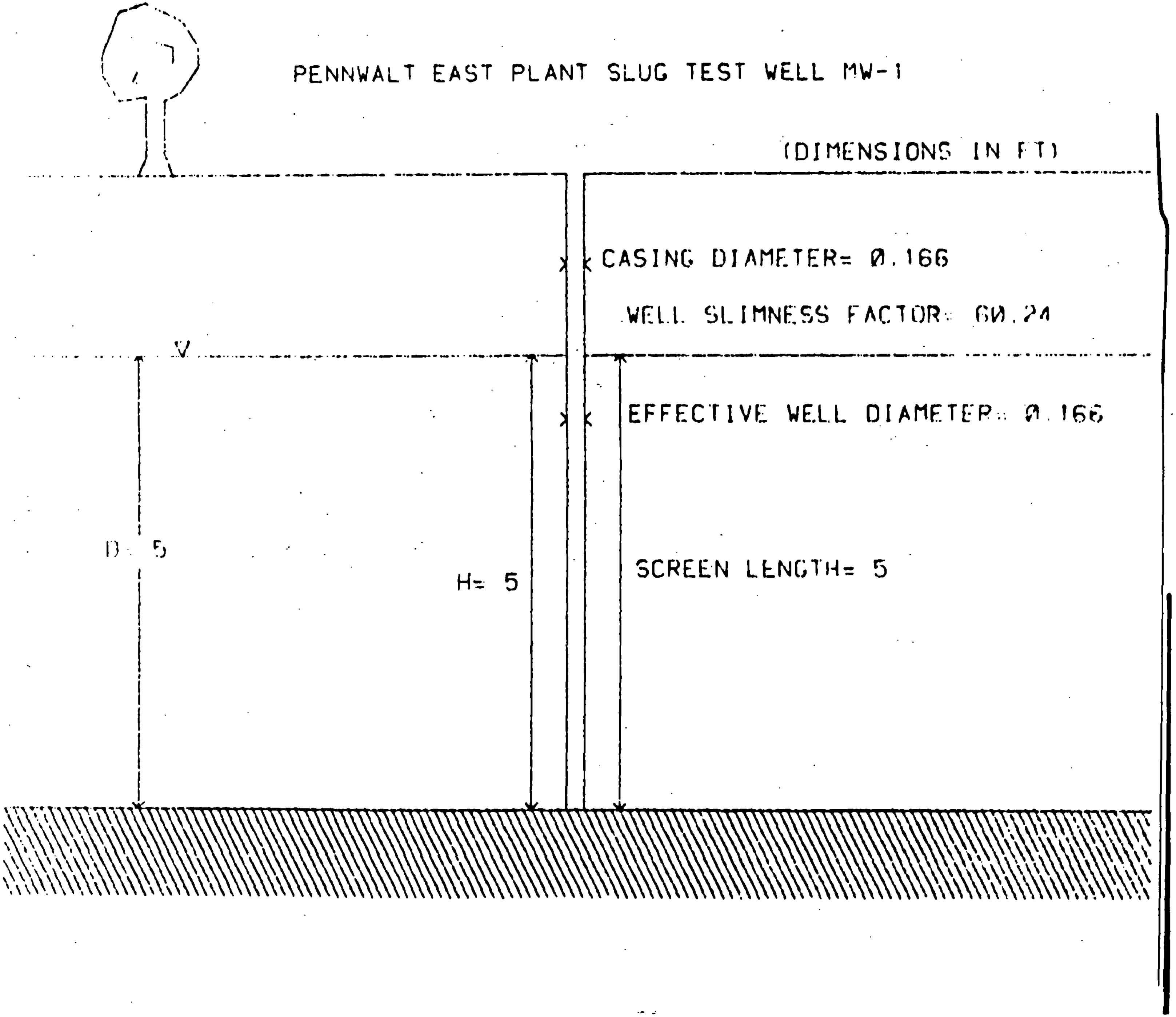
SPECIAL INSTRUCTIONS: for each sample; 2 amber glass, unpreserved liters; 1 plastic liter, NaOH; 1 plastic liter, HNO_3; 1 500ml plastic unpreserved; 2 (2 250ml plastic, H_2SO_4.

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Ti
	M.R. Gredon	Federal Express	5-16-86	1530					
Analysis	Fed'l Express	[illegible]	5/17/86	1100					
|	|		|						

RFW 16-23-001/A-2/85

APPENDIX F

PHASE I
AQUIFER SLUG TEST DATA

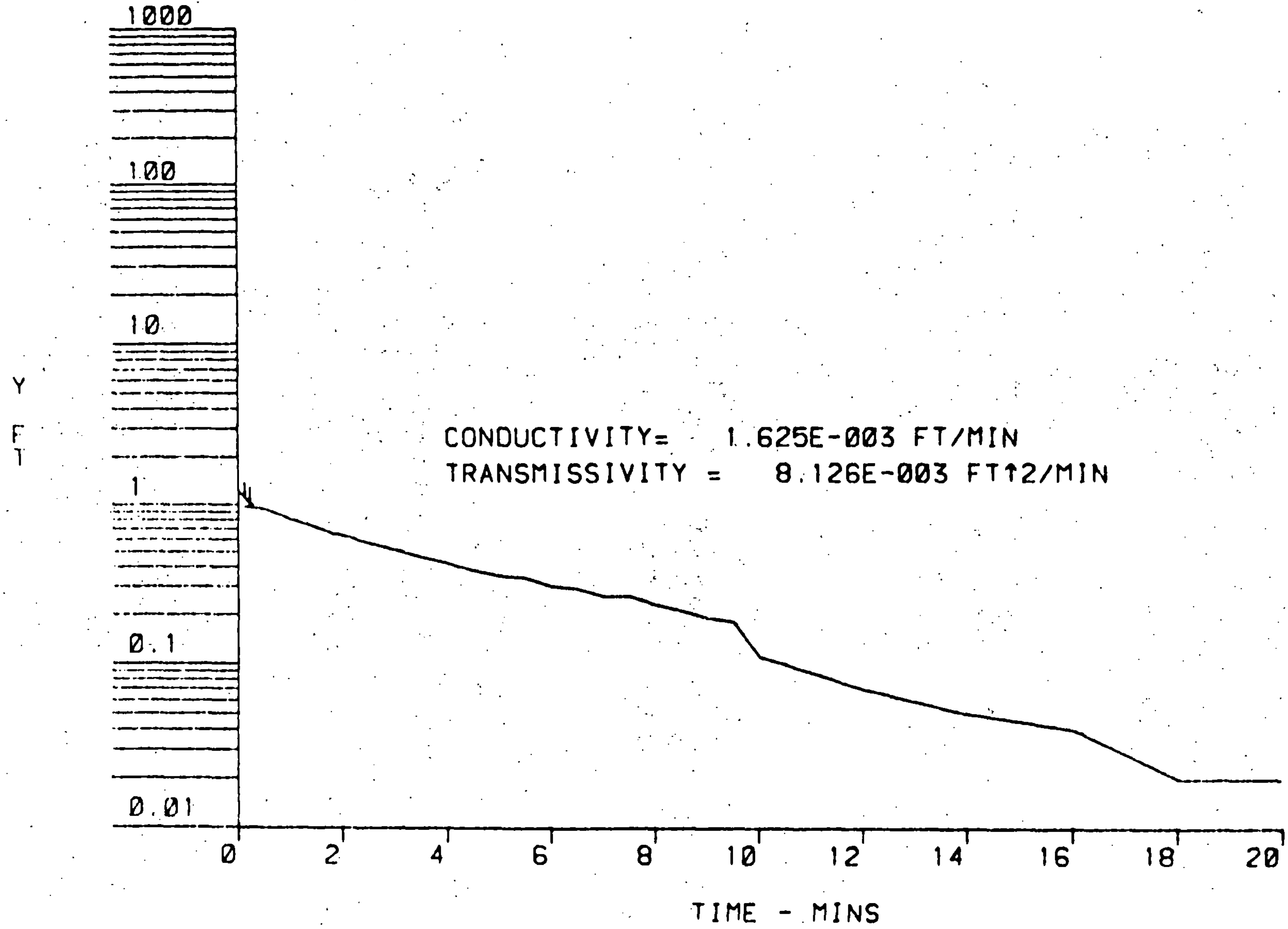


PENNWALT EAST PLANT SLUG TEST WELL MW-1

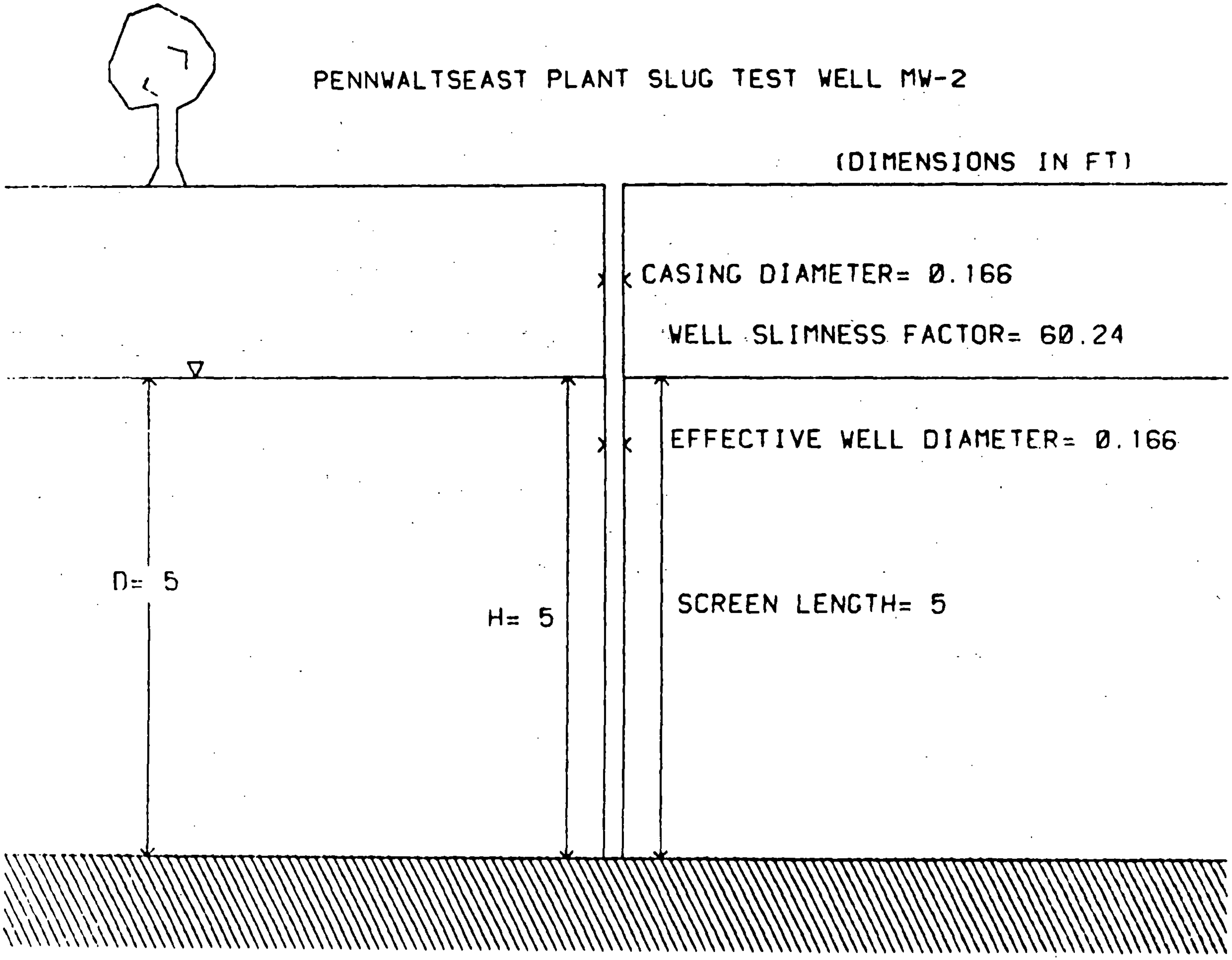
PENNWALT EAST PLANT SLUG TEST WELL MW-1

	'Y' READINGS	TIME (MINS)
1	1.11	0.1199
2	1.1	0.1365
3	1.07	0.1697
4	1.05	0.2029
5	1.03	0.2195
6	1.02	0.2693
7	1	0.2895
8	0.97	0.1196
9	0.94	0.5023
10	0.92	0.5856
11	0.89	0.6689
12	0.87	0.7522
13	0.86	0.8355
14	0.83	0.9188
15	0.81	1.0021
16	0.8	1.08
17	0.78	1.17
18	0.76	1.25
19	0.75	1.34
20	0.73	1.42
21	0.72	1.5
22	0.7	1.59
23	0.68	1.67
24	0.67	1.75
25	0.65	1.83
26	0.65	1.92
27	0.64	2
28	0.57	2.5
29	0.51	3
30	0.46	3.5
31	0.42	4

32	0.38	4.5
33	0.35	5
34	0.34	5.5
35	0.3	6
36	0.29	6.5
37	0.26	7
38	0.26	7.5
39	0.23	8
40	0.21	8.5
41	0.19	9
42	0.18	9.5
43	0.11	10
44	0.07	12
45	0.05	14
46	0.04	16
47	0.02	18
48	0.02	20



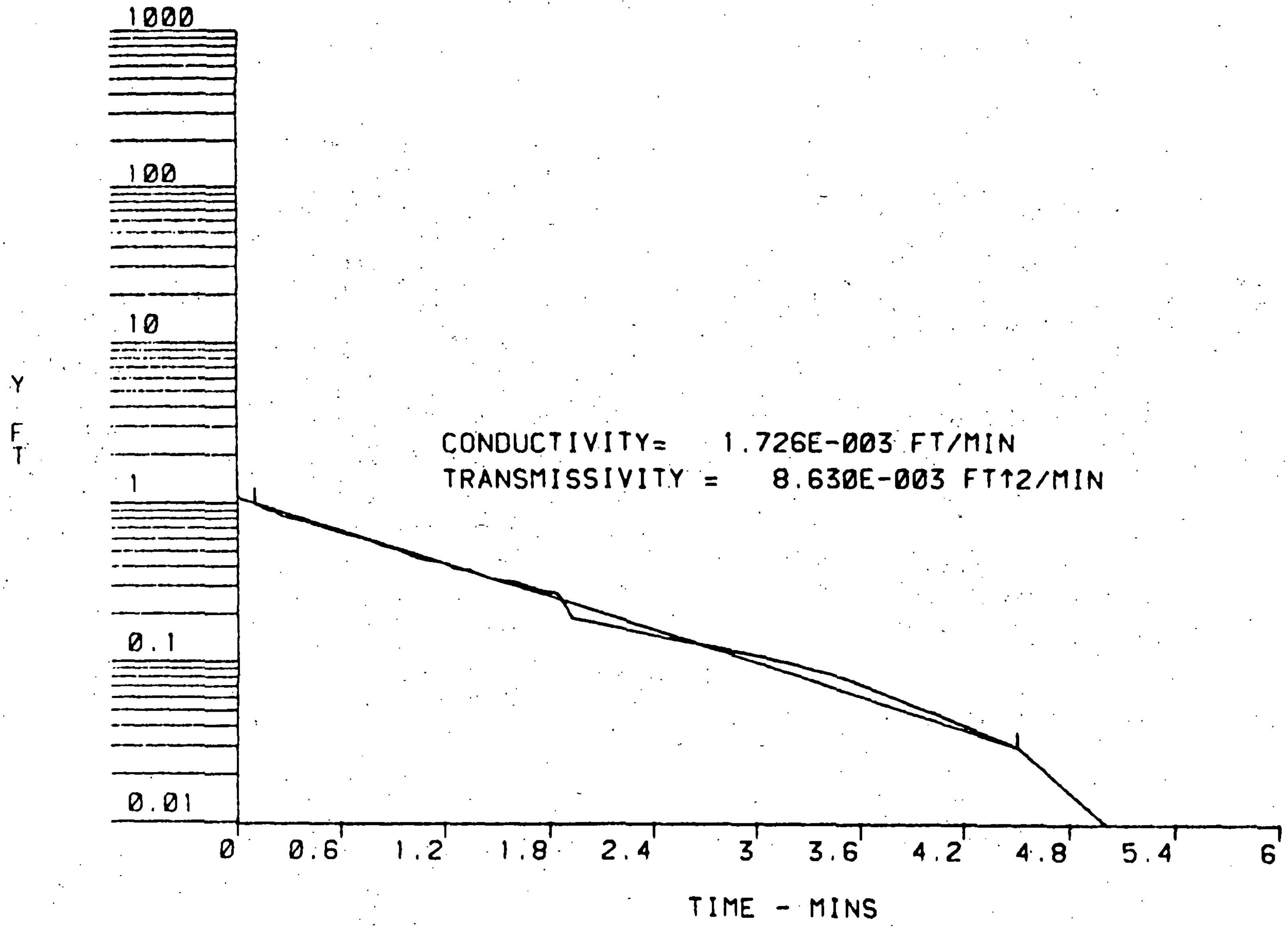
PENNWALT EAST PLANT SLUG TEST WELL MW-1


PENNWALTSEAST PLANT SLUG TEST WELL MW-2
(DIMENSIONS IN FT)
CASING DIAMETER= 0.166
WELL SLIMNESS FACTOR= 60.24
EFFECTIVE WELL DIAMETER= 0.166
D= 5
H= 5
SCREEN LENGTH= 5

PENNWALTSEAST PLANT SLUG TEST WELL MW-2

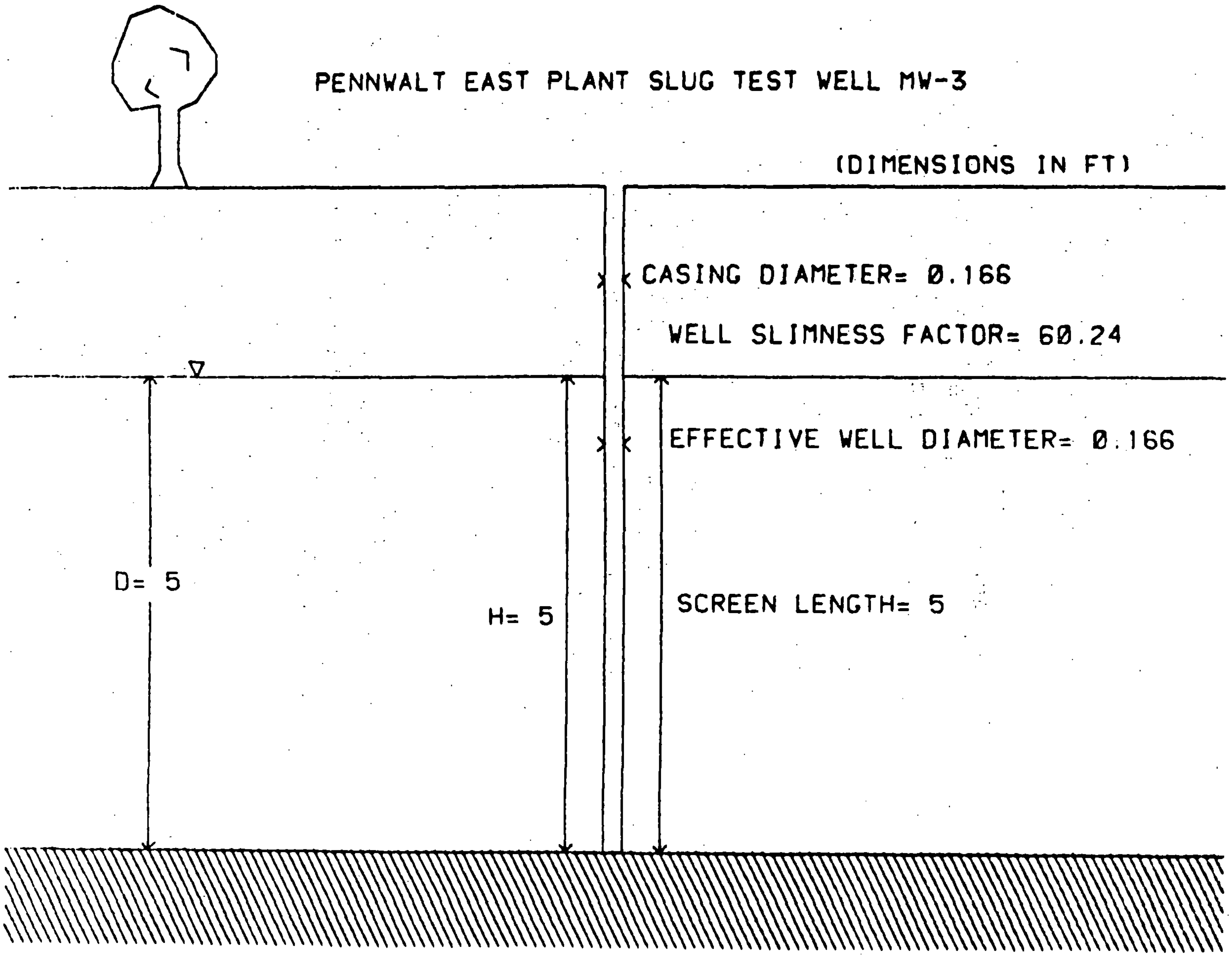
	'Y' READINGS	TIME (MINS)
1	1	0.1033
2	0.98	0.1199
3	0.97	0.1365
4	0.95	0.15
5	0.92	0.17
6	0.9	0.2029
7	0.89	0.2195
8	0.87	0.2361
9	0.85	0.2527
10	0.84	0.2693
11	0.82	0.3025
12	0.81	0.3191
13	0.76	0.419
14	0.71	0.5023
15	0.66	0.5856
16	0.63	0.6689
17	0.6	0.7522
18	0.55	0.8322
19	0.52	0.9188
20	0.47	1
21	0.44	1.09
22	0.43	1.17
23	0.39	1.25
24	0.38	1.33
25	0.35	1.41
26	0.33	1.5
27	0.321	1.59
28	0.3	1.67
29	0.28	1.75
30	0.27	1.84
31	0.19	1.92

32	0.14	2.5
33	0.11	3
34	0.08	3.5
35	0.05	4
36	0.03	4.5
37	0.01	5
38	0.01	6



PENNWALTSEAST PLANT SLUG TEST WELL MW-2

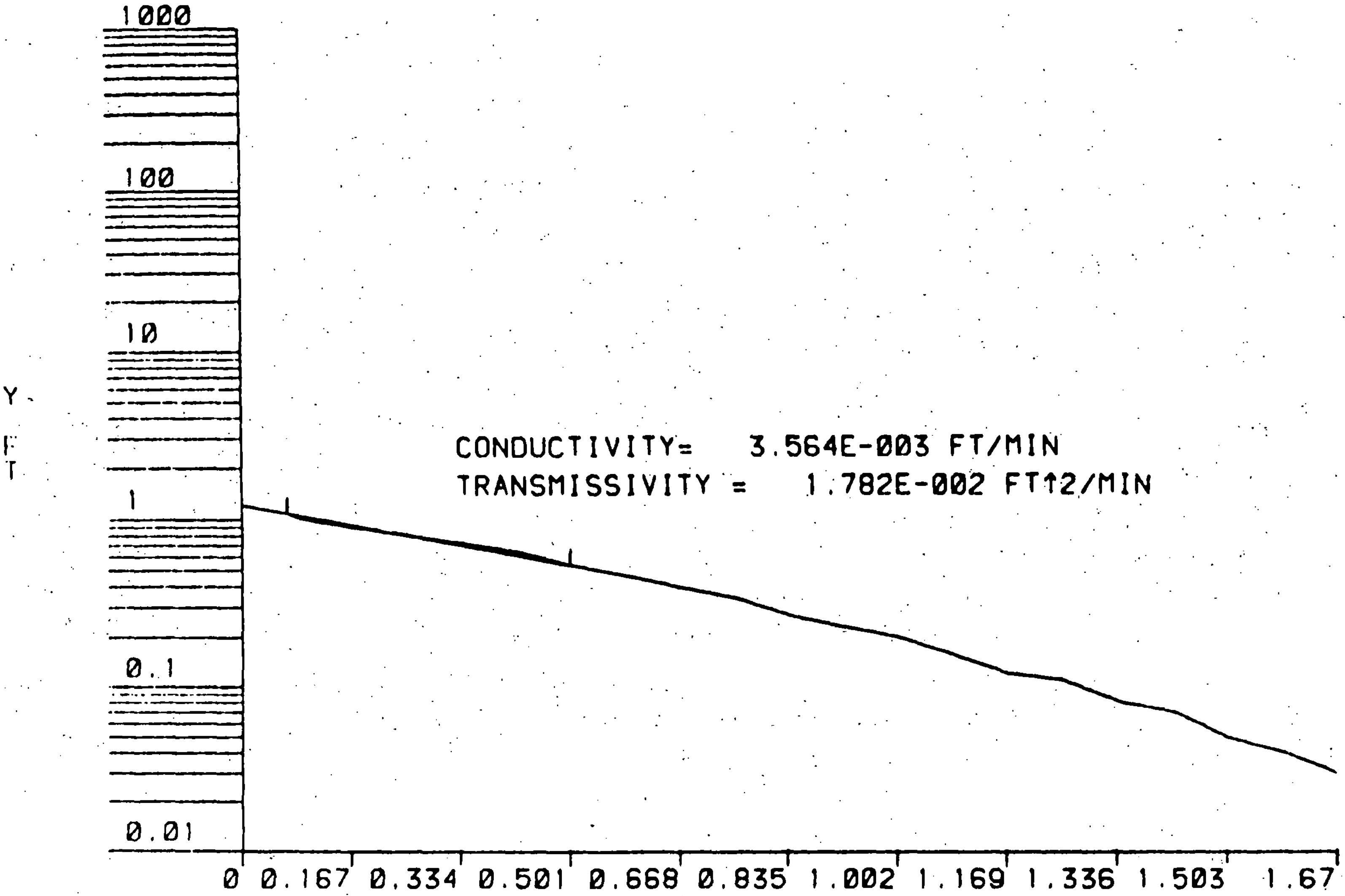
PENNWALT EAST PLANT SLUG TEST WELL MW-3



PENNWALT EAST PLANT SLUG TEST WELL MW-3

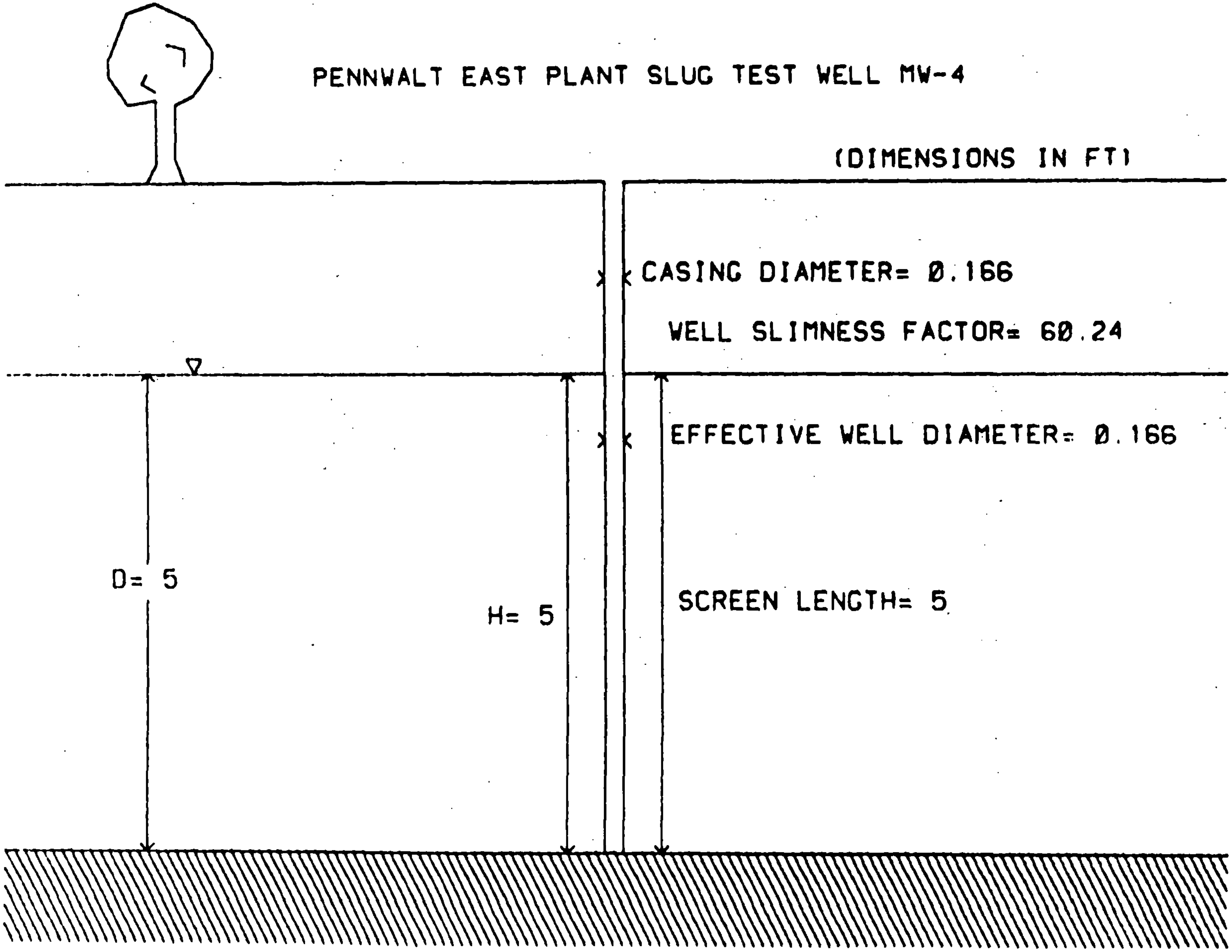
	'Y' READINGS	TIME (MINS)
1	1.08	0.0699
2	1.02	0.0865
3	0.99	0.1031
4	0.97	0.1131
5	0.94	0.1363
6	0.92	0.1529
7	0.89	0.1695
8	0.88	0.1861
9	0.86	0.2027
10	0.84	0.2193
11	0.83	0.2359
12	0.81	0.2525
13	0.78	0.2691
14	0.77	0.2857
15	0.75	0.3023
16	0.73	0.3189
17	0.72	0.3355
18	0.64	0.4188
19	0.53	0.5021
20	0.46	0.5854
21	0.39	0.6687
22	0.34	0.752
23	0.27	0.8353
24	0.23	0.9186
25	0.2	1
26	0.16	1.08
27	0.12	1.17
28	0.11	1.25
29	0.08	1.34
30	0.07	1.42

31	0.05	1.5
32	0.04	1.59
33	0.03	1.67



TIME - MINS

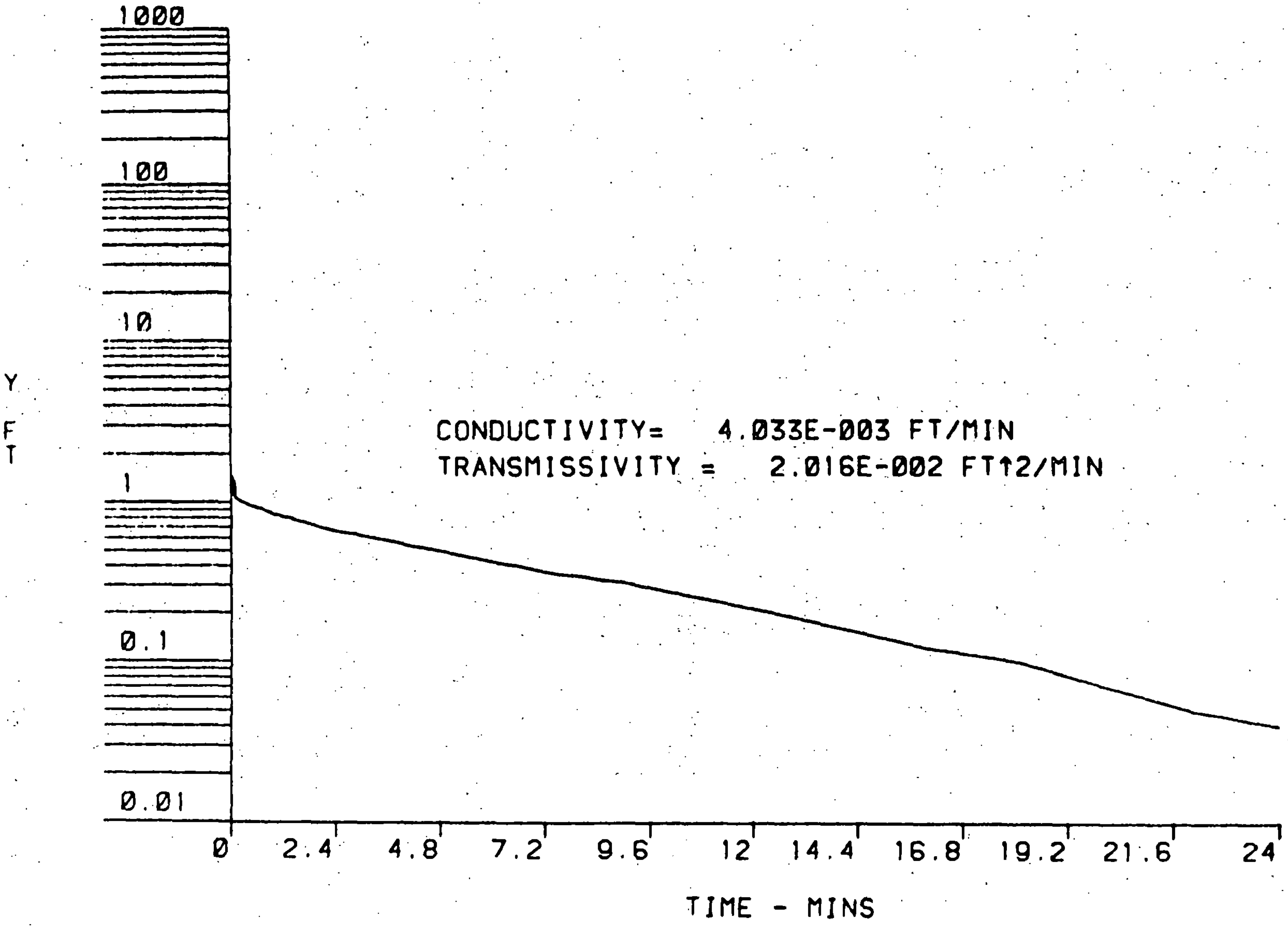
PENNWALT EAST PLANT SLUG TEST WELL MW-3


PENNWALT EAST PLANT SLUG TEST WELL MW-4
(DIMENSIONS IN FT)
CASING DIAMETER= 0.166
WELL SLIMNESS FACTOR= 60.24
EFFECTIVE WELL DIAMETER= 0.166
D= 5
H= 5
SCREEN LENGTH= 5

PENNWALT EAST PLANT SLUG TEST WELL MW-4

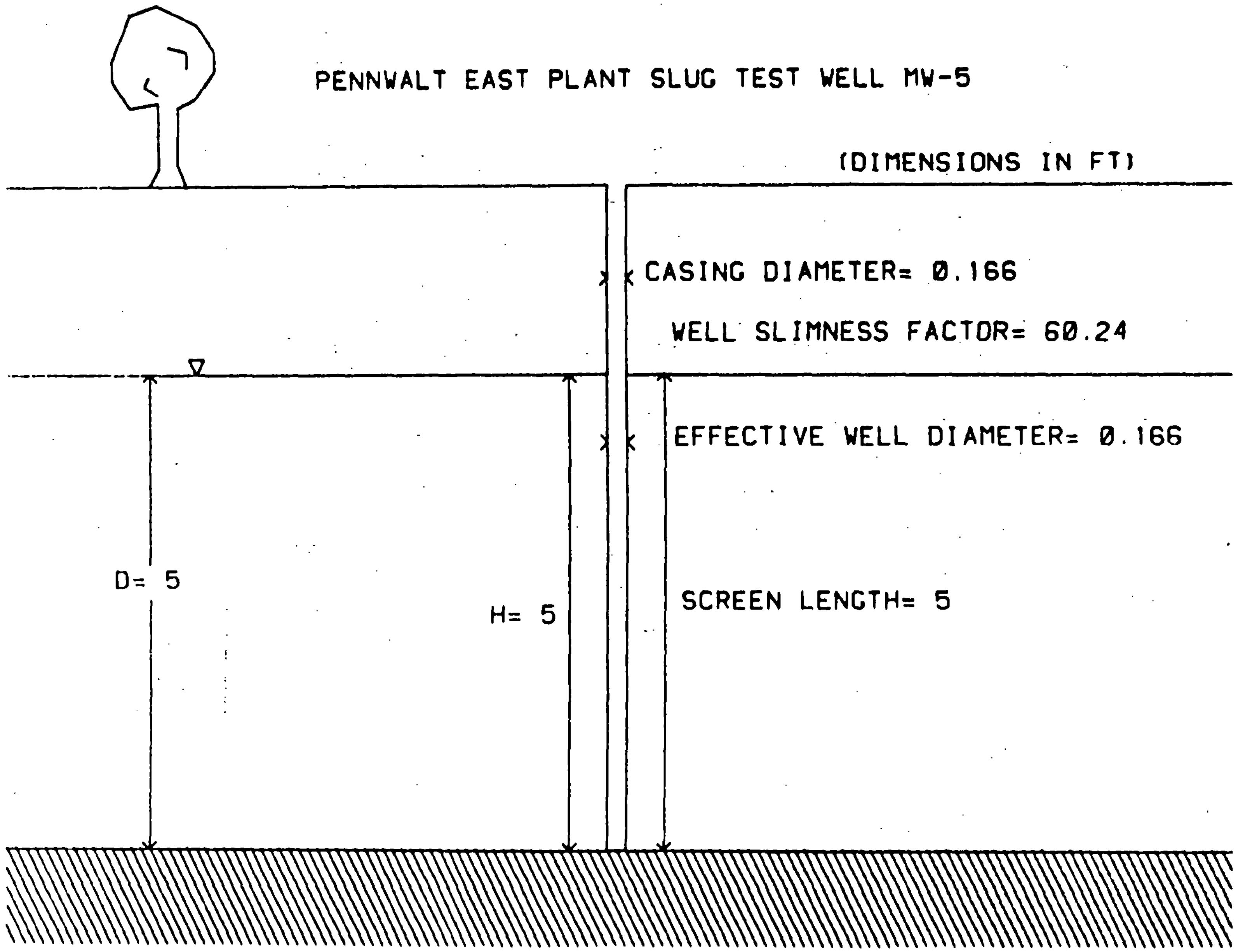
	'Y' READINGS	TIME (MINS)
1	1.15	0.0533
2	1.11	0.07
3	1.08	0.087
4	1.07	0.103
5	1.05	0.119
6	1.04	0.1529
7	1.02	0.2027
8	1	0.2359
9	0.99	0.2857
10	0.96	0.4188
11	0.94	0.5021
12	0.92	0.5854
13	0.91	0.6687
14	0.89	0.752
15	0.88	0.835
16	0.86	0.919
17	0.84	1
18	0.83	1.08
19	0.81	1.17
20	0.8	1.34
21	0.78	1.42
22	0.77	1.5
23	0.75	1.67
24	0.73	1.75
25	0.72	1.92
26	0.7	2
27	0.65	2.5
28	0.62	3
29	0.58	3.5
30	0.54	4
31	0.51	4.5

32	0.48	5
33	0.45	5.5
34	0.42	6
35	0.4	6.5
36	0.37	7
37	0.35	7.5
38	0.34	8
39	0.32	8.5
40	0.31	9
41	0.29	9.5
42	0.27	10
43	0.21	12
44	0.16	14
45	0.12	16
46	0.1	18
47	0.07	20
48	0.05	22
49	0.04	24



PENNWALT EAST PLANT SLUG TEST WELL MW-4

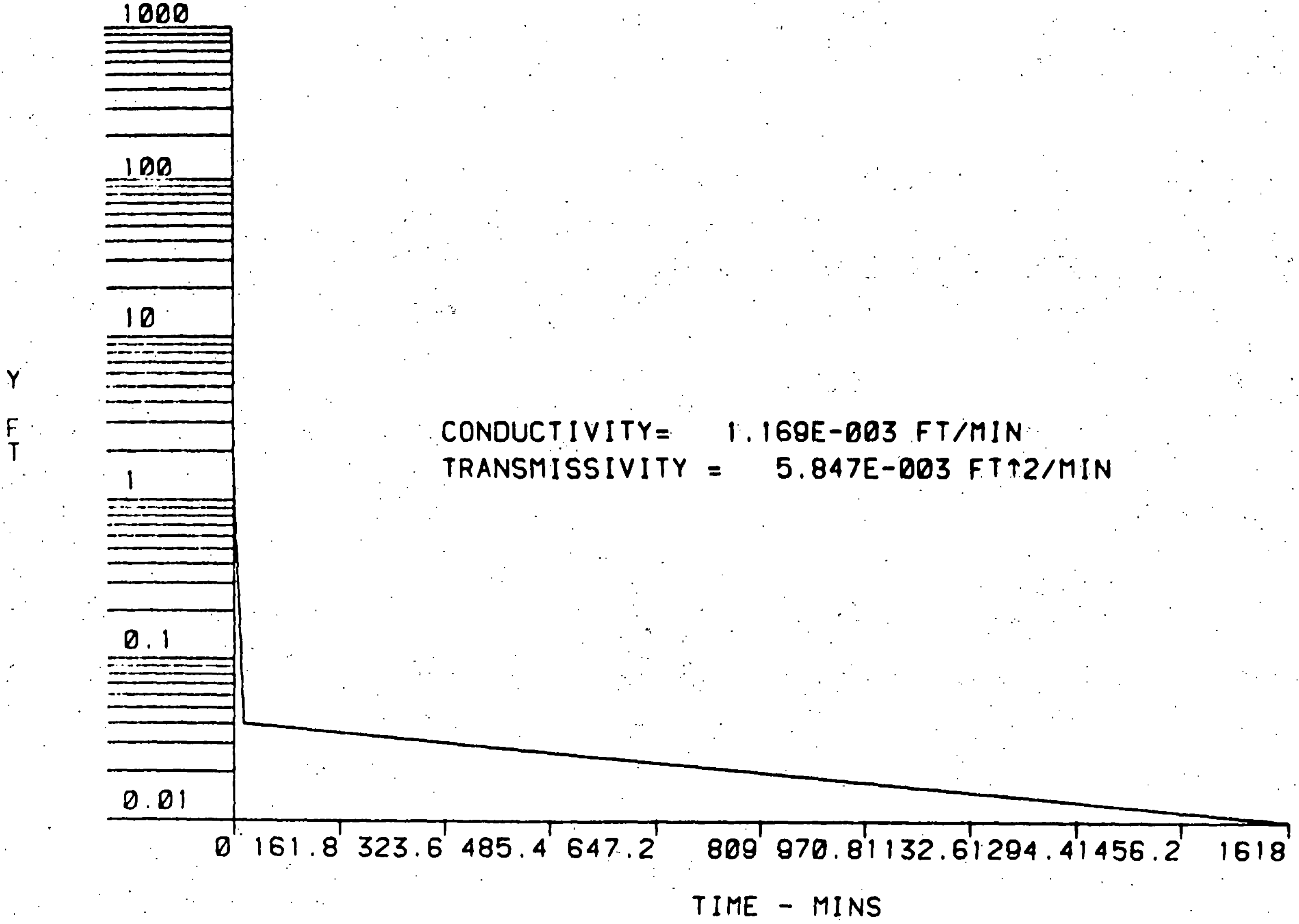
PENNWALT EAST PLANT SLUG TEST WELL MW-5



PENNWALT EAST PLANT SLUG TEST WELL MW-5

	'Y' READINGS	TIME (MINS)
1	1.14	0.1033
2	1.12	0.1199
3	1.11	0.1531
4	1.09	0.1863
5	1.07	0.2195
6	1.06	0.2527
7	1.04	0.3191
8	1.01	0.419
9	0.96	0.5023
10	0.95	0.5856
11	0.93	0.7522
12	0.92	0.8355
13	0.88	0.9188
14	0.87	1
15	0.85	1.08
16	0.84	1.17
17	0.82	1.25
18	0.8	0.134
19	0.77	1.41
20	0.76	1.58
21	0.74	1.67
22	0.73	1.75
23	0.71	1.83
24	0.69	1.92
25	0.68	2
26	0.61	2.5
27	0.55	3
28	0.49	3.5
29	0.44	4
30	0.38	4.5
31	0.35	5

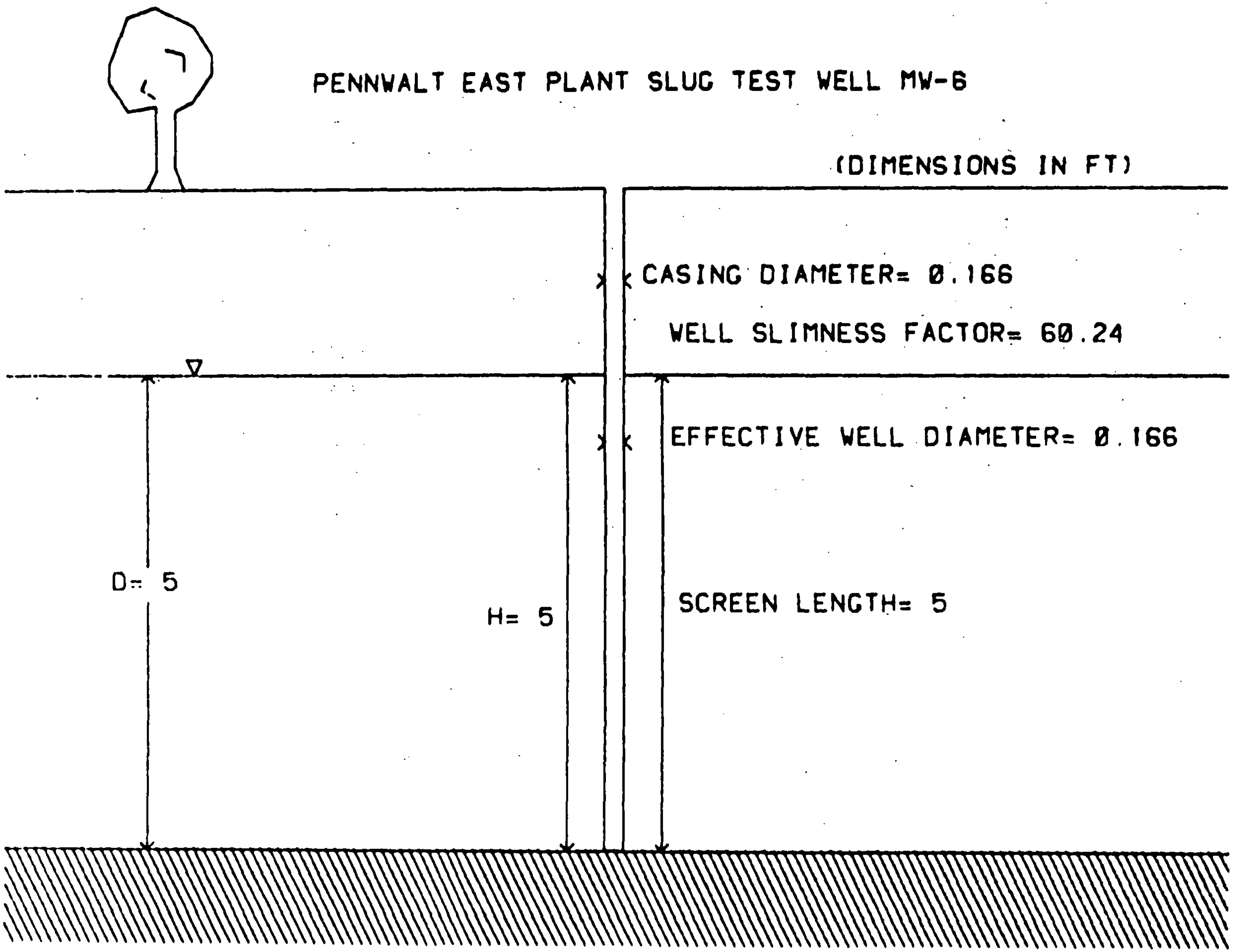
32	0.31	5.5
33	0.28	6
34	0.25	6.5
35	0.22	7
36	0.2	7.5
37	0.17	8
38	0.15	8.5
39	0.14	9
40	0.12	10
41	0.06	12
42	0.04	14
43	0.01	1618



CONDUCTIVITY= 1.169E-003 FT/MIN
TRANSMISSIVITY = 5.847E-003 FT↑2/MIN

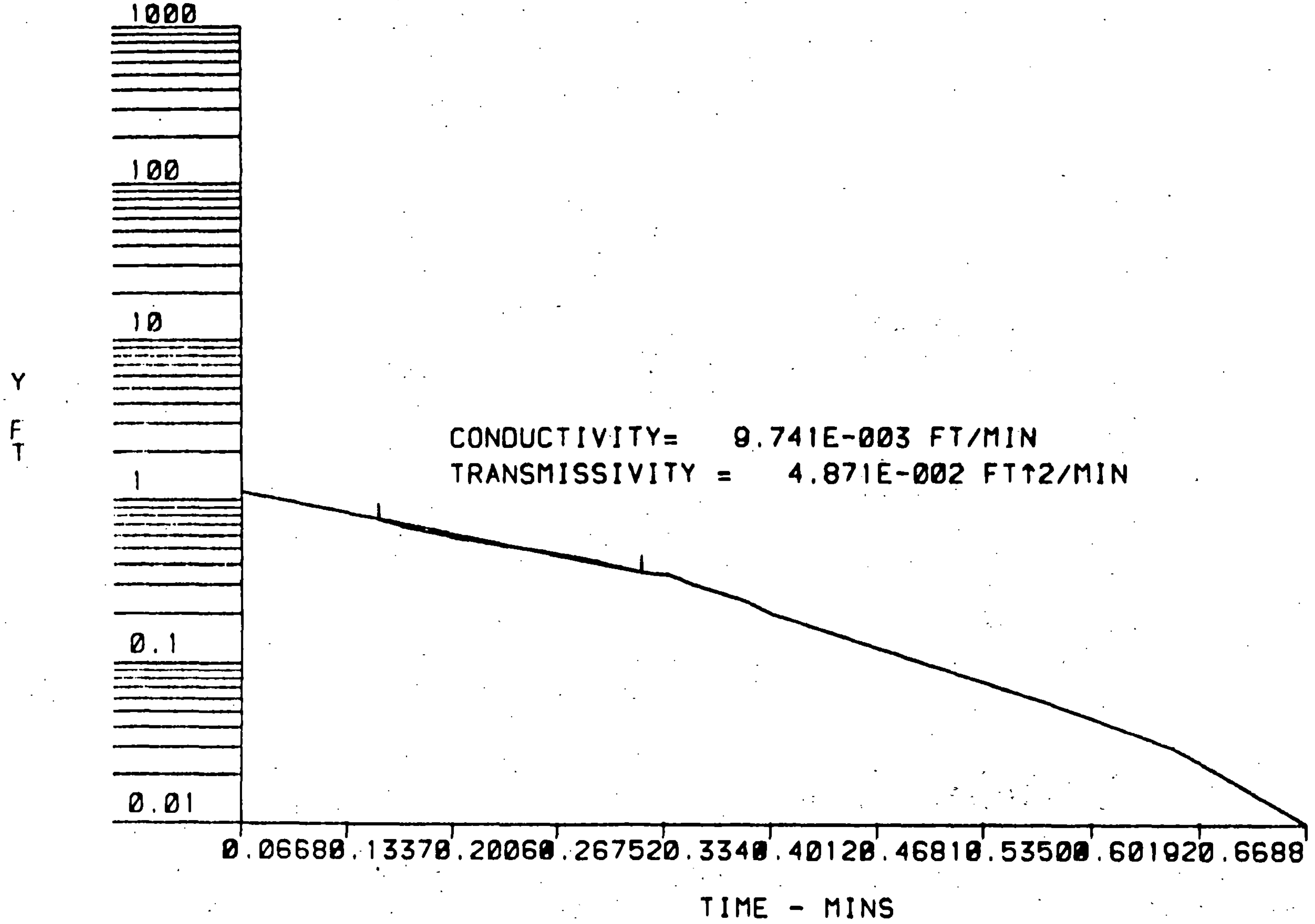
PENNWALT EAST PLANT SLUG TEST WELL MW-5

PENNWALT EAST PLANT SLUG TEST WELL MW-6



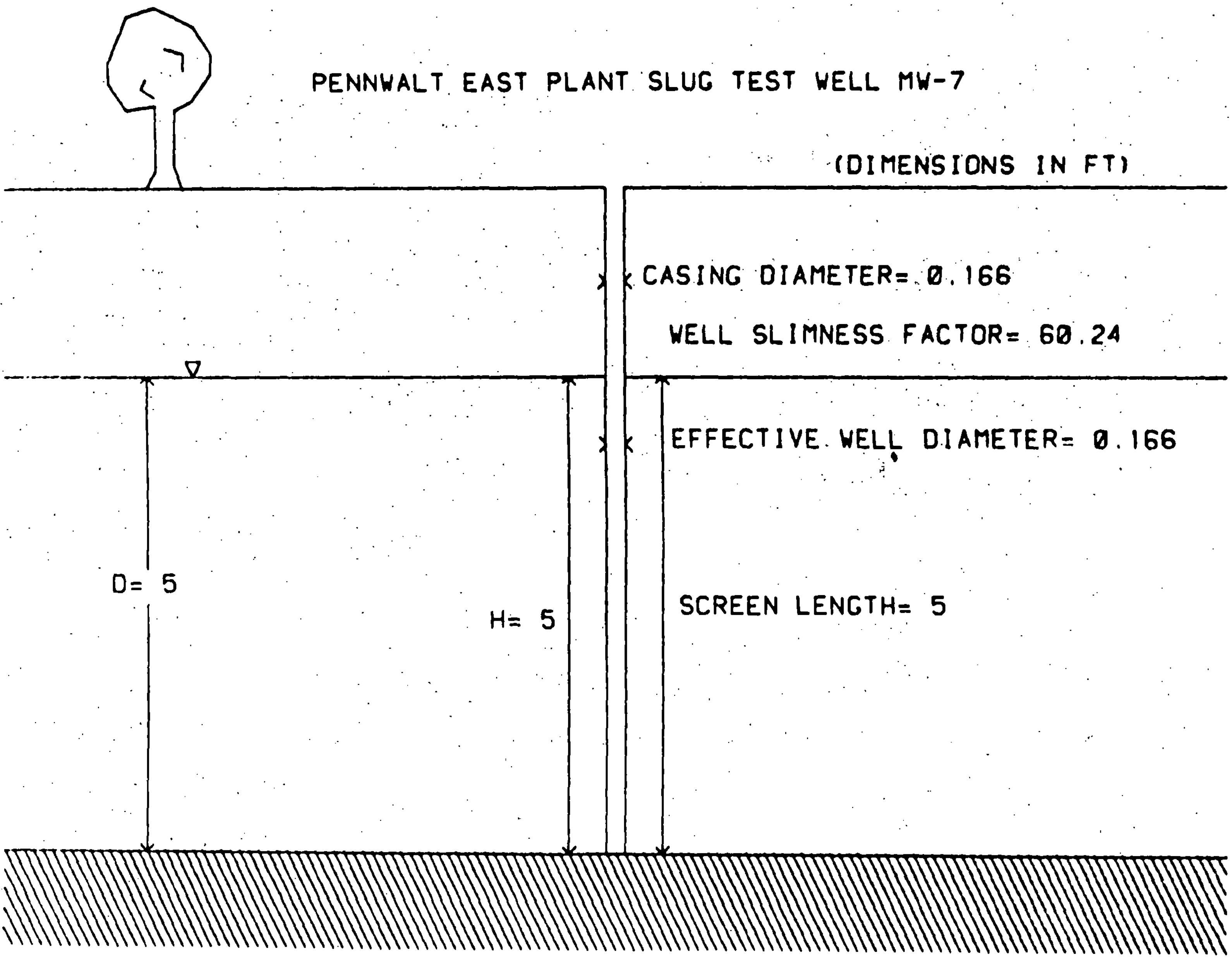
PENNWALT EAST PLANT SLUG TEST WELL MW-6

	'Y' READINGS	TIME (MINS)
1	0.76	0.0866
2	0.68	0.1032
3	0.63	0.1198
4	0.58	0.1364
5	0.55	0.153
6	0.52	0.1696
7	0.49	0.1862
8	0.46	0.2028
9	0.43	0.2194
10	0.39	0.236
11	0.36	0.2526
12	0.35	0.2692
13	0.3	0.2858
14	0.27	0.3024
15	0.24	0.319
16	0.2	0.3356
17	0.11	0.4189
18	0.06	0.5022
19	0.03	0.5855
20	0.01	0.6688



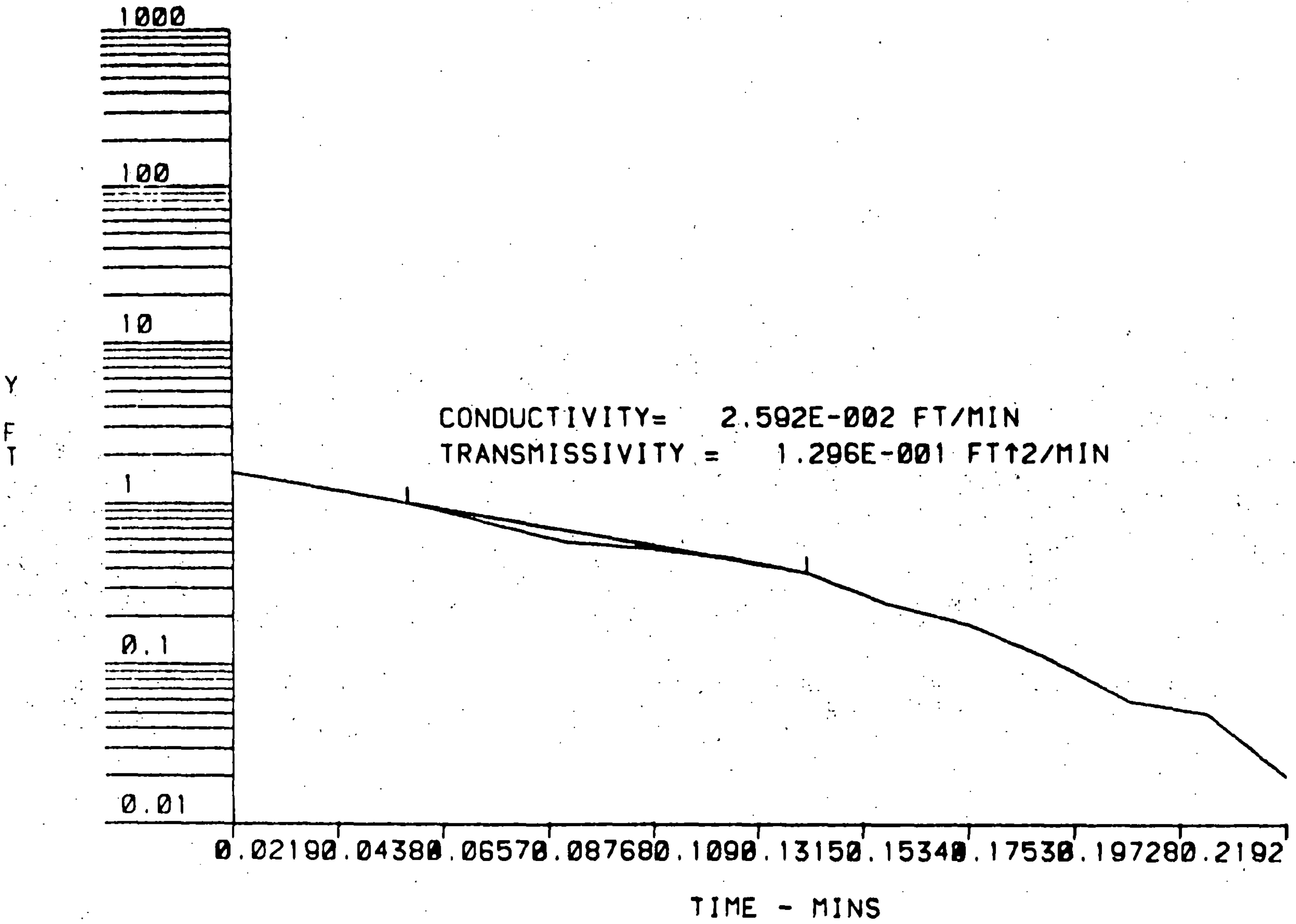
CONDUCTIVITY= 9.741E-003 FT/MIN
TRANSMISSIVITY = 4.871E-002 FT↑2/MIN

PENNWALT EAST PLANT SLUG TEST WELL MW-6


PENNWALT EAST PLANT SLUG TEST WELL MW-7
(DIMENSIONS IN FT)
CASING DIAMETER= 0.166
WELL SLIMNESS FACTOR= 60.24
EFFECTIVE WELL DIAMETER= 0.166
D= 5
H= 5
SCREEN LENGTH= 5

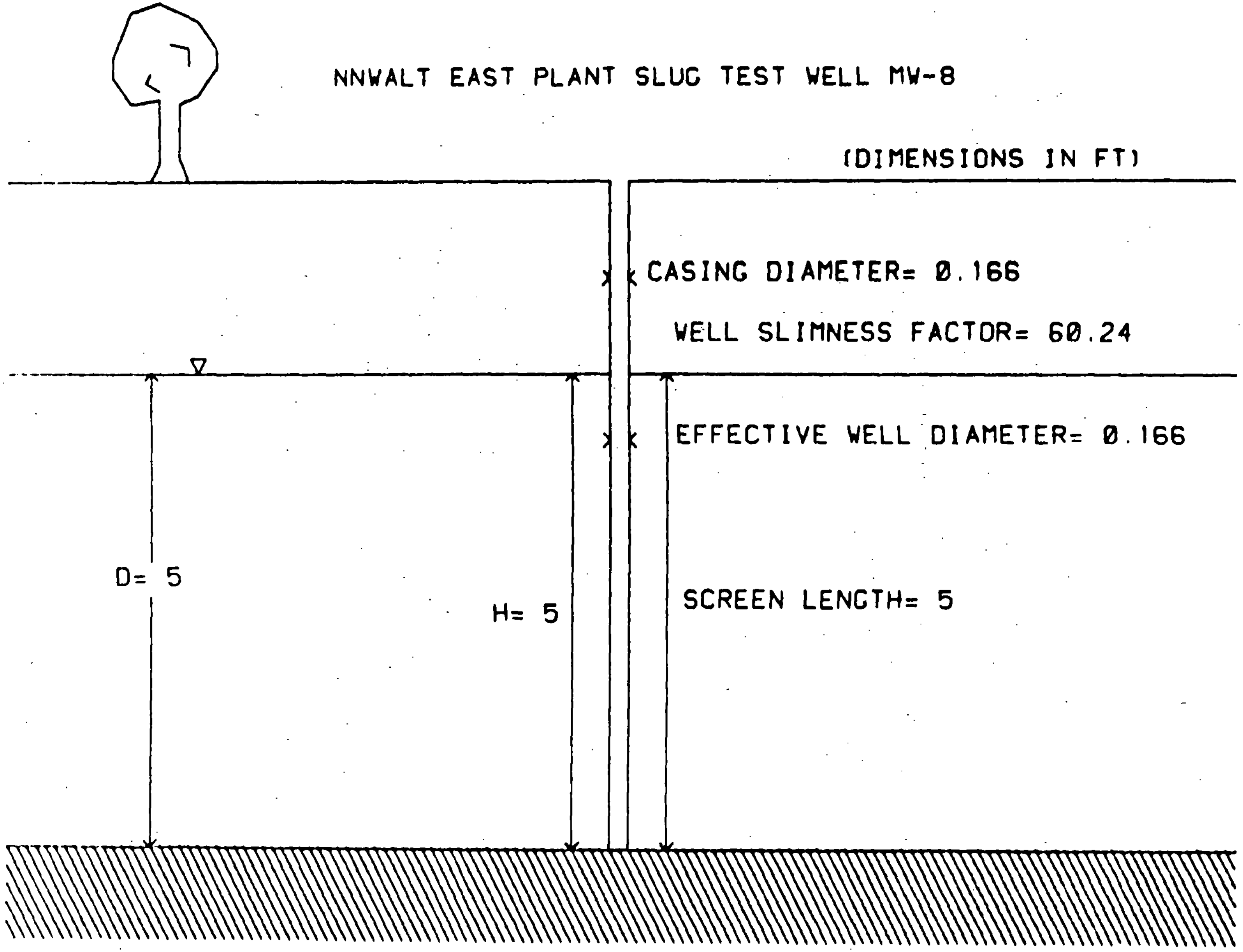
PENNWALT EAST PLANT SLUG TEST WELL MW-7

	'Y' READINGS	TIME (MINS)
1	1	0.0366
2	0.57	0.0698
3	0.52	0.0864
4	0.46	0.103
5	0.37	0.1196
6	0.24	0.1362
7	0.18	0.1528
8	0.11	0.1694
9	0.06	0.186
10	0.05	0.2026
11	0.02	0.2192



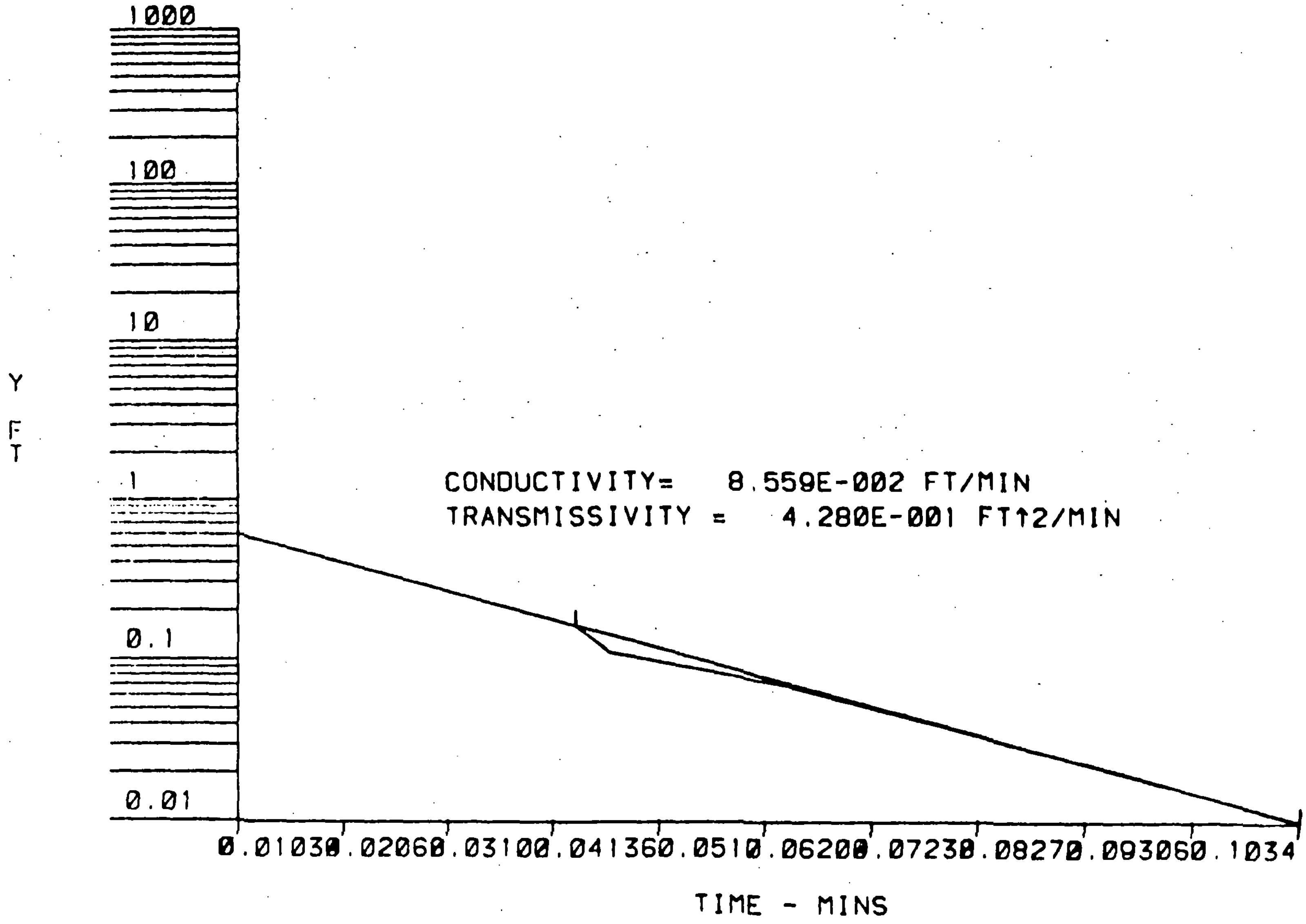
CONDUCTIVITY= 2.592E-002 FT/MIN
TRANSMISSIVITY = 1.296E-001 FT↑2/MIN

PENNWALT EAST PLANT SLUG TEST WELL MW-7


NNWALT EAST PLANT SLUG TEST WELL MW-8
(DIMENSIONS IN FT)
CASING DIAMETER= 0.166
WELL SLIMNESS FACTOR= 60.24
EFFECTIVE WELL DIAMETER= 0.166
D= 5
H= 5
SCREEN LENGTH= 5

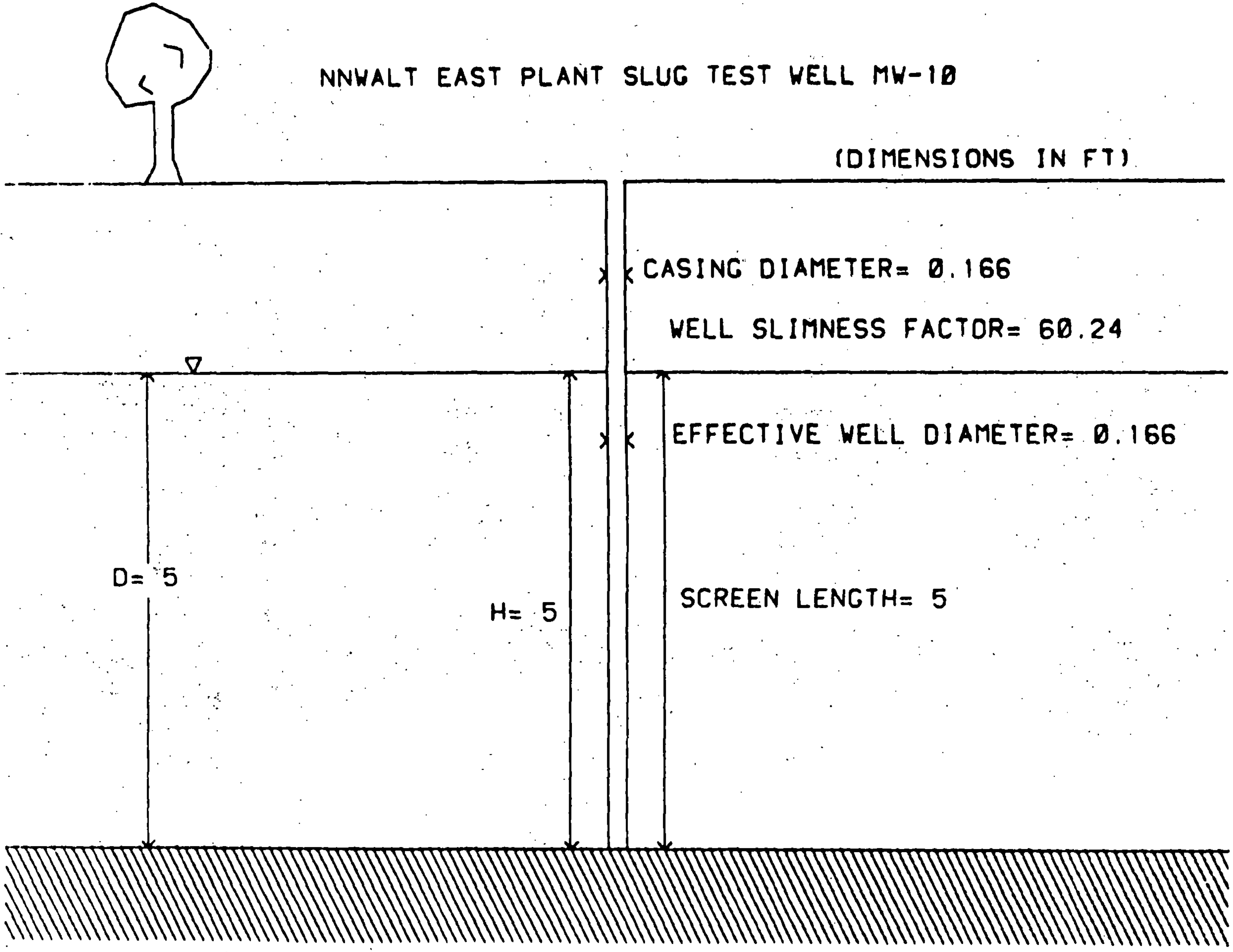
NNWALT EAST PLANT SLUG TEST WELL MW-8

	'Y' READINGS	TIME (MINS)
1	0.16	0.0333
2	0.11	0.0366
3	0.07	0.0532
4	0.02	0.0864
5	0.01	0.1034



CONDUCTIVITY= 8.559E-002 FT/MIN
TRANSMISSIVITY = 4.280E-001 FT↑2/MIN

NNWALT EAST PLANT SLUG TEST WELL MW-8

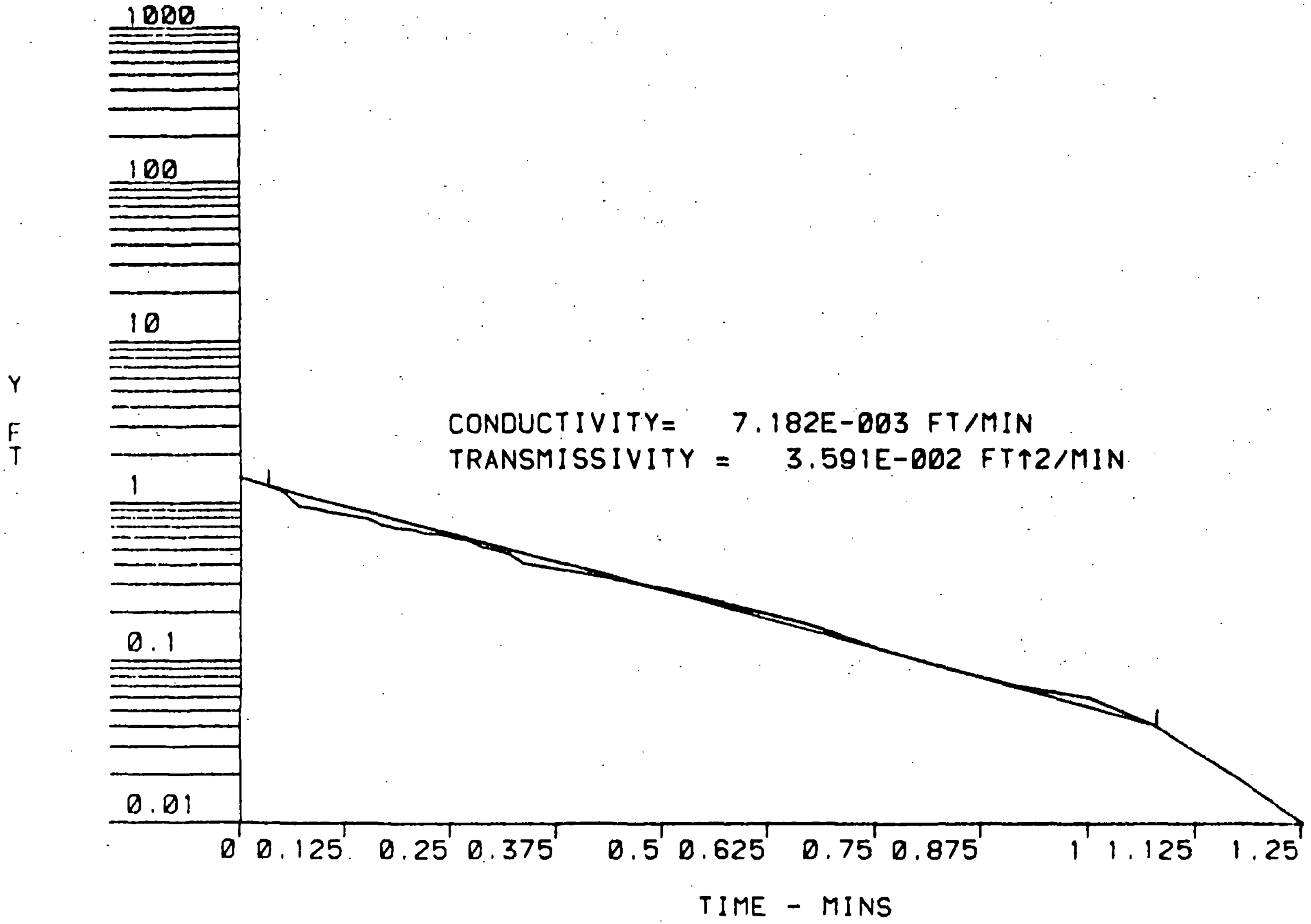


NNWALT EAST PLANT SLUG TEST WELL MW-10

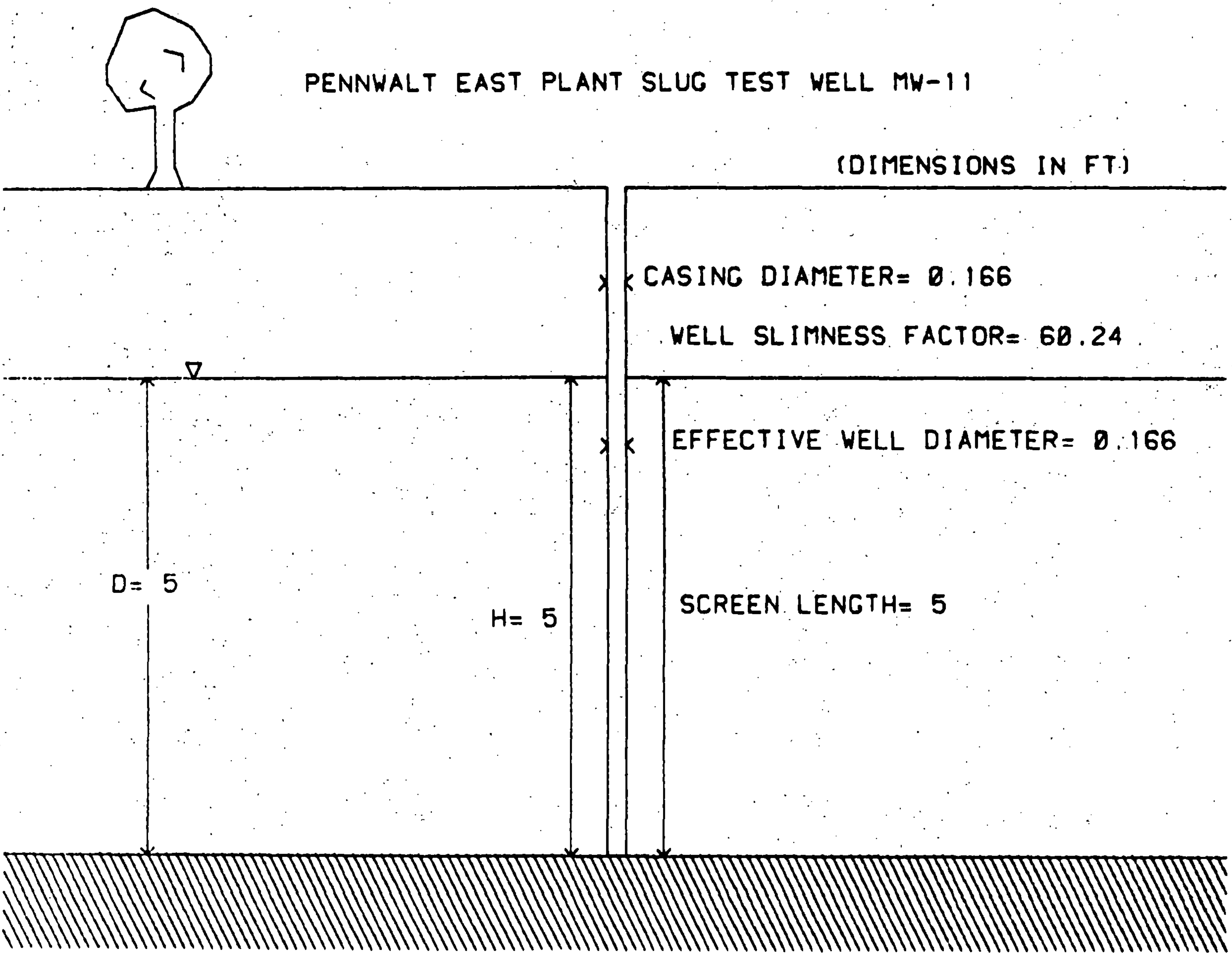
NNWALT EAST PLANT SLUG TEST WELL MW-10

	'Y' READINGS	TIME (MINS)
1	1.29	0.0333
2	1.18	0.0532
3	0.96	0.0698
4	0.93	0.0864
5	0.88	0.1034
6	0.85	0.1196
7	0.82	0.1362
8	0.79	0.1528
9	0.72	0.1694
10	0.69	0.186
11	0.68	0.2026
12	0.64	0.2192
13	0.63	0.2358
14	0.6	0.2524
15	0.58	0.269
16	0.52	0.2856
17	0.5	0.3022
18	0.47	0.3188
19	0.41	0.3354
20	0.34	0.4184
21	0.28	0.502
22	0.22	0.585
23	0.17	0.6686
24	0.12	0.7519
25	0.09	0.8352
26	0.07	0.9185
27	0.06	1
28	0.04	1.08
29	0.01	1.17

30	0.01	1.25



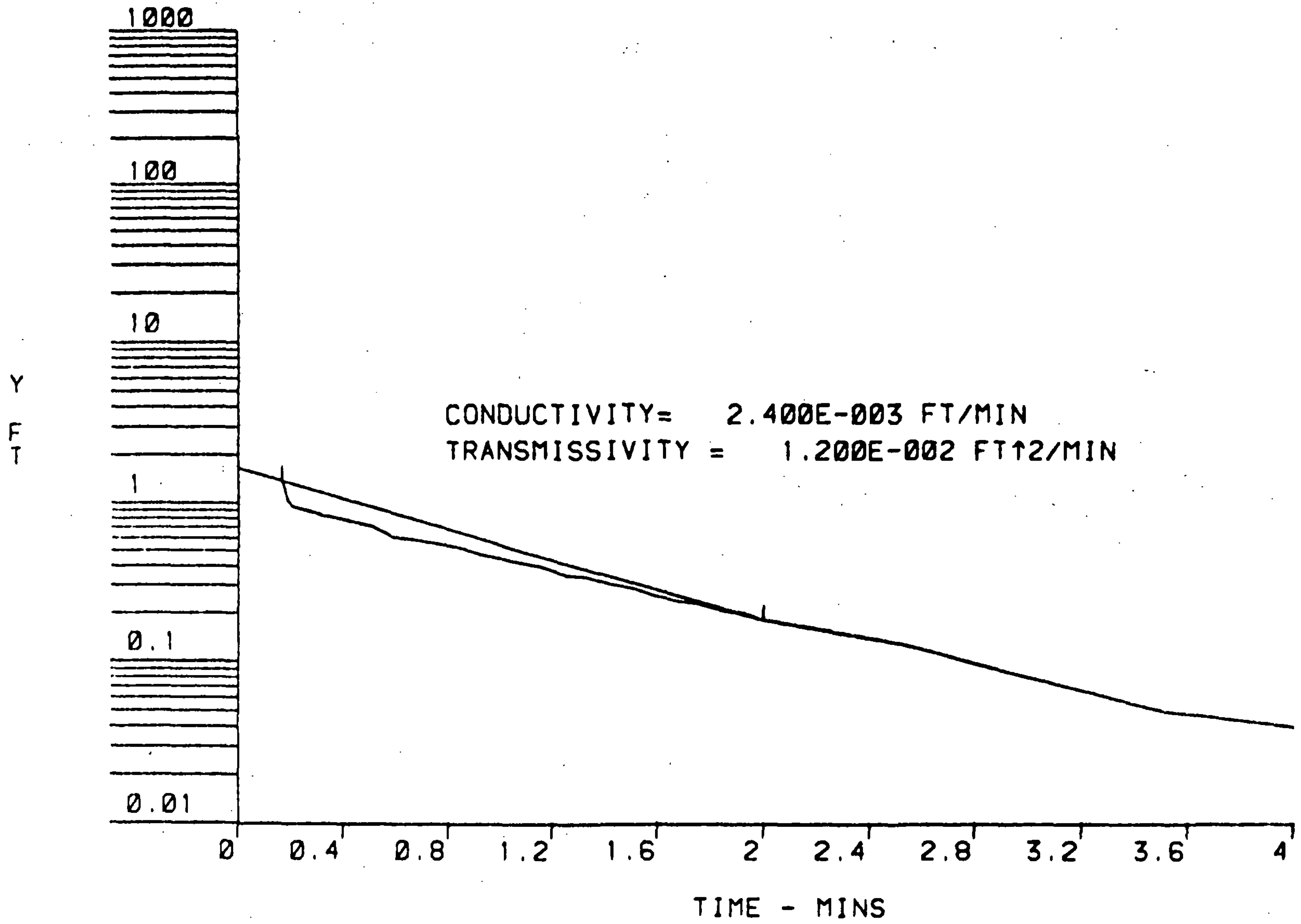
NNWALT EAST PLANT SLUG TEST WELL MW-10


PENNWALT EAST PLANT SLUG TEST WELL MW-11
(DIMENSIONS IN FT)
CASING DIAMETER= 0.166
WELL SLIMNESS FACTOR= 60.24
EFFECTIVE WELL DIAMETER= 0.166
D= 5
H= 5
SCREEN LENGTH= 5

PENNWALT EAST PLANT SLUG TEST WELL MW-11

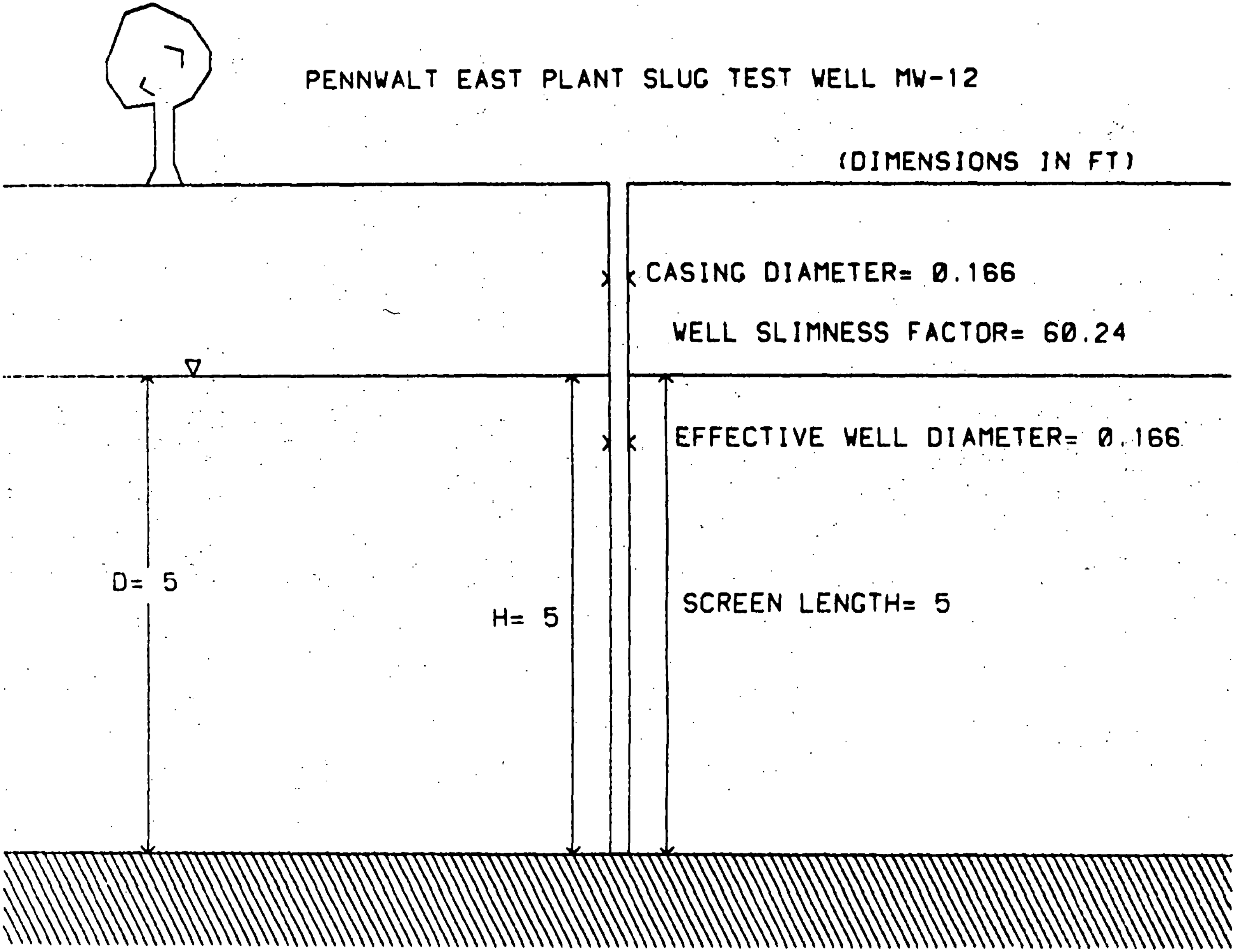
	'Y' READINGS	TIME (MINS)
1	1.37	0.1699
2	1.04	0.1865
3	0.96	0.2031
4	0.94	0.2197
5	0.92	0.2363
6	0.91	0.2529
7	0.89	0.2695
8	0.88	0.2861
9	0.86	0.3027
10	0.84	0.3193
11	0.83	0.3359
12	0.78	0.4192
13	0.72	0.5025
14	0.61	0.5858
15	0.59	0.6691
16	0.56	0.7524
17	0.53	0.8357
18	0.48	0.919
19	0.45	1
20	0.42	1.08
21	0.39	1.17
22	0.35	1.25
23	0.34	1.33
24	0.31	1.41
25	0.29	1.5
26	0.26	1.58
27	0.24	1.67
28	0.23	1.75
29	0.21	1.835
30	0.2	1.92
31	0.18	2

32	0.13	2.5
33	0.08	3
34	0.05	3.5
35	0.04	4



CONDUCTIVITY= 2.400E-003 FT/MIN
TRANSMISSIVITY = 1.200E-002 FT↑2/MIN

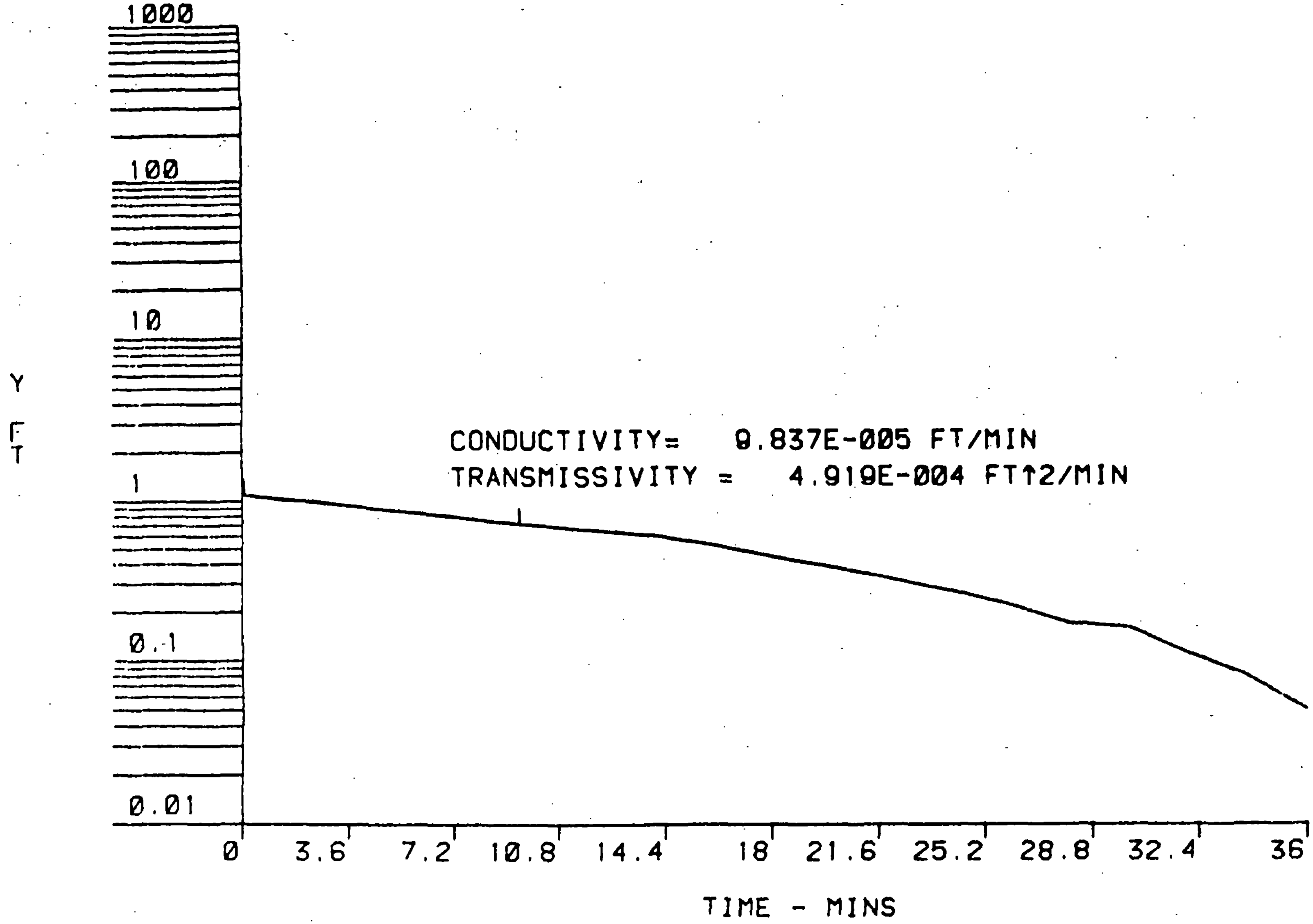
PENNWALT EAST PLANT SLUG TEST WELL MW-11


PENNWALT EAST PLANT SLUG TEST WELL MW-12
(DIMENSIONS IN FT)
CASING DIAMETER= 0.166
WELL SLIMNESS FACTOR= 60.24
EFFECTIVE WELL DIAMETER= 0.166
D= 5
H= 5
SCREEN LENGTH= 5

PENNWALT EAST PLANT SLUG TEST WELL MW-12

	'Y' READINGS	TIME (MINS)
1	1.09	0.0699
2	1.08	0.3023
3	1.06	0.5854
4	1.05	0.9186
5	1.03	1.17
6	1.01	1.42
7	1	2.5
8	0.97	3
9	0.94	3.5
10	0.92	4
11	0.89	4.5
12	0.87	5
13	0.84	6
14	0.82	6.5
15	0.81	7
16	0.78	7.5
17	0.76	8
18	0.74	8.5
19	0.73	9
20	0.71	9.5
21	0.7	10
22	0.65	12
23	0.6	14
24	0.52	16
25	0.44	18
26	0.38	20
27	0.32	22
28	0.27	24
29	0.22	26
30	0.17	28
31	0.16	30

32	0.11	32
33	0.08	34
34	0.05	36



CONDUCTIVITY= 9.837E-005 FT/MIN
TRANSMISSIVITY = 4.919E-004 FT↑2/MIN

PENNWALT EAST PLANT SLUG TEST WELL MW-12

APPENDIX G

PHASE I
SOIL AND GROUNDWATER LABORATORY ANALYTICAL DATA

The analytical data is reported as follows:

Parameters reported as "not detected" by WESTON Analytic are not included in this appendix.

The letter "J" following a concentration value indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds when a 1:1 response is assumed, or when the mass spectral data indicate the presence of a compound that meets the identification criteria but the result is less than the specified detection limit, but greater than zero (e.g.: If a detection limit of 10 ug/l, and a concentration of 3 ug/l is calculated, the result is reported as 3J).

NA = Not Analyzed

SOIL ANALYTICAL DATA

TP-1

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)
Aluminum	1960
Arsenic	17.5
Barium	27.1
Beryllium	0.7
Calcium	7330
Chromium	3.2
Copper	6.3
Iron	4140
Mercury	1.1
Magnesium	1770
Manganese	49.2
Sodium	777
Nickel	9.5
Lead	31.6
Vanadium	3.3
Zinc	26.3

TP-2

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)
Aluminum	8140
Arsenic	28.9
Barium	152
Beryllium	1.2
Calcium	53500
Cadmium	1.2
Cobalt	5.1
Chromium	34.2
Copper	60
Iron	19800
Potassium	760
Magnesium	11300
Manganese	314
Sodium	631
Nickel	34
Lead	199
Selenium	6.1
Vanadium	16.9
Zinc	379

TP-3

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)
Aluminum	3630
Barium	33.2
Beryllium	0.7
Calcium	6960
Chromium	5.3
Copper	7.3
Iron	5600
Magnesium	1300
Manganese	89.8
Nickel	1.0
Lead	8.3
Vanadium	5.8
Zinc	16.6

TP-4

ORGANIC COMPOUNDS	CONCENTRATION (mg/kg)	
Napthalene	0.04	J
2-Chloronapthalene	0.68	
bis (2-Ethylhexyl) Phthalate	0.14	J
Acetone	1.1	
2-Butanone	0.48	

Tentatively Identified Compounds (BN/A Fraction)	(mg/kg)
Benzaldehyde	2.6
Unknown (semi-volatile)	2.7
Dichloronaphthalene	0.62
Molecular Sulfur	1.6
Unknown Hydrocarbon + Br or Cl	0.6

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)
Aluminum	1470
Beryllium	0.6
Calcium	18600
Cadmium	0.3
Chromium	3.7
Copper	10.1
Iron	6980
Magnesium	3160
Manganese	234
Sodium	2200
Nickel	11.5
Lead	8.9
Vanadium	3.2
Zinc	27.3

TP-5

COMPOUND	CONCENTRATION (mg/kg)	
2-Chloronaphthalene	0.39	J
Acenaphthylene	0.16	J
Dibenzofuran	0.27	J
Fluorene	0.29	J
N-Nitrosodiphenylamine (1)	0.15	J
Phenanthrene	3.0	
Anthracene	0.61	
Fluoranthene	4.6	
Pyrene	3.0	
Benzo (a) Anthracene	2.0	
bis (2-Ethylhexyl) Phthalate	0.12	J
Chrysene	2.0	
Benzo (b) Fluoranthene	3.6	
Benzo (a) Pyrene	1.5	
Indeno (1,2,3,-cd) Pyrene	1.3	
Dibenz (a,h) Anthracene	0.32	J
Benzo (g,h,i) Perylene	0.99	
Naphthalene	0.41	J
2-Methylnaphthalene	0.56	
Methylene Chloride	0.04	

Tentatively Identified Compounds (BN/A Fraction) (mg/kg)

Benzaldehyde	3.5
Molecular Sulfur	4.1
Unknown Hydrocarbon	0.51
Benzofluoranthene	1.5
Unknown Hydrocarbon	1.8

INORGANIC PARAMETERS	CONCENTRATION mg/kg
Aluminum	12700
Arsenic	121
Barium	128
Beryllium	1.7
Calcium	21400
Cobalt	3.9
Chromium	18.3
Copper	104
Iron	43300
Potassium	882
Magnesium	944
Manganese	57.9
Sodium	1670
Nickel	14.0
Lead	161
Selenium	0.9
Vanadium	25.2
Zinc	33.7

TP-6

ORGANIC COMPOUNDS	CONCENTRATION (mg/kg)	
2-Chloronaphthalene	0.27	J
N-Nitrosodiphenylamine (1)	0.10	J
di-n-Butyl Phthalate	0.11	J
bis-(2-Ethylhexyl) Phthalate	0.12	J
Acetone	0.43	
2-Butanone	0.29	
Aroclor - 1260	0.26	J

Tentatively Identified Compounds (BN/A Fraction)	(mg/kg)
Unknown (semi-volatile)	1.7
Unknown (semi-volatile)	0.57
Unknown (semi-volatile)	0.4
Trichloronaphthalene	0.38
Molecular Sulfur	23

TP-7

ORGANIC COMPOUNDS	CONCENTRATION (mg/kg)	
1,3-Dichlorobenzene	0.10	J
1,4-Dichlorobenzene	0.3	J
1,2-Dichlorobenzene	0.41	J
1,2,4-Trichlorobenzene	5.1	
Naphthalene	3.2	
2-Methylnaphthalene	0.2	J
Dibenzofuran	0.11	J
Hexachlorobenzene	0.37	J
Phenanthrene	0.48	J
Anthracene	0.11	J
Fluoranthene	0.32	J
Pyrene	0.27	J
Benzo (a) Anthracene	0.26	J
bis (2-Ethylhexyl) Phthalate	0.16	J
Chrysene	0.19	J
Benzo (b) Fluoroanthene	0.28	J
Benzo (a) Pyrene	0.11	J
Indeno (1,2,3-cd) Pyrene	0.07	J
Benzo (g,h,i) Perylene	0.10	J
Acetone	0.33	
2-Butanone	0.2	
Trans-1,2-Dichloroethene	0.01	
Trichloroethene	0.03	J
Tetrachloroethene	0.02	J

Tentatively Identified Compounds (BN/A fraction)	(mg/kg)
Chloronaphthalene	57.0
Dichloronaphthalene	61.0
Trichlorohaphthalene	4.8
Tetrachloronophthalene	14.0
Unknown (semi-volatile)	15.0

TP-8

ORGANIC COMPOUNDS	CONCENTRATION (mg/kg)	
Naphthalene	14.0	
2-Chloronaphthalene	120.0	
Hexachlorobenzene	16.0	
Fluoranthene	1.9	J
Pyrene	2.2	J
bis (2-Ethylhexyl) Phthalate	1.5	J
Chrysene	2.4	J
Benzo (k) Fluoranthene	6.8	J
Acetone	1.2	J
Trans-1,2-Dichloroethene	0.04	J
2-Butanone	0.33	
Trichloroethene	0.31	
Tetrachloroethene	0.21	
Toluene	0.04	J
Chlorobenzene	0.11	J

Tentatively Identified Compounds (BN/A Fraction)	(mg/kg)	
Unknown Chlorinated Benzene	330.0	
Dichloronaphthalene	920.0	
Trichloronaphthalene	780.0	Scan #1387
Trichloronaphthalene	61.0	Scan #1454
Tetrachloronaphthalene	290.0	

TP-9

ORGANIC COMPOUNDS	CONCENTRATION (mg/kg)			
	TP-9		TP-9 Dup	
1,3-Dichlorobenzene	0.26	J	0.28	J
1,4-Dichlorobenzene	8.4		8.8	
1,2-Dichlorobenzene	16.0		15.0	
1,2,4-Trichlorobenzene	11.0		7.2	
2-Methylnaphthalene	0.44	J	0.37	J
Acenaphthylene	0.35	J	ND	
Dibenzofuran	0.31	J	0.25	J
Fluorene	0.40	J	0.28	J
N-Nitrosodiphenylomine (1)	0.57	J	ND	
Hexachlorobenzene	1.6	J	1.1	J
Phenathrene	2.1	J	0.51	J
Anthracene	0.35	J	ND	
di-n-Butyl Phthalate	0.7	J	0.81	J
Fluoranthene	2.6		3.0	
Pyrene	1.7	J	1.9	J
Benzo (a) Anthracene	1.6	J	1.7	J
Chrysene	1.7	J	1.7	J
Benzo (b) Fluoranthene	2.6		2.8	
Benzo (a) Pyrene	0.59	J	0.79	J
Indeno (1,2,3-cd) Pyrene	0.84	J	0.9	J
Dibenz (a,h) Anthracene	0.4	J	0.37	J
Benzo (g,h,i) Perylene	0.88	J	1.0	J
Methylene Chloride	0.28		0.04	
Acetone	0.01	J	0.01	J
Carbon Disulfide	0.01	J	ND	J
Chloroform	0.26		0.05	
2-Butanone	0.015	J	0.010	J
1,1,1 Trichloroethane	0.02	J	ND	J
Carbon Tetrachloride	0.81	J	0.21	
Vinyl Acetate	0.29		ND	
1,2-Dichloropropane	0.01	J	ND	
Trichloroethene	0.38		0.07	
Tetrachloroethene	0.66		0.14	
Trichlorofluoromethane	0.01	J	ND	
4,4' DDE	0.42	J	0.30	J
Chlorobenzene	0.02	J	ND	

TP-9 (Continued)

ORGANIC COMPOUNDS CONCENTRATION (mg/kg)

Tentatively Identified Compounds (BN/A Fraction)

	TP-9	TP-9 Dup
Unknown (semi-volatile)	2.9	ND
Tetrachlorothiophene	ND	3.0
Tetrachlorobenzene	2.0 Scan #945	ND
Tetrachlorobenzene	5.9 Scan #1000	4.1
Unknown (semi-volatile)	ND	3.0
Molecular Sulfur	4.6	4.7
Unknown Hydrocarbon	2.1	2.3

ND = Not Detected

SS-10

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)
Aluminum	3490
Arsenic	1.4
Barium	117
Beryllium	5.0
Calcium	40200
Cadmium	1.7
Cobalt	15.2
Chromium	2440
Copper	83800
Iron	123000
Mercury	0.6
Potassium	1510
Magnesium	22600
Manganese	640
Sodium	4040
Nickel	191
Lead	295
Antimony	12.8
Vanadium	54.4
Zinc	403
Cyanide	0.6

TP-11

ORGANIC COMPOUNDS	CONCENTRATION (mg/kg)	
1,2 Dichlorobenzene	1.1	J
Naphthalene	59.0	
N-Nitrosodiphenylamine (1)	0.83	J
Hexachlorobenzene	9.2	
di-n-Butyl Phthalate	0.74	J
Chrysene	0.46	J
Benzo (a) Pyrene	3.5	J
Methylene Chloride	0.1	
Acetone	0.81	
Chloroform	0.22	
2-Butanone	0.19	
Tetrachloroethene	0.16	
Toluene	0.03	J
Chlorobenzene	0.05	J

Tentatively Identified Compounds (BN/A Fraction)	(mg/kg)
Chlorinated Naphthalene	620.0
Dichloronaphthalene	290.0
Tetrachloronaphthalene	43.0
Unknown (semi-volatile)	42.0
Unknown (semi-volatile)	38.0

TP-12

ORGANIC COMPOUNDS	CONCENTRATION (mg/kg) TP-12	
Naphthalene	12000	
2-Chloronaphthalene	25000	
N-Nitrosodiphenylamine (1)	61.0	J
Pentachlorophenol (2)	46.0	J
Pyrene	9.10	J
Benzo (a) Anthracene	14.0	J
Chrysene	17.0	J
Benzo (k) Fluoranthene	200	J
Benzo (a) Pyrene	27.0	J
Methylene Chloride	0.28	
Acetone	4.7	
Chloroform	0.03	J
2-Butanone	0.61	
Trichloroethene	0.06	J
Benzene	0.19	J
Tetrachloroethene	1.6	
Toluene	0.62	
Chlorobenzene	0.11	J
Ethylbenzene	0.07	J
Total Xylenes	0.51	

Tentatively Identified Compounds (BN/A Fraction) (mg/kg)

Dichloronaphthalene	27000	
Trichloronaphthalene	9800	Scan #1369
Trichloronaphthalene	4800	Scan #1436
Tetrachloronaphthalene	2800	Scan #1522
Tetrachlororaphthalene	3500	Scan #1605

TP-14

ORGANIC COMPOUNDS	CONCENTRATION (mg/kg)	
Pentachlorophenol	5.5	
Di-n-butyl phthalate	0.66	
2-Butanone	0.04	
Acetone	0.02	J

Tentatively Identified Compounds (BN/A Fraction)	(mg/kg)
Unknown hydrocarbon	5.0
Unknown Organic Acid	2.3
Molecular Sulfur	130.0
Unknown Hydrocarbon	3.4
Unknown (semi-volatile)	4.8

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)
Aluminum	3170
Arsenic	1.2
Beryllium	0.6
Calcium	2900
Chromium	7.6
Copper	17.7
Iron	4250
Magnesium	822
Manganese	35.0
Sodium	1080
Nickel	5.1
Lead	2.7
Vanadium	8.2
Zinc	14.2

TP-15

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)
Aluminum	6300
Arsenic	1.8
Barium	31.7
Beryllium	0.8
Calcium	3670
Cadmium	0.3
Cobalt	1.4
Chromium	8.9
Copper	10.7
Iron	6380
Magnesium	1310
Manganese	51.8
Sodium	5810
Nickel	5.7
Lead	6.0
Selenium	8.7
Vanadium	8.5
Zinc	21.0

TP-15 Dup

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)
Aluminum	5810
Arsenic	1.5
Barium	32.8
Beryllium	0.9
Calcium	4400
Cadmium	0.4
Cobalt	1.5
Chromium	8.7
Copper	12.6
Iron	6730
Magnesium	1330
Manganese	58.2
Sodium	6510
Nickel	6.2
Lead	6.7
Vanadium	9.9
Zinc	21.8

SS-16

ORGANIC COMPOUNDS	CONCENTRATIONS (mg/kg)	
Di-n-Butyl Phthalate	80.0	
Fluoranthene	1.2	J
Butyl Benzyl Phthalate	56.0	
Bis (2-Ethylhexyl) Phthalate	4.8	J
Benzo (b) Fluoranthene	1.2	J
Methylene Chloride	0.20	
Carbon Disulfide	0.01	J
Chloroform	0.08	
Tetrachloroethene	0.01	J
Toluene	0.02	J
Alpha - BHC	0.19	J

Tentatively Identified Compunds (BN/A Fraction) (mg/kg)

Unknown Acetone	25
Unknown (semi-volatile) Scan #628	7.2
Unknown (semi-volatile) Scan #680	33
Unknown Organic Acid	30
Unknown Phthlate	80

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)
Al	4100
As	0.9
Ba	381
Ca	131000
Cd	1.9
Cr	19.9
Cu	84.2
Fe	19200
Hg	1.4
K	674
Mg	46900
Mn	510
Na	2380
Ni	6.5
Pb	1370
V	8.2
Zn	139

SS-17

INORGANIC PARAMETERS	CONCENTRATION (mg\kg)
Aluminum	6270
Arsenic	1.7
Barium	167
Calcium	47700
Cadmium	1.6
Cobalt	2.0
Chromium	31.3
Copper	70.3
Iron	31900
Mercury	1.5
Potassium	812
Magnesium	10500
Manganese	492
Sodium	2940
Nickel	56.5
Lead	667
Vanadium	14.5
Zinc	190

SS-18

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)
Aluminum	6430
Arsenic	0.6
Barium	268
Calcium	32900
Cadmium	4.0
Cobalt	4.9
Chromium	101
Copper	1870
Iron	57900
Mercury	1.1
Potassium	944
Magnesium	9230
Manganese	1030
Sodium	8290
Nickel	525
Lead	690
Vanadium	27.4
Zinc	614
Cyanide	20.2

TP-19

INORGANIC PARAMETERS	CONCENTRATIONS (mg/kg)
Al	7340
As	46
Ba	150
Be	1.7
Ca	16500
Co	5.8
Cr	14.6
Cu	48.5
Fe	26200
Mg	2570
Mn	133
Na	1530
Ni	17.4
Pb	82.1
Se	1.6
V	23.4
Zn	67.7

TP-20

ORGANIC COMPOUNDS	CONCENTRATION (mg/kg)	
2,4-Dimethylphenol	0.38	J
Benzoic Acid (2)	11.0	
Naphthalene	3.8	
2-Methylnaphthalene	6.5	
2-Chloronaphthalene	0.52	J
Dibenzofuran	1.3	J
Fluorene	0.34	J
Phenanthrene	3.4	
di-n-Butyl Phthalate	0.32	J
Fluoranthene	0.92	J
Pyrene	0.84	J
Benzo (a) Anthracene	0.67	J
Chrysene	0.80	J
Benzo (b) Fluoranthene	0.84	J
Benzo (a) Pyrene	0.38	J
Indeno (1,2,3-cd) Pyrene	0.42	J
Dibenz (a,h) Anthracene	0.36	J
Benzo (g,h,i) Perylene	0.95	J
Methylene Chloride	0.02	
Toluene	0.01	J

Tentatively Identified Compounds (BN/A Fraction) (mg/kg)	
Unknown PNA	4.7
Dimethylnaphthalene	4.8
Unknown Hydrocarbon	6.1
Unknown Hydrocarbon	4.5
Molecular Sulfur	6.9

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)
Aluminum	1190
Arsenic	152
Barium	68.3
Beryllium	1.0
Calcium	4150
Cobalt	4.1
Chromium	12.9
Copper	33.5
Iron	61700
Potassium	865
Manganese	32.6
Sodium	4640
Nickel	6.7
Lead	134
Selenium	2.5
Vanadium	33.8
Zinc	19.0

TP-21

ORGANIC COMPOUNDS	CONCENTRATION (mg/kg)		
	COMPOSITE (0-12 ft)	GRAB (9-9.5 ft)	GRAB DUPL (9-9.5 ft)
1,4-Dichlorobenzene	ND	0.43	NA
1,2-Dichlorobenzene	ND	0.18 J	NA
2,4-Dimethylphenol	160 J	ND	NA
Benzoic Acid	110	ND	NA
Napathalene	67	0.066 J	NA
2-Methylnapthalene	162	ND	NA
2-Chloronaphthalane	5.5	ND	NA
Acenaphthylene	72	ND	NA
Acenaphthene	16 J	ND	NA
Dibenzofuran	42	ND	NA
Fluorene	95	ND	NA
Phenanthrene	190	ND	NA
Anthracene	85	ND	NA
di-n-butyl phthalate	ND	1.3	NA
Fluoranthene	140	ND	NA
Butyl Benzyl Phthalate	ND	1.1	NA
Benzo (a) Anthracene	76	ND	NA
Chrysene	44	ND	NA
Benzo (b) Fluoranthene	51	ND	NA
Benzo (a) Pyrene	25	ND	NA
Indeno (1,2,3-cd) Pyrene	9.5	ND	NA
Dibenz (a,h) Anthracene	3.0	ND	NA
Benzo (g,h,i,) Perylene	7.2	ND	NA
Methylene Chloride	0.06	0.32	0.35
Acetone	0.18	0.21	0.21
Carbon Disulfide	0.03	ND	0.01
Chloroform	0.03	4.2	4.5
2-Butanone	0.38	0.31	0.32
Benzene	0.01 J	ND	0.19
Toluene	0.01 J	ND	ND
Chlorobenzene	0.13	5.9	6.3
Total Xylenes	0.03	ND	ND

ND = Not Detected
NA = Not Analyzed

TP-21 (Continued)

TENTATIVELY IDENTIFIED COMPOUNDS

(BN/A FRACTION) (mg/kg)

	COMPOSITE (0-12 ft)	GRAB (9-9.5 ft)	GRAB DUPL (9-9.5 ft)
Unknown (semi-volatile)	170	ND	NA
Unknown PNA	200	ND	NA
Dimethyl PNA	50	ND	NA
Unknown PNA	72	ND	NA
Unknown (semi-volatile)	54	ND	NA
Chlorobenzene	ND	1.40	NA
Unknown Hydrocarbon	ND	0.91	NA
Molecular Sulfur (Scan (1121)	ND	1.40	NA
Molecular Sulfur (Scan (1631)	ND	8.10	NA
Unknown Hydrocarbon	ND	11.00	NA

(Analysis performed on TP-21 composite only)

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)
Al	3230
As	43.1
Be	1.5
Ca	11600
Cd	5.4
Co	3.9
Cr	17.7
Cu	128
Fe	8620
Mn	20.2
Na	1250
Ni	10.4
Pb	10.3
Se	3.6
V	17.9
Zn	340

ND = Not Detected
NA = Not Analyzed

TP-22

ORGANIC COMPOUNDS	CONCENTRATION (mg/kg)	
4-Methylphenol	0.12	J
2,4-Dimethylphenol	0.14	J
1,2,4-Trichlorobenzene	0.28	J
Napthalene	0.87	
2-Methylnaphthalene	1.2	
2-Chloronaphthalene	2.5	
Acenaphthylene	0.55	
Acenaphthene	0.24	
Dibenzofuran	0.51	
Fluorene	0.74	
Phenanthrene	1.8	
Anthracene	0.55	
Fluoranthene	1.2	
Pyrene	0.83	
Benzo (a) Anthracene	0.74	
bis(2-Ethylhexyl) Phthalate	0.1	J
Chrysene	0.6	
Benzo (k) Fluoranthene	0.92	
Benzo (a) Pyrene	0.46	J
Indeno (1,2,3-cd) Pyrene	0.28	
Dibenz (a,h) Anthracene	0.087	
Benzo (g,h,i) Perylene	0.23	
Acetone	0.03	J
2-Butanone	0.04	
Aroclor - 1260	2.7	

Tentatively Identified Compounds (BN/A Fraction) (mg/kg)	
Dichloronaphthalene	4.4
Xanthene	2.4
Unknown hydrocarbon	2.6
Trichloronaphthalene	3.5
Molecular Sulfur	6.7

TP-22 (Continued)

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)
Aluminum	12800
Arsenic	20.8
Barium	109
Beryllium	1.9
Calcium	31000
Cadmium	1.0
Cobalt	13.0
Chromium	18.5
Copper	72.0
Iron	55700
Mercury	0.7
Potassium	1240
Magnesium	5830
Manganese	305
Sodium	16800
Nickel	37.1
Lead	181
Selenium	0.8
Vanadium	33.7
Zinc	304

TP-24

ORGANIC COMPOUNDS	CONCENTRATION (mg/kg)	
1,2-Dichlorobenzene	0.38	J
2-Methylnaphthalene	2.5	
Dibenzofuran	0.81	J
Fluorene	0.43	J
Phenanthrene	3.4	
Anthracene	0.56	J
di-n-Butyl Phthalate	0.23	J
Fluoranthene	2.6	
Pyrene	2.0	J
Benzo (a) Anthracene	1.2	J
Chrysene	1.2	J
Benzo (b) Fluoranthene	1.5	J
Benzo (a) Pyrene	0.83	J
Indeno (1,2,3-cd) Pyrene	0.56	J
Benzo (g,h,i) Perylene	0.64	J
Acetone	0.04	
2-Butanone	0.04	
Aroclor - 1260	4.8	

Tentatively Identified Compounds (BN/A Fraction) (mg/kg)

Unknown PNA	1.7	
Unknown Hydrocarbon	1.9	Scan #1534
Molecular Sulfur	8.0	
Unknown Hydrocarbon	1.4	Scan #1701
Chlorinated Naphthalene	1.5	

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)
Al	2220
As	3.4
Ba	49.2
Be	1.2
Ca	10200
Co	2.1
Cr	9.2
Cu	18.2
Fe	60900
Hg	0.3
K	3420
Mn	25.6
Na	10200
Ni	6.5
Pb	174
V	17.4
Zn	25.5

SS-25

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)
Aluminum	4620
Arsenic	8.7
Barium	89.6
Calcium	8560
Cobalt	2.4
Chromium	29.9
Copper	1740
Iron	57700
Mercury	1.6
Potassium	868
Manganese	177
Sodium	1030
Nickel	34.3
Lead	382
Vanadium	20.2
Zinc	135
Cyanide	1.2

TP-26

ORGANIC COMPOUNDS	CONCENTRATION (mg/kg)	
Naphthalene	0.27	J
2-Methylnaphthalene	0.38	J
Acenaphthylene	0.18	J
Dibenzofuran	0.25	J
Fluorene	0.24	J
Phenanthrene	2.3	
Anthracene	0.36	J
di-n-Butyl Phthalate	0.16	J
Fluoranthene	2.9	
Pyrene	2.1	
Benzo (a) Anthracene	1.3	
bis (2-Ethylhexyl) Phthalate	0.61	J
Chrysene	1.4	
Benzo (b) Fluoranthene	2.1	
Benzo (a) Pyrene	1.4	
Indeno (1,2,3-cd) Pyrene	1.2	
Dibenz (a,h) Anthracene	0.27	J
Benzo (g,h,i) Perylene	1.0	
Methylene Chloride	0.06	J
Acetone	0.73	
Chloroform	0.01	J
2-Butanone	0.28	
Chlorobenzene	0.02	J

Tentatively Identified Compounds (BN/A Fraction) (mg/kg)	
Unknown PNA	0.66
Unknown Hydrocarbon	0.97
Molecular Sulfur	51.0
Benzofluoranthene	1.2

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)
Al	4660
As	26.9
Ba	51.2
Be	1.2
Ca	15600
Cd	0.3
Co	2.5
Cr	8.2
Cu	26.6
Fe	15800
Hg	0.5
Mg	2030
Mn	99.4
Na	15900
Ni	12.0
Pb	261
V	13.3
Zn	44.5

TP-27

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)
Aluminum	4390
Arsenic	20.7
Barium	34.4
Beryllium	0.7
Calcium	176000
Cadmium	0.6
Cobalt	4.8
Chromium	14.8
Copper	39.1
Iron	62800
Potassium	732
Magnesium	24100
Manganese	445
Sodium	11300
Nickel	17.5
Lead	21.8
Vanadium	19.9
Zinc	4840

TP-28

ORGANIC COMPOUNDS	CONCENTRATION (mg/kg)			
	TP-28 Composite		TP-28 Grab	
1,3 Dichlorobenzene	2.7	J	ND	
Hexachloroethane	0.96	J	ND	
1,2,4-Trichlorobenzene	12		ND	
Naphthalene	14		2.0	
Hexachlorobutadiene	0.45	J	ND	
2-Methylnaphthalene	3.7		ND	
2-Chloronaphthalene	10		3.4	
Acenaphthylene	0.51	J	ND	
Acenaphthene	4.5	J	ND	
Dibenzofuran	5.4		ND	
Fluorene	7.4		ND	
Phenanthrene	44		0.320	J
Anthracene	9.9		ND	
di-n-Butyl Phthalate	ND		0.21	J
Fluoranthene	53		0.390	J
Pyrene	41		0.260	J
Benzo (a) Anthracene	30		0.16	J
bis (2-Ethylhexyl) Phthalale	0.37	J	0.19	J
Chrysene	28		0.18	
Benzo (b) Fluoranthene	ND		0.22	J
Benzo (k) Fluoranthene	48		ND	
Benzo (a) Pyrene	15		0.065	J
Indeno (1,2,3-cd) Pyrene	10		0.065	J
Benzo (g,h,i) Perylene	7.9		0.059	J
Acetone	0.06		NA	
Carbon Disulfide	0.03	J	NA	
Trans-1,2-Dichloroethene	0.01	J	NA	
Chloroform	0.03	J	NA	
2-Butanone	0.09		NA	
Trichloroethene	0.02	J	NA	
Tetrachloroethene	0.12		NA	
Chlorobenzene	0.01	J	NA	
Ethylbenzene	0.04	J	NA	
Total Xylenes	0.16		NA	
Aroclor-1260	260		1.3	

Tentatively Identified Compounds (BN/A Fraction) (mg/kg)

Unknown (semi-volatile)	460		
Dichloronaphthalene	2.8		
Unknown Organic Acid	1.4	Scan #1425	
Unknown Organic Acid	4.8	Scan #1605	
Unknown Hydrocarbon	2.6		
Unknown Organic Acid			48
Molecular Sulfur			480
Unknown Hydrocarbon			12
Unknown Chlorinated Naphthalene		Scan #1851	5.9
Unknown Chlorinated Naphthalene		Scan #1894	5.6

ND = Not Detected
NA = Not Analyzed

TP-28 (Continued)

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)	
	TP-28 Composite	TP-28 Grab
Aluminum	7890	3620
Arsenic	23.0	ND
Barium	27.7	ND
Beryllium	1.0	0.5
Calcium	80100	498000
Cadmium	0.8	ND
Cobalt	7.0	ND
Chromium	29.0	3.8
Copper	604	6.5
Iron	24100	1490
Mercury	2.6	ND
Magnesium	9240	1920
Manganese	131	164
Sodium	4070	3510
Nickel	478	2.1
Lead	1630	25.8
Antimony	10.2	ND
Vanadium	19.0	1.1
Zinc	204	29.4

TP-29

ORGANIC COMPOUNDS	CONCENTRATION mg/kg	
2-Chloronapthalene	14.0	J
Fluoranthene	11.0	J
Pyrene	6.5	J
Chrysene	7.2	J
Acetone	0.03	J
2-Butanone	0.16	
Total Xylenes	0.12	J

Tentatively Identified Compounds (BN/A Fraction) (mg/kg)

Dichloronaphthalene	26
Molecular Sulfur	550
Unknown	31
Unknown	17
Unknown	18

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)
Ag	1.8
Al	6170
AS	19.4
Ba	139
Be	0.7
Ca	124000
Cd	9.9
Co	2.1
Cr	98.3
Cu	187
Fe	23600
Hg	4.7
K	567
Mg	6540
Mn	813
Na	3590
Ni	64.8
Pb	444
V	12.2
Zn	831
Cyanide	1.6

SS-30A

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)
Aluminum	12400
Arsenic	2.1
Barium	298
Beryllium	1.4
Calcium	30900
Cadmium	6.5
Cobalt	12.8
Chromium	38.5
Copper	515
Iron	64000
Mercury	0.7
Potassium	668
Magnesium	5690
Manganese	405
Sodium	11300
Nickel	35.8
Lead	521
Vanadium	20.8
Zinc	601

SS-30B

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)
Aluminum	11400
Arsenic	3.3
Barium	194
Beryllium	1.1
Calcium	31800
Cadmium	3.9
Cobalt	7.3
Chromium	26.5
Copper	696
Iron	36000
Mercury	3.0
Potassium	791
Magnesium	5130
Manganese	258
Sodium	9140
Nickel	22
Lead	432
Vanadium	14.8
Zinc	342

SS-31

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)
Aluminum	4980
Arsenic	85
Barium	151
Calcium	27800
Cadmium	2.1
Cobalt	5.7
Chromium	55.1
Copper	283
Iron	35800
Mercury	2.0
Potassium	837
Magnesium	6100
Manganese	739
Sodium	3220
Nickel	98.9
Lead	427
Vanadium	20.8
Zinc	226

TP-32

ORGANIC COMPOUNDS	CONCENTRATION (mg/kg)	
Pentachlorophenol (2)	0.54	J
Phenanthrene	0.10	J
di-n-Butyl Phthalate	0.43	J
Fluoranthene	0.14	J
Pyrene	0.07	J
Benzo (a) Anthracene	0.06	J
Chrysene	0.07	J
Acetone	0.03	
2-Butanone	0.05	

Tentatively Identified Compounds (BN/A Fraction)	(mg/kg)
Unknown semi-volatile	2.1
Unknown semi-volatile	1.8
Unknown Organic Acid	3.1
Molecular Sulfur	51.0
Unknown Hydrocarbon	3.8

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)
Al	7930
As	1.9
Ba	39.6
Be	0.8
Ca	3570
Co	2.3
Cr	11.8
Cu	5.8
Fe	6580
Mg	1590
Mn	40.3
Na	3950
Ni	8.3
P	8.3
V	14.2
Zn	23.9

TP-33

ORGANIC COMPOUNDS	CONCENTRATION (mg/kg)	
2-Methylnaphthalene	0.05	J
Phenanthrene	0.09	J
di-n-butyl Phthalate	0.72	
Fluoranthene	0.11	J
Pyrene	0.09	J
Butyl Benzyl Phthalate	0.35	J
Benzo (a) Anthracene	0.08	J
Chrysene	0.06	J
Benzo (b) Fluoranthene	0.08	J
Benzo (a) Pyrene	0.05	J
Methylene Chloride	0.06	
Acetone	0.021	J
Chloroform	0.027	J
2-butanone	0.071	

Tentatively Identified Compounds (BN/A Fraction)

Unknown (semi-volatile)	0.64
Unknown Organic Acid	0.88
Molecular Sulfur	13.0
Unknown Hydrocarbon	1.6
Unknown (semi-volatile)	3.0

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)
Al	6260
As	30.1
Ba	50.4
Be	1.1
Ca	5850
Cd	0.8
Co	20.0
Cr	14.9
Cu	38.0
Fe	7780
Mg	1520
Mn	70.2
Na	2150
Ni	37.0
Pb	5.2
Se	2.7
V	19.3
Zn	225

TP-34

ORGANIC COMPOUNDS	CONCENTRATION (mg/kg)	
1,3 Dichlorobenzene	0.16	J
1,4 Dichlorobenzene	6.20	
1,2 Dichlorobenzene	8.40	
1,2,4 Trichlorobenzene	2.50	
Naphthalene	0.23	J
2-Methylnaphthalene	0.48	J
Acenaphthene	0.14	J
Acenaphthylene	0.18	J
Dibenzofuran	0.26	J
Fluorene	0.31	J
Phenanthrene	2.00	
Anthracene	0.42	J
Di-n-Butyl Phthalate	1.20	
Fluoranthene	2.30	
Pyrene	1.90	
Butyl Benzyl Phthalate	0.16	J
Benzo (a) Anthracene	1.40	
Chrysene	1.20	
Benzo (b) Fluoranthene	1.90	
Benzo (a) Pyrene	0.87	
Indeno (1,2,3-cd) Pyrene	0.66	
Dibenz (a,h) Anthracene	0.19	J
Benzo (g,h,i) Perylene	0.61	
Methylene Chloride	0.07	
Acetone	0.02	J
Chloroform	0.01	J
2-Butanone	0.05	
Trichlorofluoromethane	0.01	J

Tentatively Identified Compounds (BN/A Fraction) (mg/kg)

Unknown Hydrocarbon	1.80
Molecular Sulfur	1.90
Tetrachloronaphthalene	0.84
Unknown (semi-volatile)	1.10
Unknown PNA	0.64

TP-34 (Continued)

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)
Al	8830
As	38.8
Ba	59.9
Be	1.5
Ca	33400
Cd	0.4
Co	6.7
Cr	14.7
Cu	23.4
Fe	17600
Hg	1.3
K	719
Mg	5510
Mn	234
Na	626
Ni	16.0
Pb	33.0
Se	0.6
V	21.2
Zn	62.5

TP-35

ORGANIC COMPOUNDS	CONCENTRATION (mg/kg)	
Naphthalene	0.15	J
2-Methylnaphthalene	0.25	J
Dibenzofuran	0.010	J
Phenanthrene	0.51	
Anthracene	0.08	J
di-n-Butyl Phthalate	1.00	
Fluoranthene	0.64	
Pyrene	0.46	J
Butyl Benzyl Phthalate	1.80	
Benzo (a) Anthracene	0.46	J
bis (2-Ethylhexyl) Phthalate	0.06	J
Chrysene	0.40	J
Benzo (b) Fluoranthene	0.64	
Benzo (a) Pyrene	0.37	
Indeno (1,2,3-cd) Pyrene	0.24	J
Dibenz (a,h) Anthracene	0.11	J
Benzo (g,h,i) Perylene	0.28	J
Methylene Chloride	0.14	
Carbon Disulfide	0.02	J
Chloroform	0.03	J
1,2-Dichloropropane	0.05	
Toluene	0.01	J
Aroclor - 1260	1.0	

Tentatively Identified Compounds (BN/A Fraction)

Unknown Hydrocarbon	20.00
Unknown Hydrocarbon	1.800
Molecular Sulfur	8.00
Unknown Hydrocarbon Scan# 1734	0.93
Unknown Hydrocarbon Scan# 2436	0.93

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)
Al	10600
As	120
Ba	187
Be	2.3
Ca	8710
Cd	1.0
Co	8.0
Cr	27.5
Cu	398
Fe	18300
Hg	0.9
K	670
Mg	1900
Mn	107
Na	807
Ni	23.5
Pb	286
Se	2.8
V	31.7
Zn	146
Cyanide	1.9

SS-36

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)
Aluminum	7900
Arsenic	7.7
Barium	191
Calcium	135000
Cadmium	4.2
Cobalt	3.1
Chromium	37.2
Copper	78.5
Iron	40200
Mercury	14.9
Potassium	982
Magnesium	24900
Manganese	937
Sodium	1330
Nickel	26.7
Lead	227
Vanadium	27.2
Zinc	465

MONITOR WELL 9 (Soil Sample)

(16-18 ft)

ORGANIC COMPOUNDS	CONCENTRATION (mg/kg)	
1,3-Dichlorobenzene	1.00	
1,4-Dichlorobenzene	9.10	
1,2-Dichlorobenzene	3.30	
2-Methylnaphthalene	0.12	J
2-Chloronaphthalene	1.50	J
N-Nitrosodiphenylamine (1)	0.12	
Phenanthrene	0.46	
Anthracene	0.10	J
Di-n-Butyl Phthalate	1.20	
Fluoranthene	0.32	
Pyrene	0.22	J
Butyl Benzyl Phthalate	0.91	
Benzo (a) Anthracene	0.15	J
Chrysene	0.12	J
Benzo (b) Fluoranthene	0.42	
Benzo (k) Fluoranthene	0.53	
Methylene Chloride	0.19	
Acetone	0.09	
Chloroform	0.04	J
2-Butanone	1.00	
Trichloroethene	0.02	J
Benzene	0.01	J
Tetrachloroethene	0.01	J
Chlorobenzene	1.10	
Ethylbenzene	0.24	

Tentatively Identified Compounds		Estimated Concentrations
Chloronaphthalene		280
Dichloronaphthalene		270
Trichloronaphthalene	Scan #1384	105
Trichloronaphthalene	Scan #1449	69
Tetrachloronaphthalene		23

(Monitor Well - 9 Cont'd)

Inorganic Parameters	Concentrations (mg/kg)
Al	9150
As	4.6
Ba	37.4
Be	0.9
Ca	83500
Cd	0.3
Co	5.7
Cr	16.1
Cu	13.7
Fe	18900
K	1790
Mg	17300
Mn	353
Na	849
Ni	17.6
Pb	7.8
V	17.4
Zn	53.2

MONITOR WELL 10 (Soil Sample)

(9.5 - 11.5 ft)

ORGANIC COMPOUNDS	CONCENTRATION (mg/kg)	
Naphthalene	0.33	J
2-Chloronaphthalene	0.97	
Di-n-Butyl Phthalate	1.10	
Butyl Benzyl Phthalate	0.08	J
Bis(2-ethylhexyl)Phthalate	0.04	J
Benzo (a) Pyrene	0.21	J
Methylene Chloride	0.28	
Acetone	0.04	
Carbon Disulfide	0.01	J
Chloroform	0.12	
2-Butanone	0.07	
Tetrachloroethene	0.01	J
Toluene	0.03	
Total Xylenes	0.01	J
Trichlorofluoromethane	0.01	J

Tentatively Identified Compounds (BN/A Fraction (mg/kg)

Unknown Hydrocarbon	Scan #266	1.20
Unknown Hydrocarbon	Scan #295	1.10
Unknown Hydrocarbon	Scan #1039	0.65
Unknown Hydrocarbon	Scan #1148	0.71
Unknown Hydrocarbon	Scan #1350	1.60
Unknown Hydrocarbon	Scan #1356	1.60

INORGANIC PARAMETERS	CONCENTRATION (mg/kg)
Al	8500
As	10.8
Ba	55.4
Be	0.9
Ca	87400
Cd	0.2
Co	5.9
Cr	14.9
Cu	15.0
Fe	19700
K	1530
Mg	17100
Mn	353
Na	1930
Ni	17.4
Pb	7.4
V	14.9
Zn	48.6

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ORGANIC COMPOUNDS	CONCENTRATION (ug/l)	
N-Nitrosodiphenylamine (1)	2	J
Di-N-Butyl Phthalate	2	J
Methylene Chloride	11	
Trichlorofluoromethane	2	J

GROUND WATER ANALYTICAL DATA

MONITOR WELL 1

COMPOUND	CONCENTRATION
bis(2-Ethylhexyl) Phthalate	3 J
Methylene Chloride	6 J
Aroclor-1260	2.0

Tentatively Identified Compounds	Estimated Concentrations
Unknown Prthalate (semi-volatile)	1 J
Unknown (semi-volatile)	8 J
Unknown (semi-volatile)	11 J
Unknown (semi-volatile)	8 J

INORGANIC PARAMETERS	CONCENTRATION (mg/l)
Alluminum	14.5
Calcium	11.0
Cadmium	0.011
Iron	0.89
Potassium	36.0
Manganese	0.184
Sodium	800
Chloride	730
Ammonia (as Nitrogen)	0.13
Total Dissolved Solids	1880

MONITOR WELL 2

ORGANIC COMPOUNDS	CONCENTRATION (ug/L)
Methylene Chloride	6 J
Acetone	2 J
2-Butanone	2 J

INORGANIC PARAMETERS	CONCENTRATION (mg/L)
Aluminum	3.2
Calcium	406
Cadmium	0.006
Potassium	23
Magnesium	42
Manganese	2.08
Sodium	1080
Lead	0.025
Vanadium	0.01
Zinc	0.02
Chloride	1710
Ammonia (as Nitrogen)	0.87
Total Dissolved Solids	4240

MONITOR WELL 3

ORGANIC COMPOUNDS	CONCENTRATION (ug/L)	
Phenanthrene	7	J
Fluoranthene	24	
Pyrene	14	
Benzo(a)Anthracene	11	
bis(2-ethylhexyl) phthalate	2	J
Chrysene	7	J
Benzo(b)Fluoranthene	19	
Benzo(a)Pyrene	8	J
Indeno (1,2,3-cd) Pyrene	6	J
Dibenz(a,H)Anthracene	2	J
Benzo(g,h,I)Perylene	5	J
Methylene Chloride	6	J
Acetone	3	J
2-Butanone	2	J
1,1-Dichloroethane	2	J

Tentatively Identified Compounds	Estimated Concentrations (ug/l)
Unknown PNA (Semi-volatile)	9

INORGANIC PARAMETERS	CONCENTRATIONS mg/L)
Aluminum	1.9
Calcium	111
Cadmium	0.004
Cobalt	0.01
Chromium	0.01
Copper	0.01
Potassium	9
Manganese	0.33
Sodium	665
Nickel	0.02
Vanadium	0.02
Chloride	768
Ammonia (as Nitrogen)	0.41
Total Dissolved Solids	2110

MONITOR WELL 4

ORGANIC COMPOUNDS	CONCENTRATION (ug/L)	
bis(2-ethylhexyl)Phthalate	1	J
Methylene Chloride	4	J
Tentatively Identified Compounds)	**Estimated Concentration**	
Unknown Phthalate	2	J
Unknown Organic Acid	2	J
Unknown (semi-volatile)	4	J
Unknown (semi-volatile)	16	J
Unknown (semi-volatile)	10	J

INORGANIC PARAMETERS	CONCENTRATION mg/L)
Aluminum	17.3
Calcium	192
Cadmium	0.005
Iron	0.2
Potassium	36
Magnesium	104
Maganese	0.74
Chloride	5180
Sodium	0.01
Vanadium	0.02
Chloride	4930
Ammonia (as Nitrogen)	0.37
Total Dissolved Solids	2200

MONITOR WELL 5

ORGANIC COMPOUNDS	CONCENTRATION (ug/L)
Phenanthrene	3 J
Fluoranthene	7 J
Pyrene	3 J
Benzo (a) Anthracene	3 J
bis (2-Ethylhexyl) Phthalate	3 J
Chrysene	3 J
Benzo (b) Fluoranthene	3 J
Benzo (a) Pyrene	2 J
Methylene Chloride	6 J
Aroclor - 1260	0.4 J

Tentatively Identified Compound	Estimated Concentrations
Unknown Hydrocarbon (Semi-volatile)	3 J
Molecular Sulfur	36 J
Unknown (Semi-volatile)	8 J
Organic Acid	14 J
1,1,2-Trichloro-1,1,2-Trifluoroethane	33

INORGANIC PARAMETERS	CONCENTRATION (mg/L)
Aluminum	14.3
Calcium	369
Cadmium	0.004
Iron	1.4
Potassium	29
Magnesium	55
Manganese	1.59
Sodium	11500
Zinc	0.01
Chloride	8730
Ammonia (as Nitrogen)	0.76
Total Dissolved Solids	18100

MONITOR WELL 5 Duplicate

ORGANIC COMPOUNDS	CONCENTRATION (ug/L)
Phenanthrene	2 J
Fluoranthene	3 J
Pyrene	1 J
bis (2-Ethylhexyl Phthalate	2 J
Benzo (b) Fluoranthene	2 J
Benzo (a) Pyrene	1 J
Methylene Chloride	6 J
Aroclor-1260	0.3 J

INORGANIC PARAMETERS	CONCENTRATION (mg/L)
Aluminum	12.5
Calcium	426.0
Cadmium	0.005
Cobalt	0.011
Copper	0.011
Iron	0.520
Potassium	82.0
Magnesium	49.0
Manganese	1.47
Sodium	8900.0
Vanadium	0.026
Chloride	7930
Ammonia (as Nitrogen)	0.870
Total Dissolved Solids	17100

MONITOR WELL 6

ORGANIC COMPOUNDS	CONCENTRATION
Fluoranthane	3 J
Pyrene	1 J
Benzo (a) Anthracene	2 J
bis (2-Ethylhexyl) Phthalate	1 J
Chrysene	1 J
Benzo (b) Fluoranthene	1 J
Methylene Chloride	4 J
2-Butanone	2 J

Tentatively Identified Compounds	Estimated Concentrations (ug/L)
Unknown Alkene	5 J
> C_{18} Hydrocarbon	4 J

INORGANIC PARAMETERS	CONCENTRATION (mg/L)
Aluminum	13.9
Arsenic	0.02
Calcium	606
Cadmium	0.008
Iron	11.8
Potassium	128
Magnesium	61
Manganese	3.78
Sodium	13900
Selenium	0.021
Chloride	4240
Ammonia (as Nitrogen)	11.8
Total Dissolved Solids	37700

MONITOR WELL 7

ORGANIC COMPOUNDS	CONCENTRATION (ug/L)	
Phenol	150	J
4-Methylphenol	200	J
2,4-D,Methyl Phenol	250	J
Benzoic Acid (2)	700	J
Naphthalene	100	J
2 Methylnapthalene	150	J
Acenaphthylene	150	J
Acenaphthene	100	J
Dibenzofuran	150	J
Fluorene	350	J
Phenanthrene	1100	
Anthracene	400	J
Fluoranthene	1400	
Pyrene	700	
Benzo(a)Anthracene	550	
Chrysene	400	J
Benzo(b)Fluoranthene	500	
Benzo(a)Pyrene	250	J
Indeno (1,2,3-cd) Pyrene	200	J
Dibenz (a,h) Anthracene	50	J
Benzo (g,h,i) perylene	150	J
Methylene Chloride	6	J
Acetone	42	
2-Butanone	11	

Tentatively Identified Compound	Estimated Concentrations (ug/L)	
Unknown (semi-volatile)	300	J
Molecular Sulfur	1200	J
Unknown PNA	550	J
Unknown PNA	750	J
Dimethyl Phenol	1000	J

INORGANIC PARAMETERS	CONCENTRATIONS (mg/L)
Aluminum	6.9
Arsenic	0.19
Beryllium	0.01
Calcium	23
Cadmium	0.007

MONITOR WELL 7 (Continued)

INORGANIC PARAMETERS	CONCENTRATIONS (mg/L)
Cobalt	0.12
Copper	0.03
Iron	0.2
Mercury	0.005
Potassium	123
Manganese	0.07
Sodium	36900
Nickel	0.16
Selenium	0.1
Vanadium	0.35
Chloride	54400
Ammonia (as Nitrogen)	6.36
Total Dissolved Solids	96200

MONITOR WELL 8

ORGANIC COMPOUNDS	CONCENTRATION (ug/l)	
Methylene Chloride	6	J
Chloroform	11	

Tentatively Identified Compounds	Estimated Concentrations (mg/L)	
Unknown acid or ketone	38	J
Phthalate	2	J
Molecular Sulfur	10	J

PARAMETER	CONCENTRATION (mg/L)
Aluminum	4.3
Cadmium	0.002
Cobalt	0.02
Iron	28.7
Potassium	6.9
Magnesium	12.6
Manganese	1.0
Sodium	2710
Nickel	0.02
Zink	0.13
Chloride	3550
Ammonia (as Nitrogen)	2.23
Total Dissolved Solids	6900

MONITOR WELL 9

ORGANIC COMPOUNDS	CONCENTRATION (ug/L)	
2-Chlorophenol	200	
1,3-Dichlorobenzene	86	
1,4-Dichlorobenzene	860	
1,2-Dichlorobenzene	320	
4-Methylphenol	45	
2,4-Dimethylphenol	12	
Naphthalene	3400	
2-methyl naphthalene	6	J
2-chloronaphthalene	1700*	J
Phenanthrene	10	J
Fluoranthene	9	J
Pyrene	4	J
Butyl Benzyl Phthalate	3	J
Benzo (a) Anthracene	3	J
Chrysene	2	J
Benzo (b) Fluoranthene	11	J
Benzo (k) Fluoranthene	14	
Benzo (a) Pyrene	4	J
Methylene Chloride	1700	
Trans-1,2-Dichloroethene	70	J
Chloroform	8500	
Benzene	130	J
Toluene	74	J
Chlorobenzene	1000	

Tentatively Identified Compounds	Estimated Concentrations (ug/L)
Naphthalene	1500
Chloronaphthalene	2200
Dichloronaphthalene	2400
Dichloronaphthalene	2400
Trichloronaphthalene	1100
Trichloronaphthalene	690

* Exceeds Calibration Range at 11-fold dilution factor

MONITOR WELL 9 (Continued)

ORGANIC COMPOUNDS	CONCENTRATION (ug/L)

INORGANIC PARAMETERS	CONCENTRATION (mg/L)
Aluminum	22.5
Calcium	1130
Cadmium	0.002
Chromium	0.02
Iron	182
Magnesium	99
Manganese	1.84
Sodium	318
Vanadium	0.05
Zinc	0.02
Chloride	2840
Ammonia (as Nitrogen)	2.1
Total Dissolved Solids	5850

MONITOR WELL 10

ORGANIC COMPOUNDS	CONCENTRATION (ug/L)	
Naphthalene	1	J
bis (2-ethylhexyl) Phthalate	3	J
Methylene Chloride	20	
1,1-Dichloroethane	9	J
Chloroform	270	J
1,1,1-Trichloroethane	3	J
1,2-Dichloropropane	7	J
Trichloroethene	4	J
Tetrachloroethane	3	J

Tentatively Identified Compounds	Estimated Concentrations (ug/L)	
Unknown (semi-volatile)	4	J
Unknown alcohol (semi-volatile)	8	J
Unknown ketone (semi-volatile)	9	J
Unknown (semi-volatile)	7	J
Unknown phthalate (semi-volatile)	2	J

INORGANIC PARAMETERS	CONCENTRATION (mg/l)
Aluminum	6
Calcium	263
Potassium	67
Manganese	0.07
Zinc	0.01
Sodium	2790
Ammonia (as Nitrogen)	8.24
Total Dissolved Solids	7740

MONITOR WELL 11

ORGANIC COMPOUNDS	CONCENTRATION (ug/L)	
Benzoic Acid (2)	11	J
Naphthalene	1	J
2-Chloronaphthalene	2	J
Phenanthrene	1	J
Fluoranthene	2	J
Pyrene	1	J
Benzo(a)Anthracene	2	J
bis(2-Ethylhexyl) Phthalate	3	J
Chrysene	1	J
Benzo(b)Fluoranthene	1	J
Benzo(a)Pyrene	1	J
Indeno (,1,2-cd) Pyrene	1	J
Benzo (g,h,i) Perylene	1	J
Methylene Chloride	7	J
Acetone	14	
Chloroform	1	J
2-Butanone	5	J
Aroclor-1260	0.4	J

Tentatively Identified Compounds	Estimated Concentration (ug/L)	
Unknown Organic Acid (semi-volatile)	13	J
Unknown Phthalate (semi-volatile)	2	J
Molecular Sulfur	83	J
1,1,2-Trichloro-1,2,2-Trifluoroethane	36	

INORGANIC PARAMTERS	CONCENTRATION (mg/L)
Aluminum	3.0
Arsenic	0.01
Calcium	483
Potassium	44
Sodium	1450
Chloride	2300
Ammonia (as Nitrogen)	4.4
Total Dissolved Solids	7990

MONITOR WELL 12

ORGANIC COMPOUNDS	CONCENTRATION (ug/L)
bis(2-ethylhexyl)Phthalate	5 J
Methylene Chloride	7 J
Aroclor-1254	32.0

Tentatively Identified Compounds	Estimated Concentrations (ug/L)
$\geq C_{10}$ Alkane	20 J
$\geq C_{10}$ Alkane	40 J
Unknown (semi-volatile)	100 J
Unknown Hydrocarbon (semivolatile)	55 J
Unknown Hydrocarbon (semi-volatile)	310 J
1,1,2-Trichloro-1,2,2-Trifluoroethane	29

INORGANIC PARAMETERS	CONCENTRATION (mg/L)
Aluminum	6.0
Arsenic	0.01
Calcium	148
Manganese	1.39
Sodium	147
Nickel	0.01
Chloride	550
Ammonia (as Nitrogen)	24.3
Total Dissolved Solids	1500

MONITOR WELL FIELD BLANK

ORGANIC COMPOUNDS	CONCENTRATION (ug/L)
Methylene Chloride	7 J

INORGANIC PARAMETERS	CONCENTRATION (mg/L)
Cobalt	0.01
Copper	0.02
Sodium	1.85
Vanadium	0.02
Total Dissolved Solids	1

APPENDIX H

COAL PILE REFERENCES

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APPENDIX I

OVERVIEW OF MANUFACTURED GAS PLANTS

APPENDIX I

OVERVIEW OF MANUFACTURED GAS PLANTS

In order to provide a background relating to manufactured gas plant processes and associated wastes, an overview is provided below.

HISTORY OF MANUFACTURED GAS PLANTS

Manufactured gas plants had their roots in the 1700s with the discovery that coal carbonization was a major means of producing coal gas, coal tar, light oils, coke, and ammonia liquor. These by-products in turn, in most cases, were utilized as source materials for the production of various materials used in diverse industries. Manufactured gas was initially a major source of fuel for illumination in many cities in England, Germany, and the United States. The manufactured gas industry flourished until as recently as the end of World War II with some catalytic plants in operation through the 1970s.

The uses of manufactured gas grew to include those for which natural gas is utilized today. With the construction of natural gas pipelines, the manufactured gas industry eventually died out. However, with the oil embargoes that occurred in the late 1970s, preliminary feasibility studies and designs were prepared to construct "Syngas" manufacturing facilities again. With the overall lessening of world tension and strides in energy conservation, these plans for Syngas plants have fallen by the wayside along with their ancestors.

In addition to manufactured gas, coal tars and light oils grew to major importance because of their use as base materials for the chemical manufacturing industry. The tars and oils were utilized as base materials for formulation of a variety of products, including: paints and coatings, road tars, roofing and water-proofing materials, pipeline enamels, fiber conduit and fiber pipe saturants, carbon electrode binders, foundry compounds, industrial fuels, and wood preserving oils and chemicals. The refined chemicals from coal tar and from light oil were the starting materials for synthetic organic chemicals of the day, including, for example, dyestuffs, drugs, disinfectants, insecticides, antiseptics, flavoring components, vitamins, food preservatives, perfumes, photographic materials, plastics and elastomers. Coke and tars were used as heating materials in both the domestic (coke only) and industrial sectors.

The commercial recovery and use of coal tar originated in Great Britain during the late eighteenth century, but the commercial recovery of light oil from coal gas was started in Germany during the late nineteenth century. In the United States, prominence in the manufactured gas industry occurred during the period between and including the two world wars. Commercial use of such processes in this country dates back to the early 1800s The northeastern cities of Baltimore, Boston, and New York installed plants for the production of illuminating gas in the early 1800s.

Tar distillation was established as a separate industry in Philadelphia in the late 1800s. Metallurgical coke for steel production was first generated in by-product ovens in Johnstown, Pennsylvania, in the late 1800s. Many of the manufactured gas plant sites operating throughout Pennsylvania were actually not manufacturing sites, but purifier sites, processing the by-product gases from the steel industry's coke ovens.

Peak production of coal tar products in the U.S. occurred in the years prior to World War II. This was a period of marked changes in coal tar product patterns. Petroleum asphalts became favored over road tars produced from coal and demand decreased drastically. Creosote production fell because of reduced demand for creosoted crossties by American railroads. Light-oil recovery decreased due to foreign imports and the growing use of petroleum-derived products. As natural gas became available by pipeline in the Northeast, it was no longer economically feasible to maintain aging facilities for production of manufactured gas for domestic use.

MANUFACTURED GAS PROCESSES

Introduction

The manufactured gas processes changed significantly over the years that the industry operated. However, an overview of the basic process would include the following three general operations:

- Distillation -- The heating of coal or coke to drive off organic carbon-based materials (in the presence of steam, in some cases).

- Condensation -- Cooling of the coal gas to remove the condensible fraction (tars).

- Purification -- Washing and/or making contact with iron oxide-soaked chips to remove toxic materials from the gas.

In addition to these three processes, enrichment processes were utilized in some cases. For example, carburetion was one of the earliest enrichment processes in which a petroleum distillate was mixed with the hot gases and cracked in a brick chamber. Later enrichment processes utilized catalysts to modify the chemical makeup of the gas constituents.

The coal or water gases that were manufactured were chemically made up of a mixture of hydrogen, methane, carbon monoxide, nitrogen, and carbon dioxide. Trace quantities of cyanide and sulfuric compounds were also present.

The heat value of the manufactured gas varied widely based upon such factors as retort type and temperature, type of coal, and enrichment process. However, the general range was between 100 and over 1,000 Btu/cubic ft.

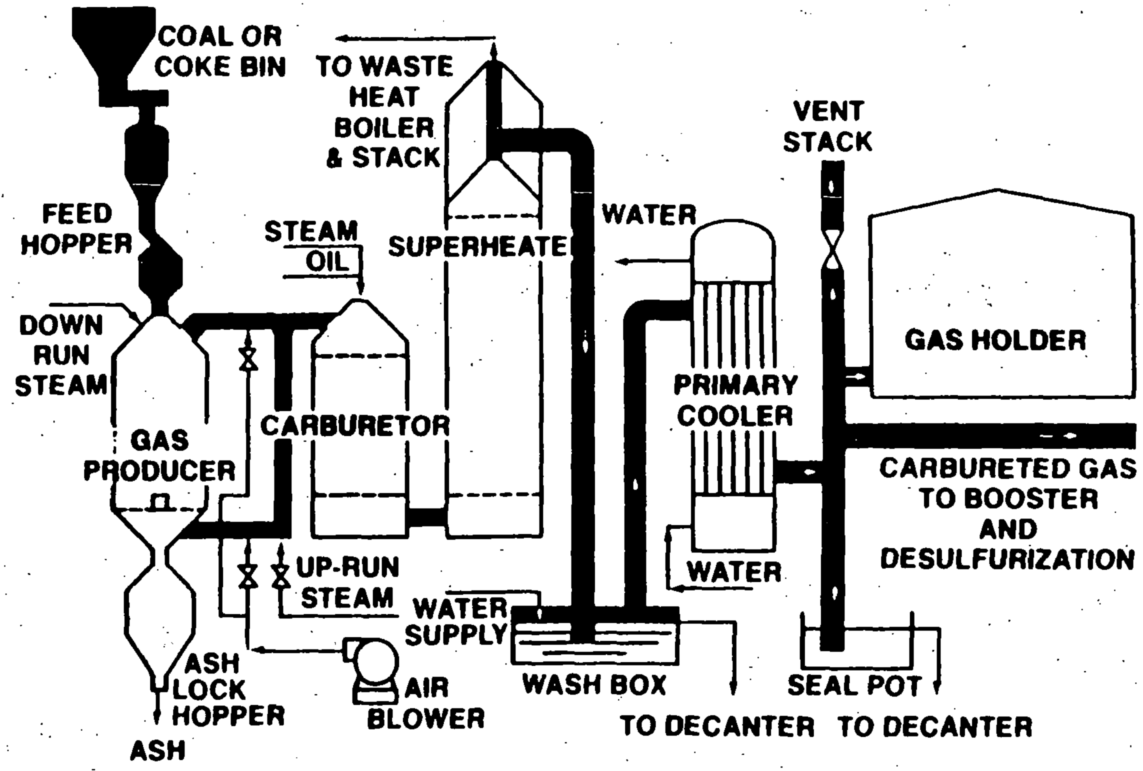
Manufactured Gas Processes

Companies sold gas from three basic types of processes as addressed in this report, specifically: carbureted water gas, coke oven gas, and catalytically cracked gas.

Carbureted water gas is basically an enriched blue gas that is a mixture of carbon monoxide and hydrogen with a heating value of approximately 300 Btu/cubic ft. The blue gas is produced by passing steam over incandescent coke with a resultant endothermic reaction. The hot blue gas is then enriched in a carburetor with a petroleum distillate (e.g., Bunker C), and then passed through a superheater (e.g., a preheated brick chamber) to crack the distillate. Figure 1 is a flow diagram of a typical water gas producer. The process is cyclical to control excessive nitrogen and carbon dioxide contamination of the gas, as well as the heating of the carburetor and superheater.

CARBURETED WATER GAS PRODUCER

GAS PROCESS FLOW



Reference: ERT/Koppers

FIGURE 1

Coke oven gas was purchased and purified at the sites which distributed the gas. Coke oven gas is a mixture of hydrogen, methane, carbon monoxide, and illuminants (e.g., ethylene) with a heating value of approximately 500 Btu/cubic ft. The gas is produced in steel coke ovens and is normally cleaned at the steel manufacturing plant for the removal of tars, ammonia, light oils, naphthalene, and some sulfuric compounds, which are sold as separate by-products, prior to sale to a gas distribution company. Figure 2 is a flow diagram of a typical coke oven gas process flow.

Catalytically cracked gas is a mixture of carbon monoxide and hydrogen with a heating value of approximately 300-400 Btu/cubic ft. This process is similar to carbureted water gas in that a low Btu gas is enriched by cracking a petroleum distillate over a nickel oxide catalyst with regulated amounts of steam. Figure 3 is a flow diagram of a typical catalytically cracked gas process.

GAS CLEANUP PROCESS

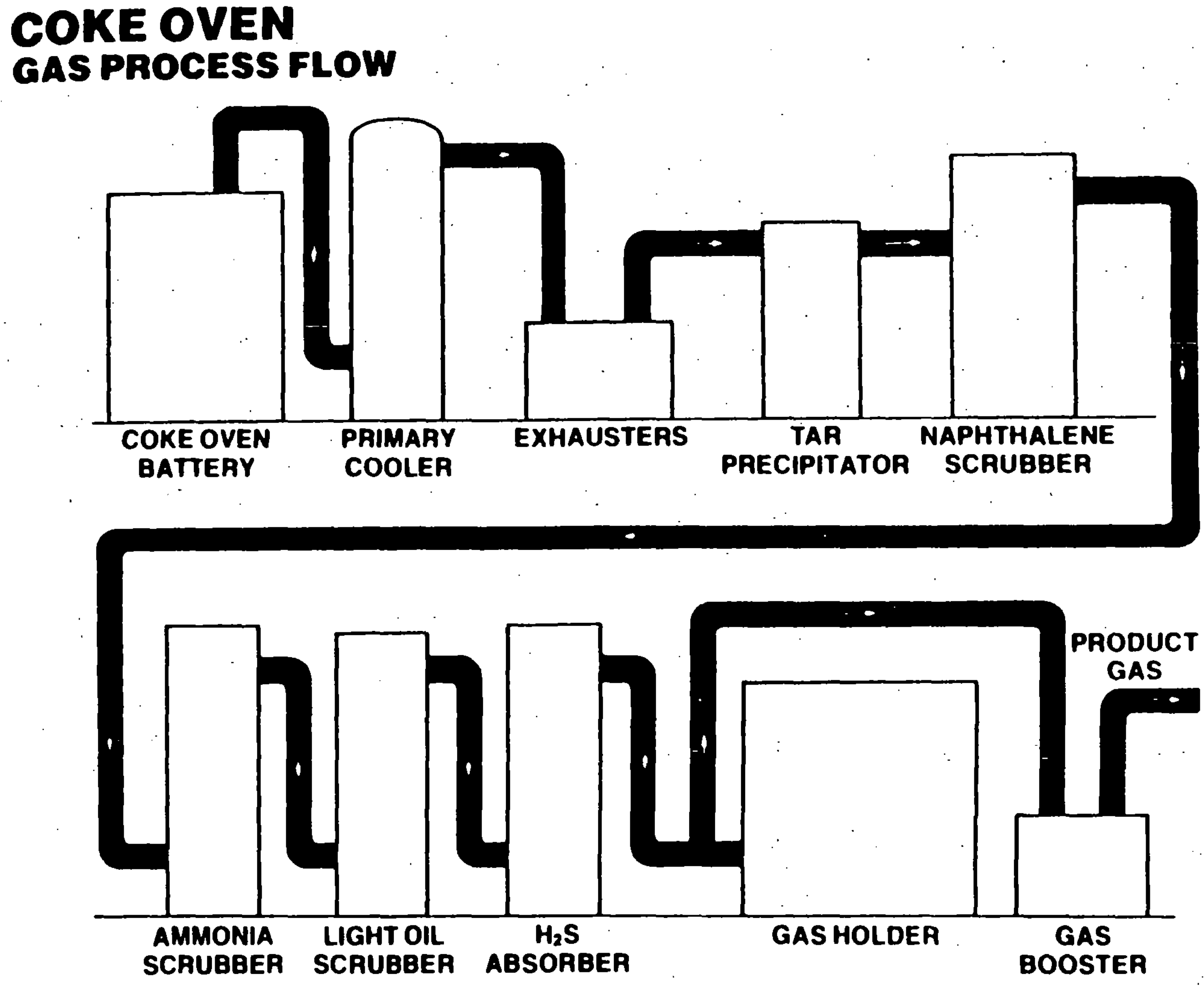
Introduction

Gas cleanup processes vary depending upon the type of gas generation process that was utilized. In general, there are three types of cleanup steps:

- Condensible removal.
- Ammonia scrubbing.
- Toxic compound removal.

All three steps occur primarily at coke oven gas facilities. Other facilities at which carbureted water gas and catalytically cracked gas were produced did not typically include ammonia scrubbing.

The condensible removal results primarily from cooling and washing of the gases. The basic phenomenon that occurs is that of the gas being cooled in either a non-contact heat exchanger or a contact-type washer/cooler. The mixture of organic material that condenses at low temperatures is removed as tar. As previously discussed, the tars were typically sold for further processing or burned as fuel in the gas production process.



Reference. ERT/Koppers

FIGURE 2

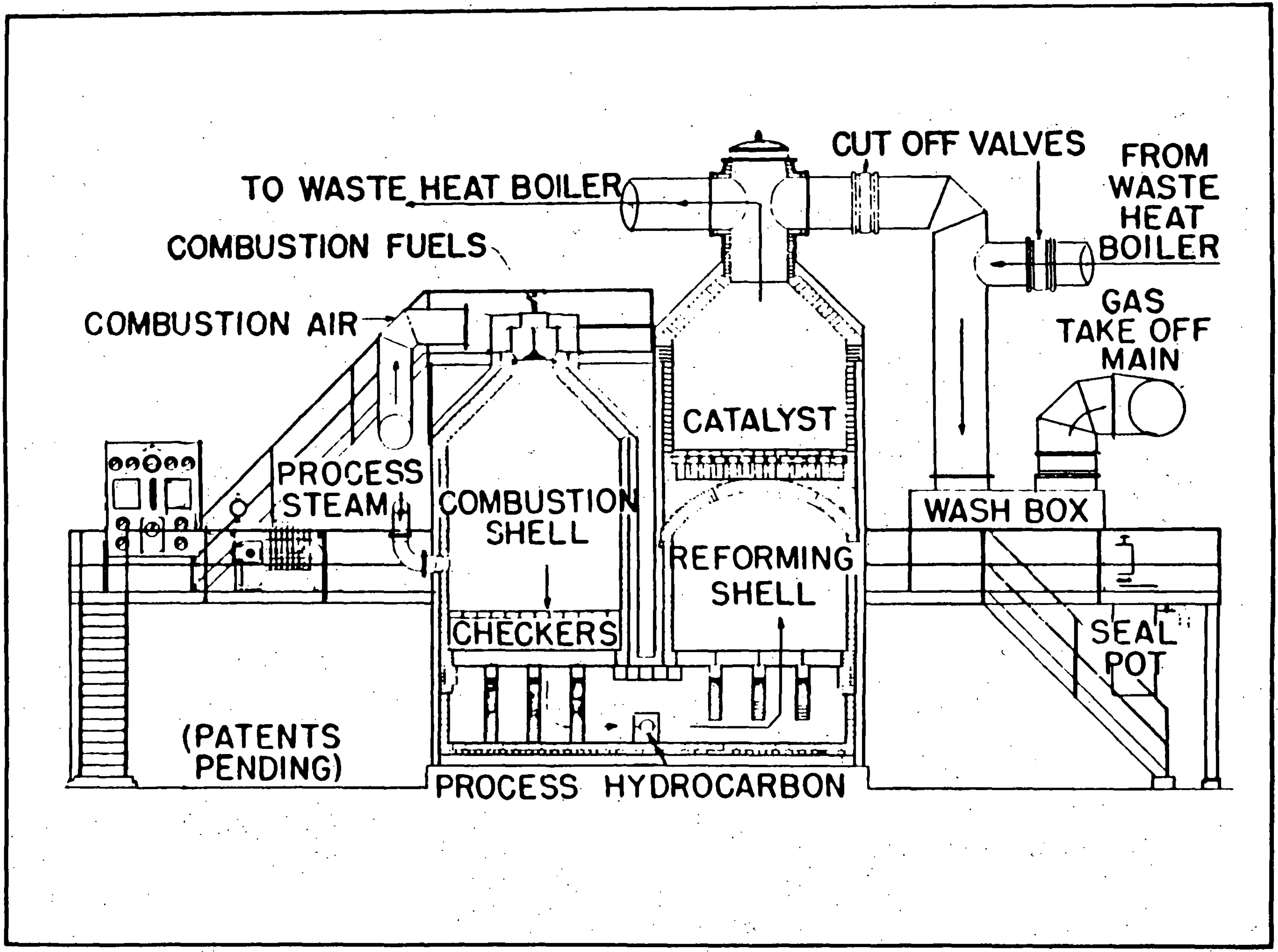


FIGURE 3 CATALYTICALLY CRACKED GAS PROCESS FLOW SHEET

Subsequent to tar removal, toxic compounds (i.e., hydrogen sulfide and cyanide) were removed. The process utilized included fixed bed purifier boxes. The purifier boxes contained wooden chips that were treated with iron oxide. The iron oxide was used as a scavenger for hydrogen sulfide in the gases. The iron oxide was regenerated by cycling the purifier boxes (i.e., blowing air through the beds, releasing sulfur dioxide into the atmosphere). Over time, the iron oxide/wood chip beds lost their usefulness because of the formation of extremely stable ferric/ferrous cyanide complexes on the wood chips. This state was easily detected because the ferric/ferrous cyanide complexes exhibit a bright blue color (i.e., Prussian blue). Disposal of the spent bed material was typically through on-site combustion to fire the retorts or through on/off-site landfill disposal.

BY-PRODUCTS AND WASTES

Introduction

The typical products/by-products and wastes generated at manufactured gas plants are summarized by process in Table 1. Table 2 is a summary of chemical compounds that have been identified in manufactured gas wastes. Many of the by-products identified in Table 1 were typically sold or utilized as a fuel source within the manufactured gas processing plant.

Potential Waste Sources of Concern

In the evaluation of manufactured gas plant sites, the areas of potential concern result primarily from four operations or past practices:

- Spills and leaks of products/by-products during normal operation and closure of facilities.
- Products/by-products that may have been utilized or left in place during closure.
- Deposits of wastes that were deposited on-site.
- Wastewaters that discharged on- and off-site.

The specific concerns relative to these four operations and/or practices listed above include:

- Leaching of metals from ash, slag, and clinkers landfilled on-site.

Table 1

Manufactured Gas Plant Products/By-Products and Wastes

Process	Products/By-products	Wastes
Gasifier or Retorts	Manufactured Gas	Ash Slag Clinkers
Coolers or Washers/Coolers	Tars	Sludges Waste Waters
Purifier Boxes	Cleaned Gas	Spent Iron Oxide

Table 2

Characteristic Chemical Compounds of Manufactured Gas Wastes

perylene
benzo(a)pyrene
cresols
xylenols
triphenylene
dibenzo(a,h)anthracene
trimethylphenol
o-isopropylphenol
chromium
arsenic
benzo(a)anthracene
acenaphthylene
phenanthrene
1-methylanthracene
benzo(g,h,i)perylene
chrysene
phenol
acenaphthene
benzo(b)fluoranthene
indeno(1,2,3-c,d)pyrene
quinoline
benzidine
sulfur
anthracene
fluorene
pyrene
benzo(e)pyrene
benzo(k)fluoranthene
benzo(b)thiophene
carbazole
cadmium
lead
biphenyl
naphthalene
1-methylnaphthalene
2-methylnaphthalene
C_2-naphthalenes
fluoranthene
acridine
indole
aniline
dibenzofuran

Reference: U.S. EPA

- Contamination of soils, groundwater, or surface water by spent iron oxide.
- Contamination of soils, groundwater, or surface water by tars and light oils as a result of past operational spills and leaks, tars or sludges that accumulated within process piping and tanks, and wastewaters.

Leaching of Metals

The leaching of metals is a complex situation. The types of metals that can be found is a function of the metals present in the coal or coke that was originally combusted, their mobility, and the hydrogen ion concentration (pH) of the water that comes in contact with ash, slag, and clinkers. Table 3 characterizes ranges of typical metals that can be found in soils at manufactured gas plant sites. It should be noted that these ranges are a function of the coal type and specific sources and therefore could vary.

Contamination from Spent Iron Oxide

The contamination of soils, groundwater, and surface water by spent iron oxide waste potentially result because they contain high concentrations of sulfur and significant concentrations of various cyanides. Table 4 characterizes compounds that may be identified in spent oxide waste.

The cyanide wastes that were generated vary in chemical form; however, in general, two types of classifications can be utilized (i.e., biodegradable and complex compounds). The biodegradable compounds have broken down or are in the process of breaking down in the soil. The complexed compounds, ferrocyanides, are extremely stable compounds. The ferrocyanides have a distinct color -- Prussian blue -- that, for example, has been utilized in writing inks.

Contamination from Tars

The contamination of soils, groundwater, and surface water by tars, tar acids, tar sludges, and wastewaters is the final area of concern. These wastes are typically a complex mixture of polynuclear aromatic (PNA) compounds and phenols. Table 5 characterizes typical compounds found in manufactured gas plant tars. These compounds are those that raise the highest concern relative to waste from manufactured gas plants. The concern stems from the fact that some of these compounds are known or suspected carcinogens. However, no data exist relative to the increased health risk to humans relative to these compounds. In fact, may of these compounds are also found in fuel oil in our homes, roads and driveways outside our homes, in roofing materials over our homes, and in many other places around us.

Table 3

Characteristic Metal Concentrations Measured in Soil Samples from Eight British Gas Plant Sites

Element	Number of Samples	Concentration Range (mg/kg)
arsenic	208	<1 - 250
boron	83	<1 - 8
cadmium	209	<1 - 64
chromium	145	2 - 250
cobalt	26	4 - 32
copper	108	2 - 250
lead	243	1 - 4,000
mercury	124	<1 - 8
molybdenum	26	1 - 32
nickel	83	8 - 250
zinc	125	2 - 1,000

Reference: Wilson and Stevens

Table 4

Typical Analysis of Spent Oxide

	Percent
Free sulfur	44.70
Moisture	18.88
ferric monohydrate	5.26
ferrous monohydrate	6.25
Basic ferric sulfate	1.25
ferric ammonium ferrocyanide	3.80
ferrocoferric ammonium ferrocyanide	2.50
ferric pyridic ferrocyanide	1.20
Organic matter peat fiber	4.68
Tar	1.21
silica	1.05
naphthalene	0.72
pyridine sulfate	0.77
ammonium sulfate	2.06
calcium sulfate	0.12
ferrous sulfate	0.02
ammonium thiocyanate	1.30
Sulfur otherwise combined	1.33
Organic matter soluble in alkalies (humus)	1.54
Combined water and loss (by difference)	2.36
	100.00

Reference: Hill

Table 5

Characteristic Compounds Found in Manufactured Gas Plant Tars

---

benzene
toluene
xylenes
phenol
cresols
xylenols
pyridine
naphthalene
methylnaphthalenes
dimethylnaphthalenes
acenaphthene
carbazole
fluoranthene
anthracene
phenanthrene
fluoranthene
pyrene
chrysene
benzo(a)anthracene
benzo(k)fluoranthene
benzo(a)pyrene
perylene
benzo(g,h,i)perylene
benzo(b)chrysene
dibenzo(a,h)anthracene

Reference: ERT/Koppers

In general, there are three pathways that concern humans relative to these compounds: breathing, eating/drinking, and direct skin contact. The breathing pathway is especially important for volatile aromatics, such as benzene, and particular forms of PNAs. The only OSHA standard for breathing these materials is known as the Coal Tar Pitch Volatile (CTPV) standard. The CTPV standard, which if exceeded would require respiratory protection, is analogous to the exposure that an individual would receive seated in a compact car while one cigarette was being smoked by another individual in the car. There are no other OSHA standards for other exposure pathways.

In summary, there is little documented information on the risk associated with manufactured gas tars. The hypothetical concerns relate to potential long-term effects of exposure of humans to high concentrations of compounds which have been shown to increase the risk of cancer in laboratory animals. The health risk to humans from manufactured gas plant tars will require greater study over the next few years; however, based upon information available now, equivalent risks from these tars have not been documented as being statistically greater than risks encountered by many people from typical sources found around the home or workplace.

APPENDIX J

PHASE II
TECHNICAL OPERATION PLAN

APPENDIX J

PENNWALT PHASE II
EAST PLANT
WYANDOTTE, MICHIGAN

TECHNICAL OPERATION PLAN

1.0 SOIL TRENCHING AND SOIL SAMPLING

1.1 HALOWAX AREA

1.1.1 Test Pits

WESTON will conduct three days of backhoe excavations, to visually delineate the extent of contaminated soils in the Halowax area. Suspected contaminated soils have a black, oily, stained appearance. No chemical analysis of test pit samples will be performed. Locations of test pits will be determined by WESTON personnel during a site visit prior to the start of backhoe activities.

1.1.2 Test Borings

Approximately 12 test borings will be installed in and around the Halowax area to verify the horizontal and vertical extent of contamination. Test borings will be located following the evaluation of the test pit activities.

Four samples per boring will be retained for HSL semi volatile analysis. Two samples per boring will be collected from the fill and coarse grained native soils overlying the clay stratum. Two samples per boring will be collected from the clay unit. The samples collected from the clay unit will be collected at intervals approximately 2 to 3 ft and 5 to 6 ft below the top of the clay. It is anticipated that four of the test borings will be located in the contaminated zone and eight of the borings will be located on the perimeter of the contaminated zone. Table 1 summarizes analytical soil sampling to be conducted during PHASE II activities.

1.2 TP-28 AREA

1.2.1 Test Pits

WESTON will conduct two days of backhoe trenching excavations to visually delineate the boundaries of the

Table 1

PHASE II SOIL SAMPLING

Location	Semi-Volatiles	Pest./PCB	Inorganics
Halowax	52	3	N/A
TP-28	35	19	N/A
SS-16, 17, 18	N/A	N/A	6
Field Blank	3	1	1
Duplicates	6	2	1

former burn pit. No analytical sampling will be conducted during test pit activities. Locations of test pits will be determined by WESTON personnel during a site visit prior to the start of backhoe activities.

1.2.2 Test Borings

Approximately eight test borings will be performed in the TP-28 area to verify the horizontal and vertical extent of contamination related to burn pit activities. Test borings will be located following the evaluation of test pit activities. Four samples per boring will be retained for HSL semi-volatile analysis and two samples per boring will be retained for Pesticide/PCB analysis. Samples will be collected from the fill and coarse grained native soils and from the underlying clay stratum. Samples obtained from the clay unit will be collected at intervals approximately 2 to 3 feet and 5 to 6 feet below the top of clay. It is anticipated that two of the test borings will be located in the former burn pit and six test borings will be located on the perimeter of the burn pit.

1.3 SS-16, 17, 18 AREA

1.3.1 Soil Sampling

Hand auger borings will be completed at each of these sampling locations. Two samples will be collected from each boring: One sample will be obtained from 0.5 to 1.0 feet, and one sample from 1.0 to 1.5 feet. Samples collected from this area will be analyzed for HSL metals to determine depth and concentrations of metals previously found on the surface at these locations.

2.0 GROUND WATER SAMPLING AND WATER LEVEL MEASUREMENTS

2.1 Ground Water Sampling

WESTON will collect ground water samples from monitor wells MW-7, MW-8, MW-9, and MW-12 to confirm the analytical results obtained during Phase I efforts. Table 2 summarizes the sampling locations and parameters to be analyzed during this effort.

Table 2

PHASE II GROUND WATER SAMPLING

Location	Volatiles	Semi-Volatiles	Pest./PCB	Inorganics	Field Parameters
MW-7	N/A	1	N/A	1	1
MW-8	1	N/A	N/A	N/A	N/A
MW-9	1	1	N/A	N/A	N/A
MW-12	N/A	N/A	1	N/A	N/A
Trip Blank	1	N/A	N/A	N/A	N/A
Field Blank	1	N/A	N/A	1	1
	4	3	2	2	2

N/A = Not Analyzed

2.2 GROUND WATER LEVEL MEASUREMENTS

A maximum of four complete rounds of surface and ground water measurements will be obtained to establish typical ground water flow direction at the East Plant site.

3.0 SAMPLING PROCEDURES

3.1 Soil Sampling

Continuous samples of the fill and native coarse grained soils shall be collected utilizing hollow stem auger and split spoon techniques. Following the penetration of the first split spoon sample into the clay unit, five foot continuous core sample will be obtained from the clay stratum. Utilization of a 5 foot continuous core sampler in the clay will minimize sample contamination from the overlying saturated fill and native soils. An HNu Photoionization detector or an OVA flame ionization detector will be used to monitor soil organic vapors during drilling activities. Soil samples will be collected for laboratory analysis based on visual observations and organic vapor readings.

Representative soil samples from laboratory prepared split spoons and continuous core samples will be placed in appropriate sample bottles and sealed with teflon lined screw tops. Each sample container will be labeled to identify: boring number, depth, and date of collection. Collected samples will be packed with ice in an insulated cooler and will be shipped following chain-of-custody procedures to WESTON's Stockton, California Laboratory. All pertinent data will also be recorded in the field log book by the field team leader.

3.2 GROUND WATER SAMPLING

Phase II ground water sampling will adhere to the following procedures:

1. Measure and record the depth to water from the top of the PVC casing. All measuring devices used in the well must be thoroughly rinsed with distilled water prior to use.

2. Subtract the depth to the top of the water from the depth to the bottom of the casing to determine the height and volume of standing water in the casing.

3. Using a pump or bailer, remove a quantity of water from the well equal to three to five times the calculated volume of water in the well. If the well recharge is found to be excessively slow following the removal of the first volume, the well will be allowed to recharge and this second volume of water will be collected for analysis.

4. Using a bailer, obtain a sample for chemical analyses after pumping or bailing is complete.

5. All sampling equipment will be decontaminated after sampling to prevent cross contamination between sampling wells. Materials incidental to sampling such as bailer ropes and tubing will also be flushed with distilled water or discarded between wells. Sampling equipment will be protected from the ground surface by clean plastic sheeting.

6. All samples for chemical analyses will be placed in specially prepared bottles. The bottles will be filled to the top and capped securely. Each filled sample bottle will be placed in an insulated ice chest immediately after sampling and delivered to WESTON's laboratory.
   Equipment for sampling wells includes the following:

- Well measuring apparatus
- Suction pump and tubing
- Teflon bailer

3.3 ANALYTICAL PARAMETERS

All samples will be sent to WESTON's laboratory in Stockton, California for analysis. Parameters to be analyzed for are listed in Table 1. WESTON's laboratory is USEPA certified and all analytical work will be done according to acceptable EPA protocols.

4.1 HEAVY EQUIPMENT DECONTAMINATION

Prior to coming on site, the drilling rig and backhoe will be thoroughly steam cleaned. Subsequently, drilling equipment (augers, spoons, rods, etc.) will be steam cleaned between boreholes and the backhoe bucket, peds and tires will be steam cleaned between test pit areas or at least at the end of day. All split spoons and associated sampling equipment will be cleaned between samples using a detergent wash and deionized water rinse according to procedures outlined for ground water sampling in the following Section 4.2

4.2 GROUND WATER SAMPLING DECONTAMINATION

Split spoons and the pump and bailer used for ground water sampling, as well as other miscellaneous sampling equipment, shall be decontaminated between sample locations. If a pump is used, it will be decontaminated by submerging the intake of the pump first in a washing solution (Alconox-type detergent) and then in clean potable water, and pumping these solutions through the pump system.

The procedure for decontaminating the sampling equipment is as follows:

1. Place used equipment (i.e., bailers, pumps, buckets, etc.) on plastic ground sheet at the head of the "decon line."

2. Rinse equipment in tub of potable water to remove surface dirt and mud, if necessary.

3. Scrub equipment with a bristle brush in a basin filled with detergent and potable water.

4. Rinse detergent off in a tub of potable water.

5. Final rinse with deionized water.

6. Place decontaminated equipment on clean plastic ground sheet for transport.

5.0 QUALITY ASSURANCE

The quality assurance effort for a sampling program is developed to demonstrate that sampling procedures, sample storage and sample transport do not alter the composition of the sample in a way that would effect the concentration or the identification of the analyte being determined.

An additional purpose of the quality assurance effort is to determine that contaminants are not introduced into the sample during the sampling process.

The types of quality assurance samples that are included in the sampling quality assurance program at the Pennwalt site will include:

- Field Blanks - A field blank is collected after the equipment has been decontaminated. The blank sample is obtained by "collecting" a sample of DI water using the same sampling procedures that are used for the actual samples.

- Trip Blanks - The purpose of the trip blank is to document that the integrity of samples maintained through transportation of the samples. Trip blanks consist of appropriately prepared sample bottles that are filled with DI water prior to leaving for the field. The blanks are carried to the field. Following sampling, the blanks are packed with the samples and returned to the laboratory for analysis. The trip blank sample bottles should not be opened after filling and prior to analysis. Trip blanks will be obtained for VOA samples only.

- Field Duplicates - The purpose of a field duplicate is to document the reproducibility of the results and the representativeness of the samples collected. Field duplicates of ground water samples are not split or replicate samples. Collection of a field duplicate sample requires re-collection of the sample using the same procedures as used for collection of the first sample. The duplicate should be collected immediately after the first sample.

6.0 SITE SAFETY

All the proposed borings may encounter soil or ground water contamination, but not at levels which pose an imminent health threat. Therefore, level D safety protection will be in effect with continuous air monitoring with an organic vapor detector (HNu or OVA). Respiratory (Level C) protection will be immediately available should air monitoring show the presence of vapor levels in the working space at levels exceeding pre-determined action levels. A complete safety plan will be prepared to the start of field activities and will be available on site. The preliminary Safety Plan for this project is attached at the end of this sampling Plan. It will be finalized and approved by WESTON's Corporate Health and Safety Director before field work is started.

Level D Safety Equipment

- Steel-Toe Safety Boots
- Cotton Work Gloves
- Cotton Overalls
- Hard Hats
- Disposable Booties

Level C Safety Equipment

- Steel-Toe Safety Boots
- Neoprene Gloves over Surgical Gloves
- Respiratory Protection (Full Face Respirator with Organic Vapor Cartridges)

- Tyvek Coveralls)
- Hard Hats
- Disposable Booties

APPENDIX K

PHASE II
TEST PIT DESCRIPTIONS
SOIL BORING DESCRIPTIONS

HALOWAX AREA
TEST PIT DESCRIPTIONS

PHASE 2 TEST PIT INVESTIGATION

HALOWAX AREA

TRAVERSE TPH-50

TEST PIT NO.	DEPTH (INCHES)	SOIL DESCRIPTION	9-16-86
50-1	0-18	Olive brown, gray gravelly sandy silt.	
	18-19	Layer of tar material.	
	19-60	Dark gray gravelly slag.	
	60-72	Brown fibrous peat, slightly oily at 60".	
	72-84	Gray sandy clay.	

Water filled pit to 30" below ground surface.
Backhoe hit and broke 8" decommissioned clay pipe at approximately 48" below ground surface.

OVA = 5-7ppm

TEST PIT NO.			9-16-86
50-2	0-18	Olive brown, gray gravelly sandy silt.	
	18-19	Layer of tar material.	
	19-60	Dark gray gravelly slag, oily appearance above peat.	
	60-72	Brown fibrous peat, not saturated.	

Water filled pit to 30" below ground surface.

OVA 3-4ppm

PHASE 2 TEST PIT INVESTIGATION

HALOWAX AREA

TRAVERSE TPH-51

TEST PIT NO.	DEPTH (INCHES)	SOIL DESCRIPTION	9-16-86
51-1	0-18	Dark brown gravelly silty sand.	
	18-48	Fine to coarse gravelly sand.	
	48-54	Brown fibrous peat.	
	54-65	Fine sandy clay.	

Oil stained water seeping into pit at 24" and filling pit to 36" below ground surface. Water has oily sheen on surface.

OVA = 35ppm

TEST PIT NO.			9-16-86
51-2	0-54	Gravelly silty ash fill with red bricks.	
	54-60	Brown fibrous peat.	
	60-78	Fine sandy clay. Slight oil sheen on soil and water surface.	

Backhoe hit and broke 8" clay pipe at 36" below ground surface.

OVA = 8-10ppm

PHASE 2 TEST PIT INVESTIGATION

HALOWAX AREA

TRAVERSE TPH-52

TEST PIT NO.	DEPTH (INCHES)	SOIL DESCRIPTION	9-15-86
52-1	0-24	Black fine sandy silt fill.	
	24-60	Brown gravel, trace oily slag fill.	
	60-72	Gray clay, very plastic.	

Water filled pit to 30" below ground surface with a slight oil sheen on water surface.

OVA = 5ppm

TEST PIT NO.			9-15-86
52-2	0-24	Black fine sandy silt fill.	
	24-60	Brown gravel and slag fill, slight oil staining.	
	60-72	Gray very plastic clay.	

Water filled pit to 30" below ground surface with a slight oil sheen on water surface.

OVA = 12-15ppm

PHASE 2 TEST PIT INVESTIGATION

HALOWAX AREA

TRAVERSE TPH-52

TEST PIT NO.	DEPTH (INCHES)	SOIL DESCRIPTION	9-15-86
52-3	0-24	Black fine sandy silt fill material.	
	24-48	Brown gravel and slag fill. Black oily staining below 30".	
	48-72	Gray clay, very plastic.	

Water filled pit to 30" below ground surface.

OVA = 25-30ppm

TEST PIT NO.			9-15-86
52-4	0-24	Black fine sandy silt fill.	
	24-48	Brown gravel and slag fill. Black oil staining below 30".	
	48-60	Mixed fill; predominantly wood rubble.	
	60-72	Gray clay plastic.	

OVA = 25-30ppm

PHASE 2 TEST PIT INVESTIGATION

HALOWAX AREA

TRAVERSE TPH-52

TEST PIT NO.	DEPTH (INCHES)	SOIL DESCRIPTION	9-16-86
52-5	0-60	Black gravel ash and slag fill.	
	60	Gray brown clay, trace oil staining above clay.	

Water seeping in at 30" below ground surface.

OVA = 1-2ppm

TEST PIT NO.			9-16-86
52-6	0-18	Dark brown, gray gravelly sandy silt ash fill.	
	18-54	Gravelly slag and construction rubble.	
	54-66	Fine sandy clay.	

Water filled pit to 22.8" below ground surface, no apparent oil staining.

OVA = 1-3ppm

PHASE 2 TEST PIT INVESTIGATION

HALOWAX AREA

TRAVERSE TPH-52

TEST PIT NO.	DEPTH (INCHES)	SOIL DESCRIPTION 9-16-86
52-7	0-24	Black gravelly sandy silt, some construction rubble.
	24-60	Black gravelly slag.
	60-72	Dark brown peat with metal and wood scraps.
	72-84	Blue gray sandy clay, very plastic.

Water filled pit to 18" below ground surface, no apparent oil staining.

PHASE 2 TEST PIT INVESTIGATION

HALOWAX AREA

TRAVERSE TPH-53

TEST PIT NO.	DEPTH (INCHES)	SOIL DESCRIPTION	9-15-86
53-1	0-24	Black gravelly silty sand fill.	
	24-48	Mixed fill, concrete, glass and wood. Slight oil staining on saturated soils.	

Water filled pit quickly to 24" below ground surface with a slight oil sheen on water surface.

OVA = 5ppm

TEST PIT NO.			9-15-86
53-2	0-24	Black gravelly sandy silt fill material.	
	24-60	Black shale and slag fill with concrete and wood rubble, very porous, slight oil staining.	

Water filled pit to 29" below ground surface with oil sheen on water surface.

OVA = 20ppm

PHASE 2 TEST PIT INVESTIGATION

HALOWAX AREA

TRAVERSE TPH-53

TEST PIT NO.	DEPTH (INCHES)	SOIL DESCRIPTION	9-15-86
53-3	0-18	Black gravelly sandy silt.	
	18-72	Shale, concrete, glass and wood fill; very porous. Oil staining.	

Water seeping into pit at 24", and filling to 32.4" below ground surface. Water has oil sheen on surface.

OVA = 40ppm

TEST PIT NO.			9-15-86
53-4	0-24	Black gravelly sandy silt fill.	
	24-42	Gray clay fill; very plastic.	
	42-75	Black wet gravelly silty sand, glass and wood fill.	

Oily water seeping into pit at 24" below ground surface. Standing water at 46" with very oily sheen on water surface.

OVA = 70ppm

PHASE 2 TEST PIT INVESTIGATION

HALOWAX AREA

TRAVERSE TPH-53

TEST PIT NO.	DEPTH (INCHES)	SOIL DESCRIPTION	9-15-86
53-5	0-42	Black gravelly sandy fill, construction rubble; glass and wood.	
	42-72	Black, wet, oily mixed fill.	

Water seeping into pit at 24" and filling pit to 52" below ground surface.

OVA = 40ppm

TEST PIT NO.			9-15-86
53-6	0-18	Black gravelly sandy silt fill.	
	18-24	Black slag fill.	
	24-78	Black gravelly fill, mixed rubble; bricks, shale.	

Water seeping into pit at 24" and filling pit to 50" below ground surface. Water has oily appearance.

OVA = 150ppm

PHASE 2 TEST PIT INVESTIGATION

HALOWAX AREA

TRAVERSE TPH-54

TEST PIT NO.	DEPTH (INCHES)	SOIL DESCRIPTION	9-15-86
54-1	0-24	Black sandy silt ash fill.	
	24-60	Fine to coarse gravelly, slightly oily slag.	
	60-78	Blue gray clay.	

Water filled pit to 24" below ground surface. Water has slight oil sheen on surface.

OVA = low detectable readings

TEST PIT NO.			9-15-86
54-2	0-24	Black sandy silt ash fill.	
	24-60	Fine to coarse gravelly slag.	
	60-72	Mixed construction rubble; wood, metal.	
	72-84	Gray clay.	

Water filled pit to 24" below ground surface. Water has oily sheen on surface.

OVA = 1-2ppm

PHASE 2 TEST PIT INVESTIGATION

HALOWAX AREA

TRAVERSE TPH-54

TEST PIT NO.	DEPTH (INCHES)	SOIL DESCRIPTION	9-15-86
54-3	0-24	Black sandy silt ash fill.	
	24-60	Fine to coarse gravelly very oily slag.	
	60	Gray plastic clay	

Water filled pit to 18" below ground surface, oil on water surface.

OVA = 8ppm

TEST PIT NO.			9-15-86
54-4	0-48	Black gravelly slag with wood and concrete rubble. Very oily below 30".	

Water filled pit to 30" below ground surface.

OVA = 35ppm

PHASE 2 TEST PIT INVESTIGATION

HALOWAX AREA

TEST PIT - 55

TEST PIT NO.	DEPTH (INCHES)	SOIL DESCRIPTION	9-16-86
55	0-24	Black gravelly sandy silt ash.	
	24-54	Black gravelly slag.	
	54-60	Black stained peat.	
	60-72	Dark gray sandy clay.	

Water filled pit to 30" below ground surface with trace to slight oil sheen on surface.
Oil appears to be laying just above peat and clay.

OVA = 5-6ppm

HALOWAX AREA
SOIL BORING LOGS

WESTON
DESIGNERS CONSULTANTS

WELL LOG

Page 1 of 2

Well No. BH-1 Client PENNWALT Job No. Log By N. Powers
9-24-86

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks HNu [ppm]
	0		0-2'	6"	8 1	1	Black gravelly mixed FILL, REFUSAL at 6" MOVED HOLE BACK CONCRETE at 6"	0
	2		2-4	12"	2 3	2 4	2-4' Brown to Black gravelly SANDY SILT, MIXED FILL SATURATED at 3'	0
	4	S-1	4-6'	18"	3 1	2 1	4-6' BLACK gravelly sand Fill with lenses of olive gray SILTY CLAY	0
	6		6-8	18"	3 1	2 2	6-8' Dark GRAY SILTY CLAY	0
	8		8-10	18"	2 1	1 1	8-10' Gray SILTY Fine sand, moist	0
	10		10-12	24"	4 7	5 7	10-12' BLUE gray SILTY Fine SAND	0
	12		12-14	12"	4 5	6 6	12-19.5 GRAY AND OLIVE gray Fine SAND, WET	0
	14		14-16	24"	4 4	5 6		0
	16	S-2	16-18	24"	4 8	6 12		0
	18		18-20	24"	10 19	14 21		0
	20							

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WELL LOG

Page 2 of 2

Well No. BH-1 Client PennWALT Job No. Log By N. P
9-24-86

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks HNU [ppm]
	20	S-3	19-20	60"			19.5 - 24.6 Dark GRAY sandy CLAY, small pebbles, STIFF, very Firm.	0
	22	S-4	22-24					0
		S-4 dup						
	24						END OF BORING 24'	

WESTON

WELL LOG

Page 1 of 1

Well No. BH-2 Client PENNWALT Job No. Log By N. POWERS
9-24-86

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts	Description	Remarks HNU [ppm]
	0		0-2	18"	5 8 22 6	0-5' Brown to Black gravelly sandy SILT FILL WITH BRICKS & WOOD. SATURATED AT 2'	0
	2		2-4	6"	3 8 2 1		0
	4	S-1	4-6	24"	3 1 1 1	5-7' OLIVE GRAY Fine sandy SILT SLIGHT OIL SHEEN AND BLACK STAINING.	0
	6		6-8	18"	2 1 1 8	7-10' GRAY dk gray Fine sandy silt WITH OIL SHEEN.	0
	8	S-2	8-10	24"	2 4 6 7		1-2 ppm
	10		10-12	24"	5 8 11 15	11-12' GRAY Fine SAND, WET loose above 1" of coarse gravels. OILY Appearance	0
	12		12-14	24	3 4 7 12	13'-21' DARK GRAY very firm sandy CLAY	0
	14		14-16				
	16	S-3	16-21	60"			
	18						
	20	S-4				END OF BORING 21'	

WESTON
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WELL LOG

Page 1 of 2

Well No. BH-3 Client PENNWALT Job No. Log By N. POWERS
9-25-86

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks OVA [ppm]
	0		0-2'	24"	5 7	5 8	0-1.5' BROWN SILTY FILL 1.5-2.0' Black SILTY FILL	0
	2		2-4	18"	4 6	5 11	2.0-4.0' Black and Brown mixed gravelly, SANDY SILT FILL SATURATED AT 3.5'.	0
	4	S-1	4-6	24"	8 4	2 3	4.0-6.0' Same AS ABOVE, OIL SHEEN ON SURFACE	0.5ppm OVA
	6		6-8	12"	7 3	4 2	6.0-8.0 Same AS ABOVE, INCREASE in OIL SHEEN & STAINING	0
	8		8-10	24"	3 1	1 1	8-9' AS ABOVE, INCREASE IN CONSTRUCTION FRAGMENTS, BRICK, wood. 9-10'- Blue gray SILT loam, BLACK OIL STAINED STREAKS.	0
	10	PCB	10-12	24"	5 10	8 11	10-12' Blue gray silt loam to a silty fine sand, oil sheen & slight oil staining.	0
	12		12-14	24"	5 11	8 14	12-15.5' BROWN, Fine to medium sand. Oil sheen and streaked staining.	0
	14	S-2	14-16	24"	5 8	7 11	15.5-24 Dark gray, STIFF, sandy CLAY, small pebbles NO STAINING	1ppm
	16 18 20	S-3	19-24	60"				

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WELL LOG

Page 2 of 2

Well No. BH-3 Client PENNWALT Job No. Log By N P
9-25-86

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks OVA [ppm]
	20		19-24	60"			Dark Gray, stiff sandy clay with small pebbles	0
	22							
		S4						
	24						END. OF BORING 24'	

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WELL LOG

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Well No. BH-4 Client PENNWALT Job No. ________ Log By N. Powers 9-25-86

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks HNU
	0		0-2'	24"	9 4	6 3	4"Brown silty ash Fill to Black Gravelly mixed Fill. SATURATED 1.5'	0
	2		2-4'	24"	4 3	3 2	Black, gravelly silty sand and mixed Fill.	0
	4	S-1	4-6'	24"	3 1	1 1	AS ABOVE.	0
	6		6-8'	6"	1 1	1 3	mixed fill and gravel above blue gray silty Clay loam at 7'.	0
	8		8-10'	24"	2 4	3 6	8-10' Dark gray Silty Fine Sand.	0
	10	S-2	10 12'	24"	1 4	2 7	10-14' Olive gray silty sand with small, fine fibers.	0
	12		12-14'	24"	5 7	6 10		0
	14	S-3	14-16	24"	5 10	7 12	14-15' GRAY SILTY fine sand above 2" of coarse gravelly sand 15-19'	0
	16		16-18	54"			Gray, sandy CLAY, stiff, with small pebbles	
	18	S-4	18-20				END OF BORING 19'	
	20							

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WELL LOG

Page 1 of 2

Well No. BH-5 Client PENNWALT Job No. Log By N. Powers
9-23-86

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks OVA/HNU [ppm]
	0	S-1	0-2'	24"	6 6	5 4	0-6" Dark gray sandy SILty Fill 6"-~~24~~4' Black gravelly silty ~~6o~~ sand Fill, saturated at 6"	0/0
	2		2-4	24"	2 2	2 3		0/0
	4		4-6	21"	2 1	2 1	4-6.5' Black GRAVELLY SILTY FILL, Fine wood chips WET. OUT OF FIll AT 6.5'	0/0
	6	S-2	6-8	24"	1 1	1 3	6.5-~~8~~7.5' GRAY CLAY, WITH SAND LENSES, OIL STAINED, WET.	1/0
	8		8-10	8"	2 4	2 6	7.5-10' OLIVE GRAY SANDY LOAM and sand. WET. OIL SHEEN,	0/0
	10	S-3	10-12	18"	4 9	5 11	10-12' OLIVE GRAY SILTY SAND WITH BLACK STAINING and oil SHEEN ON SATURATUD SURFACE.	0/0
	12		12-14	24"	2 11	4 15	12-13' GRAY SILTY FINE SAND, SLIGHT BLACK STAINING	
	14	S-4	14.5 - 19.5				13-19.5' DARK GRAY Fine SANDY CLAY, VERY FIRM, Pebbles. ~~oil~~ Light brown oil along fractures in clay and ~~in~~ under pebbles	0/0
	16							
	18							

WELL LOG

Page 2 of 2

Well No. BH-5 Client PENNWALT Job No. Log By N.P 9-23-86

Lithology and Well Construction	Depth	Sample No	Interval	Recovery	Blow Counts		Description	Remarks OVA/HNU (ppm)
	19 20		19.5-21.5	18"	4 7	5 9	GRAY Fine sandy CLAY, WET, SOFT.	0/0
	22						END OF BORING 21.5'	

WESTON
DESIGNERS CONSULTANTS

WELL LOG

Page 1 of 1

Well No. BH-6 Client PENNWALT Job No. Log By N. Powers
BWB
9-25-86

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks HNU (ppm)
	0		0-2	24"	4 4	5 3	0-4' Black SILTY GRAVELLY ASH FILL, SATURATED NO OIL STAINING.	0
	2		2-4	20"	2 3	3 4		0
	4		4-6	24"	3 2	4 1	4-6' AS ABOVE, TRACE OILY SHEEN and Napthalene ODOR.	0
	6	S-1 PCB	6-8	24"	1 2	1 1	6-8' AS ABOVE TO 7'. 7-8' Blue gray silty clay loam with oil sheen.	1ppm
	8		8-10	24"	4 6	6 6	8-10' 4" of black oil SATURATED PEAT ABOVE OLIVE gray STAINED silty Fine sand.	0
	10		10-12	20"	4 8	5 10	10-12' STRATIFIED Blue gray silty clay loam and olive gray SILTY SAND. STAINING Throughout	0
	12	S-2	12-14	24"	5 10	8 12	12-13' GRAY SILTY Fine SAND SLIGHT BLACK STAINING 13' GRAY CLAY, Pebbles light brown oil at interface of clay and sand and around pebbles	0
	14	S-3	14-19	60"			14-19' DARK GRAY fine sandy CLAY, STIFF. light brown oil in clay fractures and under pebbles. LAST 12" increase in sand and moister, softer than above	HNU 60ppm in Freshly opened SPOON samples
	16							
	18	S-4						
	20						K-21	
							END OF BORING 19'	

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WELL LOG

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Well No. BH-7 Client PENNWALT Job No. Log By N. Powers
9-29-8

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks OVA [ppm]
	0	S-1 dup.	0-2	18"	4 2	3 1	BROWN SILTY FILL ABOVE Black gravelly slag FILL	0
	2		2-4	6"	1 2	1 1	2-4.5' Black gravelly SLAG FILL SATURATED AT 3'	0
	4		4-6'	24"	1 1	1 3	4.5-5.0' BROWN Fibrous PEAT 5-6' Bluegray sandy silt	0
	6		6-8'	12"	1 2	1 3	6-8' light gray SANDY SILT	0
	8		8-10	20"	4 8	7 10	Olive gray to gray SILTY SAND with peat FIBERS	0
	10	S-2	10-12	24"	8 19	14 24	AS ABOVE to 13.5' SLIGHT OIL SHEEN ON SATURATED SURFACE.	0
	12		12-14	20"	8 14	10 18	13.5'-15.5' GRAY SANDY CLAY, Firm	0
	14	S-3	15-16.5				15.5-17.0' Bluegray CLAY, Firm	
	16		14-19	60"			17-19.0' BROWN Gray CLAY MOIST	0
	18	S-4	17.5-18.5					
	20						END OF BORING - 19.0'	

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WELL LOG

Page 1 of 1

Well No. BH-8 Client PENNWALT Job No. Log By J. SPRATT
N. Powers 9-86

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks OVA [ppm]
	0		0-2	18"	7 3	9 1	light brown gravel and SANDY FILL SATURATED AT 1.0'	0
	2		2-4	12"	4 10	7 12	OLIVE BROWN SAND, Fine to 3' TURNS to CLAYYSILT TO Black gravelly ASH FILL.	0
	4	S-1	4-6'	18"	6 3	8 2	OLIVE BROWN SILTY SAND AND BLACK GRAVELLY SANDY ASH FILL	0
	6		6-8	1.5'	2 2	4 1	ASH FILL, SOME COAL	0
	8		8-10	12"	1 3	3	DARK BROWN SILTY SANDY FILL AUGER REFUSAL AT APPROX 9.5-10.0' TRACE OIL SHEEN	0
	10	S-2	10-12		18 23	42 20	10-11' Coarse cobbles with OIL STAINING 11-11.5' DRY SANDY SILT · HARD PAN.	4-6ppm
	12		12-14	15"	8 12	10 13	11.5-12.0' SANDY CLAY with NATURAL ORGANICS, COARSE GRAVELS. UNKNOWN ODOR	5ppm
	14 16	S-3	15-16				12-14.0' GRAY SANDY CLAY Gold oil droplets on water SURFACE	
	18 20	S-4	17.5-18.5				14-19.0' GRAY FINE SANDY CLAY MOIST! SOFT. NO APPARENT STAINING	0
							END OF BORING - 19.0'	

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WESTON
DESIGNERS CONSULTANTS

WELL LOG

Page 1 of 1

Well No. BH- 9 Client PENNWALT Job No. ______ Log By J. SPRATT
9-26-8

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks OVA [ppm]
	0		0-2	12"	3 2	3	0-6' Brown to Black coarse SANDY SLAG. SATURATED AT APPROX. 2-3'	0
	2		2-4'	18"	3 2	4 1		0
	4	S-1	4-6'	10"	4 3	4 1		0
	6		6-8'	12"	4 2	3 1	6-7.5' Blue gray SILT TO 7.5' 7.5-9.5' Olive gray FINE SILTY SAND to Olive medium SAND	0
	8	S-2	8-10'	12"	5 11	7 14	9.5-14' OLIVE GRAY SANDY CLAY to DARK GRAY sandy CLAY	0
	10		10-12	12"	6 12	10 15		0
	12		12-14	12"	8 15	12 18		0
	14						14-19' GRAY SILTY SANDY CLAY	
	16	S-3	14-19'	60"				0
	18	S-4						
	20						END OF BORING 19'	

K-24

WESTON
DESIGNERS CONSULTANTS

WELL LOG

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Well No. BH-10 Client PENNWALT Job No. Log By J. SPRATT
N POWERS
9-26-86

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks OVA [ppm]
	0		0-2'				0-2' CONCRETE Augered Through.	
	2		2-4'	12"	1 2	1 2	2-4' DARK BROWN-GRAY SATURATED GRAVEL, SLAG	0
	4	S-1 VOA	4-6'		2 1	2 1	4-6' 4" of light gray DRY silty SAND to Black oily stained gravelly SILTY SAND, SLAG. AT interface OF GRAY and Black, purple Streak	40-400 ppm
	6							
	8						CNA reading downhole = 400 ppm Breathing ZONE = 40-60 ppm For approx. 10-15 sec. then went down to 10 ppm	
	10							
	12						END OF BORING 6'	
	14							
	16							

WESTON
DESIGNERS CONSULTANTS

WELL LOG

Page 1 of 1

Well No. BH-11 Client PENNWALT Job No. ______ Log By N. Powers
9-26-8

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks
								OVA (ppm)
	0		0-2'		5 9	7 11	4" of Brown silty ASH FILL To Black gravelly mixed ASH AND FILL Bricks,	0
	2		2-4'		3 3	3 3	Black gravelly mixed Fill SATURATED at 2.5'. TRACE OIL SHeen.	0.5ppm
	4	S-1	4-6		3 1	1 1	AS ABOVE TO 5.5' INCREASE in OIL SHEEN. 5.5-6.0'. BROWN SATURATED PEAT with oil sheen and SLIGHT ODOR	0.5-2ppm
	6		6-8	0"	2 1	1 1	NO RECOVERY	0
	8		8-10	24"	4 5	5 7	Olive Fine sandy silt, moist with fine brown peat fibers to olive sand. DISTINCT OIL SHEEN and Black staining	0
	10	S-2	10-12	24"	5 9	7 11	OLIVE gray SILTY SAND WITH Black and gold oil streaks GRAY SILTY CLAY at 11' DISTINCT OIL SHEEN & STAINING at INTERFACE OF SAND and CLAY.	1-3ppm
	12		12-14'		8 11	9 14	12-14' GRAY SILTY CLAY - NO SIGNS OF OIL OR STAINING AS ABOVE	0
	14 16	S-3	14-19'	60"			Dark GRAY Fine sandy CLAY, stiff with small pebbles. Increase in moisture from 18-19'	
	18	S-4 PCB						0
							END OF BORING 19'	
	20						K-26	

WESTON

WELL LOG

Page 1 of 1

Well No. BH-12 Client PENNWALT Job No. Log By N. Powers

10-6-86

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks HNU (ppm)
	0		0-2'	24"	10 14	13 8	6" of GRAY CEMENT ABOVE Black gravelly silty SLAG FILL	0
	2		2-4'	20"	2 8	2 11	BLACK gravelly SLAG FILL, SATURATED SILTY AT 3.5'	0
	4	S-1	4-6'	24"	8 9	10 6	Black gravelly sandy silt, Less gravel than above. Slight OIL sheen POCKETS OF DRY AREAS	0
	6 8		6-8'	20"	5 6	5 8	6-8' Black Fine sandy silt above olive gray SILTY Fine - med. SAND SLIGHT OIL SHEEN ORGANIC, SEPTIC ODOR.	0
	10	S-2 VOA	8-10'	15"	2 8	5 12	8-10' AS ABOVE - NO OIL SHEEN.	0
	12	S-2A	10-12'	24"	8 15	10 13	10-16' GRAY SANDY CLAY, Firm, STIFF, SMALL pebbles.	0
	14 16	S-3	14-16'	60"			16-19' - GRAY SANDY CLAY, SOFT MOIST, STICKY SMALL PEBBLES	
	18	S-4	18 18.5'					
	20						END OF BORING 19.0'	

WESTON

WELL LOG

Page 1 of 1

Well No. BH-13 Client PENNWALT Job No. Log By N. Powers

10-6-8

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts			Description	Remarks HNU (ppm)
	0		0-2'	18"	4 5	5 6		Dark Brown to Black gravelly Slag some silty sand FILL and coal pieces. SATURATED AT 2.0'	0
	2		2-4'	0"	2 2	2 2		NO RECOVERY	0
	4	S-1	4-6'	24"	1 0½	0½ 1		GRAY SANDY SILT WITH BROWN FIBROUS PEAT TRACE OIL SHEEN ON SURFACE.	0
	6		6-8'	24"	2 4	2 5		Blue gray STICKY SILTY CLAY above OLIVE gray SILTY SAND from 7.5-80'.	0
	8		8-10'	18"	6 12	9 15		8.0-11.5' Olive gray silty SAND to 11.5'	
	10	S-2	10-12'	15"	3 6	6 8		120-18.0' Brown gray, stiff CLAY small pebbles.	
	12								
	14	S-3 dup	14-14.5						
				60"					
	16								
		S-4	17-17.5						
	18							END OF BORING - 18.0'	

BURN AREA
TEST PIT DESCRIPTIONS

PHASE 2 TEST PIT INVESTIGATION

BURN PIT AREA

TRAVERSE TPB-58

TEST PIT NO.	DEPTH (INCHES)	SOIL DESCRIPTION	9-17-86
58-1	0-18	Olive brown sandy silt fill.	
	18-22	White pastey sludge.	
	22-78	Black gravelly slag with construction fill material (wood, logs, brick).	
	78-94	Dark gray sandy clay with brown mottles.	

Water filled pit to 48" below ground surface with slight oil sheen on water surface.

OVA = 3-5ppm

TEST PIT NO.			9-17-86
58-2	0-24	Brown silty sand fill.	
	24-60	Black slag, mixed fill (wood, pipes).	
	60-102	Gray fine sandy clay, oil stained.	

Water entered pit slowly at 36". Standing water at 66" with oily sheen on water surface.

OVA = 10ppm

PHASE 2 TEST PIT INVESTIGATION

BURN PIT AREA

TRAVERSE TPB-59

TEST PIT NO.	DEPTH (INCHES)	SOIL DESCRIPTION	9-17-86
59-1	0-6	Black silty sand, ash fill.	
	6-18	Gray silty sand with brick fragments and rubble.	
	18-30	White concrete structure Backhoe could not dig further.	

TEST PIT NO.			9-17-86
59-2	0-48	Stratified rubble and wet ash fill. Saturated at 36".	
	48 +	Oily saturated ash material.	

OVA = 150-200ppm

TEST PIT NO.			9-17-86
59-3	0-24	Stratified brown sandy silt fill.	
	24-72	Black sludgey rubble, brick and pipe.	
	72-80	Gray, wet clayey sand.	
	80-96	Dark gray, wet, sticky fine sandy clay.	

Water seeping into pit at 36" and filling pit to 66" below ground surface.

PHASE 2 TEST PIT INVESTIGATION

BURN PIT AREA

TRAVERSE TPB-59

TEST PIT NO.	DEPTH (INCHES)	SOIL DESCRIPTION	9-17-86
59-4	0-12	Brown silty sand ash fill above 2 inches of gravelly silty sand.	
	12-30	Black silty fly ash.	
	30-36	White pastey sludge.	
	36-72	Light gray ash, dry, dusty.	
	72-90	Black gray clayey sand.	

Water seeping into pit at 41" below ground surface and filling pit to 78" below ground surface. Water has oil sheen on surface.

PHASE 2 TEST PIT INVESTIGATION

BURN PIT AREA

TRAVERSE TPB-60

TEST PIT NO.	DEPTH (INCHES)	SOIL DESCRIPTION 9-17-86
60-1	0-24	Black sandy silt ash fill.
	24-50	Gravelly slag and fly ash fill with lenses of white pastey sludge. Large pocket of white pastey sludge in north corner at 42". Some metal scrap and wood rubble.
	50-94	Gray, sandy clay slightly plastic.

Water filled pit to 60" below ground surface. No apparent oil staining.

OVA = low detectable reading above background level.

TEST PIT NO.		9-17-86
60-2	0-18	Olive brown silty sand ash.
	18-42	Black gravelly slag with construction fill, concrete.
	42-46	White pastey sludge.
	46-72	Mixed fill: concrete wood and slightly oily slag.
	72-90	Black fine to coarse, oil stained clayey sand.

Water filled pit to 46" below ground surface. Water has slight oil sheen on surface.

PHASE 2 TEST PIT INVESTIGATION

BURN PIT AREA

TRAVERSE TPB-60

TEST PIT NO.	DEPTH (INCHES)	SOIL DESCRIPTION	9-17-86
60-3	0-24	Sandy silt fill.	
	24-54	6" of white pastey sludge above black gravelly slag.	
	54-66	White pastey, sandy sludge.	
	66-72	Black oily gravelly slag with mixed construction fill.	
	72-84	Gray fine to coarse sand.	
	84-96	Dark gray sandy clay	

Water entered pit at 48" and filled pit to of 54" below ground surface.

OVA 25-30ppm

TEST PIT NO.			9-17-86
60-4	0-60	Black ash and silty fine sand, with little wood scrap, dry.	
	60-78	Gray fine sandy clay,dry.	

Water seeping in very slowly at 66", no water standing in pit.

PHASE 2 TEST PIT INVESTIGATION

BURN PIT AREA

TRAVERSE TPB-61

TEST PIT NO.	DEPTH (INCHES)	SOIL DESCRIPTION	9-17-86
61-1	0-18	Dark gray sandy silt, ash fill.	
	18-30	Rust brown gravelly, oxidized hard pan.	
	30-48	Stratified gravelly slag and gray sludge material.	
	48-84	Dark gray sludge mixed with wood and construction rubble.	
	84-102	Dark gray, plastic, fine sandy clay.	

Water filled pit to 66" below ground surface. Trace oil sheen on water surface.
Septic odor.

OVA = 1-3ppm

TEST PIT NO.			9-17-86
61-2	0-12	Olive brown silty sand and gravel.	
	12-90	Gravelly slag and black sludge. Mixed wood and brick construction rubble.	

Water slowly filling pit at 36". Standing water at 60" below ground surface.

OVA = >10ppm

PHASE 2 TEST PIT INVESTIGATION

BURN PIT AREA

TRAVERSE TPB-61

TEST PIT NO.	DEPTH (INCHES)	SOIL DESCRIPTION	9-17-86
61-3	0-12	Olive brown silty sand.	
	12-84	Black gravelly silty slag, increasing amount of construction rubble (bricks, pipes).	
	84-96	Dark gray silty clay.	

Water filled pit to 54" below ground surface. No apparent oil staining.

PHASE 2 TEST PIT INVESTIGATION

BURN PIT AREA

TRAVERSE TPB-62

TEST PIT NO.	DEPTH (INCHES)	SOIL DESCRIPTION	9-17-86
62-1	0-30	Brown gravelly, sandy silt fill, mixed rubble; bricks.	
	30-90	Black oily stained gravelly slag, increase in brick and rubble fill.	
	90-102	Black stained, gray fine sandy clay.	

Water seeping into pit at 42", filling pit to 60" below ground surface.

OVA = 6-8ppm

TEST PIT NO.			9-17-86
62-2	0-30	Brown, gravelly sandy silt fill with mixed rubble.	
	30-34	White paste, sludge material.	
	34-84	Black stained, gravelly, oily slag, mixed rubble; bricks, glass, wire.	
	84-102	Black clayey fine sand.	

Water entering pit rapidly at 48" below ground surface and filling to 54" below ground surface. Water has oil sheen on surface and bottle debris.

BURN AREA
SOIL BORING LOGS

WELL LOG

Page 1 of 1

Well No. BB-14 Client PENNWALT Job No. Log By N. Powers

10-6-86

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks HNU [ppm]
	0	S-1	0-2'	12"	6 14	8 10	0-2' 10" Brown SILT above SATURATED Black mixed Fill, Coal and brick fragments	1ppm
	2		2-4'	18"	6 8	8 6	2-4' Mixed Fill, sandy SILT Cinders, gray ASH, coal pieces	0
	4		4-6'	0			No recovery	
	6		6-8'	0			No recovery PUSHED SPOON IN Black and gray fine sandy SILT	0
	8	S-2 VOA	8-10'		2 2	3 1	8'-10' Brown SANDY SILT mixed with PEAT FIBERS AT 9'. 9-10' Blue gray to gray sandy clay.	0
	10		10-12'	12"			10-12' Blue gray fine SANDY CLAY	0
	12	S-3 VOA	13.5-14' 12-17'	42"			12-17' Brown gray fine sandy Clay Firm, DRY. RUST MOTTLES	
	14							
	16	S-4						
							END OF BORING - 17.0'	
	18							
	20							

WELL LOG

Page 1 of 1

Well No. BB-15 Client PENNWALT Job No. Log By N. Powers

10-7-8

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks
	0		0-2'	24"	3 12	8 16	0-2' GRAY SILTY SAND FILL to Black SILTY SAND CONCRETE PIECES AT 8"	
	2		2-4'	12"	4 5	5 5	2-5.8' Black, wet gravelly silty SAND and mixed Fill; Brick Fragments. SATURATED at 3'.	
	4	S-1	4-6'	24"	2 2	2 2		
	6		6-8'	1.2"	3 2	1 2	5.8-10' Olive sand to GRAY SILTY Fine Sands, some peat Fibers	
	8		8-10'	0			10-12' NO RECOVERY; CAVE IN MATERIAL FROM 10-12' SPOON IS brown silty peat to a blue clayey SAND.	
	10		10-12		2 2	3 2	12-14' Gray sandy clay, SOFT	
	12	S-2 VOA	12-14	10"			14-16' Brown gray dry fine Sandy Clay, very firm small pebbles.	
	14	S-3 dup VOAs	14.5-15				16-19' GRAY BROWN, fine sandy Clay, increase in moisture	
	16							
	18	S-4	18-18.5					
	20						END OF BORING 19.0'	

WELL LOG

Page 1 of 1

Well No. BB-16 Client PENNWALT Job No. Log By N. Powers

10-7-86

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks HNU [ppm]
	0		0-2'	24"	3 4	8 4	0-5' BROWN gravelly SILT and mixed fill; coalpieces, Brick fragments, wire SATURATED at 2.5'	0
	2		2-4'	12"	3 20	4 15		0
	4	S-1	4-6'	15"	3 1	1 2	5.0'-6.0' Black oily stained gravel and mixed Fill as above. OIL SHEEN on surface.	6
	6		6-8'		1 1	3 2	6-8' NO RECOVERY	0
	8	S-2 VOA	8-10'		4 2	3 1	8-10' GRAY, and black stained silty sand	6
	10		10-12'	6"	1 3	2 4	10-12' Blue gray very fine sandy Clay loam, soft. No oil STAINING	0
	12	S-3 VOA	12-13.5					
	14		11.5-16.5	42"			12-15' Blue gray, STICKY sandy clay loam	0
		S-4	15-16				15-16' Olive gray sand	
	16						16-16.5' dark brown, sandy clay, Firm	
	18						END OF BORING - 16.5'	
	20							

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WELL LOG

Page 1 of 1

Well No. BB-17 Client PENNWALT Job No. Log By N. Powers
10-7-8

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks HNu (ppm)
	0		0-2'	24"	2 4	3 5	0-1' Brown fine sandy silt and mixed FILL 1'-7.0'	
	2		2-4'	10"	3 8	8 4	Black gravelly silty sand Fill, with Brick Fragments and cement chips SATURATED AT 1.8'	
	4		4-6'	6"	6 52	8 10		
	6		6-8'	12"	8 4	9 2	7-10' Dark GRAY SILTY SAND WITH PEAT FIBERS at 9-10'	
	8	S-1 voa	8-10'	12"	4 1	5 1		
	10	S-2	10-12'	24"	1 5	3 5	10-16' Blue gray, STICKY sandy Clay loam, SOFT	
	12						16-17'	
	14		12-17'	42"			light Brown, wet sand	
	16	S-3 S-4 dup						
	18						END OF BORING - 17.0'	
	20							

K-40

WELL LOG

Page 1 of 1

Well No. BB-18 Client PENNWALT Job No. ______ Log By T. Marks

10-8-86

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks HNU [ppm]
	0		0-2'	24"	3 12	8 10	0-1.2' Brown SILTY SAND FILL 1.2-6.0'	0
	2		2-4'	20"	2 2	2 1	Brown to dark gray gravelly silty SAND and mixed fill brick Fragments, coal pieces	0
	4		4-6'	16"	7 2	3 1	SATURATED at APPROX 1.8'	0
	6	S-1 VOA's	6-8'	18"	3 1	1 1	6.0-7.5' Brown coarse to medium sand with brick and coal	0
	8		8-10'	12"	1 1	1 3	7.5-8.0' Dark Gray silty fine sand Fuel odor 8.0-10.0'	0
	10		10-12'	12"	1 2	1 2	Green gray SILTY SANDY CLAY 10-12.0' Green gray sandy SILTY CLAY	0
	12	S-2	12-14'	15"	7 10	10 12	12-16.0' Brown Fine to medium Silty SAND	0
	14		14-16'	15"	6 10	6 12	16-20' Brown gray sandy clay, Pebbles, plastic, Firm.	0
	16 18	S-3 VOA S-4	16-20'	48"			INCREASE in MOISTURE K-41	
	20						END OF BORING - 20.0'	

WELL LOG

Page 1 of 1

Well No. BB-19 Client PENNWALT Job No. Log By T. MARKS

10-8-8

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks HNU [ppm]
	0		0-2'	20"	2 22	4 8	0-2.5' Dark gray, gravelly SAND, CONCRETE FILL, MOIST	0
	2	S-1	2-4'	20"	4 8	4 4	2.5-6.0' Light GRAY SOFT ASH DRY	0
	4		4-6'	8"	4 3	5 3		0
	6		6-8'	6"	1 2	1 3	6-8' Black, gravelly silty fine to medium sand SATURATED,	0
	8	S-2 VOA	8-10'	24"	2 3	2 3	8.0-9.3' AS above - SLIGHT ODOR, SATURATED BLACK PASTE-LIKE	HNU = 2ppm in sample jar 0ppm in AIR.
	10		10-12'	15"	1 2	1 2	9.3-15' Green gray silty, sandy CLAY Brown mottling and organic fragments	0
	12		12-14'		2 3	3 5		0
	14 16	S-3 S-4	14-16.5'	30"			15-16.5 Blue green-brown SANDY SILTY CLAY, some GRAVEL.	
	18 20						END OF BORING 16.5'	

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WELL LOG

Page 1 of 1

Well No. BB-20 Client PENNWALT Job No. Log By T MARKS
10-9-86

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks HNU [ppm]
	0		0-2'	18"	2 3	1 12	0-1.8' light brown to pink granular pastey FILL 1.8-2.0' BlACK to brown SLAG.	0
	2		2-4'	1	1 5	1	2-4.0' Buff to Pink pastey FILL WITH Green inclusion	0
	4	S-1	4-6'	15"	1 8	3 9	4-5.3' white pastey fill 5.3-7.0' Dark gray gravelly fill	0
	6		6-8'	14"	2 1	[illegible] 1	7-7.2 white pastey fill 7.2-8.0 Dark brown to black granular fill	0
	8	S-2 VOA	8-10'	14"	3 3	3 3	8-10 Dark gray silty medium SAND	0
	10		10-12'	8"	1 1	1 2	10-13.5 DARK gray clayey SILT. very fine sand and wood frag. at 13.5'	0
	12		12-14'	22"	2 4	3 4	13.5-14' Blue green sandy silty clay with roots.	0
	14		14-19'	36"				
	16	S-3 VOA					16-16.3' Brown, clayey sand with some gravel.	0
	18	S-4					16.3-19.0' Dark olive green sandy clay, plastic.	
	20						END OF BORING - 19.0'	

WELL LOG

Page 1 of 2

Well No. BB-21 Client PENNWALT Job.No. Log By T. MARISS

10-9-

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks HNu [ppm]
	0		0-2'	26"	1 5	2 6	0-8' Dark gray gravelly Mixed FILL, SLAG. SATURATED AT APPROX 2'	0
	2		2-4'	15"	1 4	3 2		0
	4		4-6'	4"	3 1	2 1		0
	6		6-8'	2"	1 2	1 2	84-9.8' Olive green SILTY CLAY with roots.	0
	8	S-1 VOA	8-10'	24"	1 2	2 3	9.8-10' Olive green silty clay medium sand.	0
	10	S-2	10-12'	18"	1 3	1 1	10.8-11' Brown clayey silty fine Sand. 11-11.3' Brown peat. 11.3-12.0' Brown to olive green clayey sand.	0
	12		12-14'	18"	1 2	2 2	12-13.2' Olive brown clayey silty very fine SAND.	0
	14		14-16'	21"	3 8	5 11	13.2-14.5' Blue green sandy CLAY 14.5-14.8' GRAY CLAYEY SAND.	0
	16 18 20	S-3	166-21.6	60"			14.8-21.6 Brown to green gray gravelly, plastic, sandy CLAY Becomes moist towards 21.6'.	0

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WELL LOG

Page 2 of 2

Well No. BB-21 Client PENNWALT Job No. Log By T. MARKS
10-9-86

Lithology and Well Construction	Depth	Sample No.	Interval	Recovery	Blow Counts		Description	Remarks HNU [ppm]
	20							
		S4	16.6-21.6				Green gray gravelly, plastic, SANDY CLAY, MOIST	0
	22						END OF BORING - 21.6'	

BURN AREA
SOIL BORING PROFILING SUMMARY

Burn Area
Soil Boring Profiles
9/30/86

	Depth (in.)	Description	OVA (ppm)	HNu (ppm)
P-1	0-96	White sludge saturated at 36 inches	1-2	0
	96-108	Brown peat	1,000+	1-2
	108-156	Gray sand	1,000+	10
P-2	0-48	Brown to black gravelly fill	1,000+	0
	48-96	Black, very oily fill	1,000+	0
	96+	Gray sand	1,000+	0
P-3	0-84	Brown to black ash fill	1-3	0
	84-108	Gray sand	1-3	0
P-4	0-48	Black ash fill	1,000	High humidity, no measurement
	48-84	Black, oil-stained sludge	1,000	High humidity, no measurement
	84+	Gray sand	1,000	

BUILDING 35A/38A SURFACE SOIL SAMPLE DESCRIPTIONS

Building 35A/38A Surface Soil Sample Descriptions

Surface Sample		Depth (feet)	General Description	HSL Parameters
SS-16	S-1	0.5-1.0 1.0-1.5	Deteriorated concrete Auger refusal	Metals ---
SS-17	S-1	0.5-1.0	Coarse-grained fill with silt and sand	Metals
	S-2	1.0-1.5	Coarse-grained fill with silt and sand	Metals
SS-18	S-1	0.5-1.0	Coarse-grained fill with silt and sand	Metals
	S-2	1.0-1.5	Coarse-grained fill with silt and sand	Metals
Field blank			Water	Metals

APPENDIX L

PHASE II
SOIL LABORATORY ANALYTICAL DATA

Table L-1

Summary of Laboratory Soil Analyses Performed in Building Areas

Surface Sample		Depth (feet)	General Description	HSL Parameters
SS-16	S-1	0.5-1.0	Deteriorated concrete	Metals
		1.0-1.5	Auger refusal	---
SS-17	S-1	0.5-1.0	Coarse-grained fill with silt and sand	Metals
	S-2	1.0-1.5	Coarse-grained fill with silt and sand	Metals
SS-18	S-1	0.5-1.0	Coarse-grained fill with silt and sand	Metals
	S-2	1.0-1.5	Coarse-grained fill with silt and sand	Metals
Field blank			Water	Metals

Table L-2

Summary of Results - BH-1
Halowax Area

Boring Location	Sample No.	Depth (feet)	Compounds Tested For Compound Identified	Concentration (mg/kg)
BH-1	S-1	4-6	BNA's	
			Naphthalene	18
			2-Chloronaphthalene	212
			Dimethyl Phthalate	48
	S-2	16-18	BNA's ND*	
	S-3	19.6-20.6	BNA's ND*	
	S-4	22-24	BNA's ND*	
	S-4 (duplicate)	22-24	BNA's ND*	

*ND = Not detected above lower limit of detection.

Table L-3

Summary of Results - BH-2
Halowax Area

Boring Location	Sample No.	Depth (feet)	Compounds Tested For Compound Identified	Concentration (mg/kg)
BH-2	S-1	4-6	BNA's ND*	
	S-2	8-10	BNA's ND*	
	S-3	16-17	BNA's ND*	
	S-4	19-21	BNA's ND*	

*ND = Not detected above lower limit of detection.

Table L-4

Summary of Results - BH-3
Halowax Area

Boring Location	Sample No.	Depth (feet)	Compounds Tested For Compound Identified	Concentration (mg/kg)
BH-3	S-1	4-6	BNA's	
			1,4-Dichlorobenzene	218
			1,2-Dichlorobenzene	138
			1,2,4-Trichlorobenzene	170
			2-Chloronaphthalene	228
			Dimethyl Phthalate	51
	Not numbered	10-12	PCB's ND*	
	S-2	14-16	BNA's ND*	
	S-3	19-20	BNA's ND*	
	S-4	23-24	BNA's ND*	

*ND = Not detected above lower limit of detection.

Table L-5

Summary of Results - BH-4
Halowax Area

Boring Location	Sample No.	Depth (feet)	Compounds Tested For Compound Identified	Concentration (mg/kg)
BH-4	S-1	4-6	BNA's	
			Phenanthrene	10
			Fluoranthene	14
			Pyrene	12
	S-2	10-12	BNA's	
			ND*	
	S-2 (lab duplicate)	10-12	BNA's	
			ND*	
	S-3	14-15	BNA's	
			ND*	
	S-4	18-19	BNA's	
			ND*	

*ND = Not detected above lower limit of detection.

Table L-6

Summary of Results - BH-5
Halowax Area

Boring Location	Sample No.	Depth (feet)	Compounds Tested For Compound Identified	Concentration (mg/kg)
BH-5	S-1	0-2	BNA's	
			ND*	
	S-2	6-8	BNA's	
			2-Chloronaphthalene	20
			Phenanthrene	23
			Fluoranthene	23
			Pyrene	20
	S-3	10-12	BNA's	
			Naphthalene	10
			2-Chloronaphthalene	269
			Dimethyl Phthalate	60
	S-4	15-16	BNA's	
			ND*	

*ND = Not detected above lower limit of detection.

Table L-7

Summary of Results - BH-6
Halowax Area

Boring Location	Sample No.	Depth (feet)	Compounds Tested For Compound Identified	Concentration (mg/kg)
BH-6	S-1	6-8	BNA's	
			Naphthalene	3
			2-Chloronaphthalene	11
			Phenanthrene	5
			Anthracene	2
			Fluoranthene	5
			Pyrene	3
			Benzo(a)Anthracene	2
			bis(2-Ethylhexyl)Phthalate	4
			Chrysene	2
			Benzo(b)Fluoranthene	1
			Benzo(k)Fluoranthene	2
			Benzo(a)Pyrene	2
			PCB's	
			ND*	
	S-2	12-14	BNA's	
			Napthalene	23
			2-Chloronaphthalene	171
			Dimethyl Phthalate	37
	S-3	14-15	BNA's	
			Naphthalene	23
			2-Chloronaphthalene	132
			Dimethyl Phthalate	28
	S-4	17.5-18.5	BNA's	
			Napthalene	8.6
			2-Chloronaphthalene	78
			Dimethyl Phthalate	16

*ND = Not detected above lower limit of detection.

Table L-8

Summary of Results - BH-7
Halowax Area

Boring Location	Sample No.	Depth (feet)	Compounds Tested For Compound Identified	Concentration (mg/kg)
BH-7	S-1	0-2	BNA's	
			Naphthalene	2.9
			2-Chloronaphthalene	.5
			Phenanthrene	3
			Fluoranthene	5
			Pyrene	5
			Benzo(a)Anthracene	3
			Chrysene	4
			Benzo(b)Fluoranthene	1
			Benzo(k)Fluoranthene	6
			Benzo(a)Pyrene	4
	S-1 (duplicate)	0-2	BNA's ND*	
	S-2	10-12	BNA's ND*	
	S-3	15-16.5	BNA's ND*	
	S-4	17.5-16.5	BNA's ND*	

*ND = Not detected above lower limit of detection.

Table L-9

Summary of Results - BH-8
Halowax Area

Boring Location	Sample No.	Depth (feet)	Compounds Tested For Compound Identified	Concentration (mg/kg)
BH-8	S-1	4-6	BNA's	
			ND*	
	S-2	10-12	BNA's	
			Naphthalene	2
			2-Chloronaphthalene	9.2
			Hexachlorobenzene	0.2 J
			di-n-Octyl Phthalate	0.2 J
	S-3	15-16	BNA's	
			ND*	
	S-4	17.5-18.5	BNA's	
			ND*	

J = Compound identified below lower limit of detection; value shown is estimated.
*ND = Not detected above lower limit of detection.

Table L-10

Summary of Results - BH-9
Halowax Area

Boring Location	Sample No.	Depth (feet)	Compounds Tested For Compound Identified	Concentration (mg/kg)
BH-9	S-1	4-6	BNA's ND*	
	S-2	8-10	BNA's ND*	
	S-3	15-16	BNA's ND*	
	S-4	17-18	BNA's ND*	

*ND = Not detected above lower limit of detection.

Table L-11

Summary of Results - BH-10
Halowax Area

Boring Location	Sample No.	Depth (feet)	Compounds Tested For Compound Identified	Concentration
				(mg/kg)
BH-10	S-1	4-6	BNA's	
			1,3-Dichlorobenzene	3.8
			1,4-Dichlorobenzene	30
			1,2-Dichlorobenzene	10
			Naphthalene	600
			2-Chloronaphthalene	5,100
				(ug/kg)
			VOA's	
			Methylene Chloride	200 J
			Benzene	1,100
			Toluene	230 J
			Chlorobenzene	1,200
			Total Xylenes	690

J = Compound identified below lower limit of detection; value shown is estimated.

*ND = Not detected above lower limit of detection.

Table L-12

Summary of Results - BH-11
Halowax Area

Boring Location	Sample No.	Depth (feet)	Compounds Tested For Compound Identified	Concentration (mg/kg)
BH-11	S-1	4-6	<u>BNA's</u>	
			2-Chloronaphthalene	23
			Hexachlorobenzene	189
	S-2	10-12	<u>BNA's</u>	
			Hexachloroethane	29
			Naphthalene	17
			2-Chloronaphthalene	144
			Dimethyl Phthalate	27
	S-3	15-16	<u>BNA's</u>	
			ND*	
	S-4	18-19	<u>BNA's</u>	
			ND*	
			<u>PCB's</u>	
			ND*	

*ND = Not detected above lower limit of detection.

Table L-13

Summary of Results - BH-12 Halowax Area

Boring Location	Sample No.	Depth (feet)	Compounds Tested For Compound Identified	Concentration
				(mg/kg)
BH-12	S-1	4-6	BNA's	
			Hexachlorobenzene	1
	S-2	8-10	BNA's	
			4-Methylphenol	2
	S-2A	10-12	BNA's	
			ND*	
				(ug/kg)
			VOA's	
			Methylene Chloride	12
			Acetone	289
			Carbon Disulfide	1 J
			1,1,1-Trichloroethane	1 J
			Trichloroethene	3 J
			Tetrachloroethene	1 J
			Toluene	3 J
			Total Xylenes	2 J
	S-3	14.5-16	BNA's	
			ND*	
	S-3 (duplicate)	14.5-16	BNA's	
			ND*	
	S-4	18.18.5	BNA's	
			ND*	
			PCB's	
			ND*	

J = Compound identified below lower limit of detection; value shown is estimated.

*ND = Not detected above lower limit of detection.

Table L-14

Summary of Results - BH-13
Halowax Area

Boring Location	Sample No.	Depth (feet)	Compounds Tested For Compound Identified	Concentration (mg/kg)
BH-13	S-1	4-6	BNA's ND*	
	S-2	10-12	BNA's ND*	
	S-3	14-14.5	BNA's ND*	
	S-4	17-17.5	BNA's ND*	

* ND = Not detected above lower limit of detection.

Table L-15

Summary of Results - BB-14
Burn Area

Boring Location	Sample No.	Depth (feet)	Compounds Tested For Compound Identified	Concen-tration
				(mg/kg)
BB-14	S-1	0-2	BNA's	
			Naphthalene	3
			2-Methylnaphthalene	3
			Dibenzofuran	1
			Hexachlorobenzene	4
			Phenanthrene	7
			Anthacene	1
			Fluoranthene	7
			Pyrene	5
			Benzo(a)Anthracene	3
			bis(2-Ethylhexyl)Phthalate	2
			Chrysene	4
			Benzo(b)Fluoranthene	3
			Benzo(k)Fluoranthene	3
			Benzo(a)Pyrene	3
	S-2	8-10	BNA's	
			ND*	
			Pesticide/PCB's	
			ND	
				(ug/kg)
			VOA's	
			Methylene Chloride	2 J
			Acetone	364
			Carbon Disulfide	4 J
			Total Xylenes	1 J

*ND = Not detected above lower limits of detection.

Table L-15
(continued)

Boring Location	Sample No.	Depth (feet)	Compounds Tested For Compound Identified	Concentration
				(mg/kg)
BB-14 (continued)	S-3	13.5-14	BNA's ND*	
			Pesticide/PCB's ND*	
				(ug/kg)
			VOA's Acetone	 79
				(mg/kg)
	S-4	16-17	BNA's ND*	

J = Compound identified below lower limit of detection; value shown is estimated.
*ND = Not detected above lower limit of detection.

Table L-16

Summary of Results - BB-15
Burn Area

Boring Location	Sample No.	Depth (feet)	Compounds Tested For Compound Identified	Concentration
				(mg/kg)
BB-15	S-1	4-6	BNA's	
			Phenanthrene	1
			Pyrene	1
			Benzo(a)Anthracene	1
			Chrysene	1
			Benzo(k)Fluoranthene	1
			Benzo(a)Pyrene	1
	S-2	12-14	BNA's	
			ND*	
			Pesticide/PCB's	
			ND*	
				(ug/kg)
			VOA's	
			Methylene Chloride	2 J
			Acetone	81
			2-Butanone	15
				(mg/kg)
	S-3	14.5-15	BNA's	
			ND*	
			Pesticide/PCB's	
			ND*	
				(ug/kg)
			VOA's	
			Methylene Chloride	5 J
			Acetone	76
			2-Butanone	18

J = Compound identified below lower limit of detection; value shown is estimated.
*ND = Not detected above lower limit of detection.

Table L-16
(continued)

Boring Location	Sample No.	Depth (feet)	Compounds Tested For Compound Identified	Concentration
				(mg/kg)
BB-15	S-3 (duplicate)	14-15	BNA's ND*	
			Pesticide/PCB's ND*	
				(ug/kg)
			VOA's	
			Methylene Chloride	1 J
			Acetone	36
				(mg/kg)
	S-4	18-18.5	BNA's ND*	

J = Compound identified below lower limit of detection; value shown is estimated.
*ND = Not detected above lower limit of detection.

Table L-17

Summary of Results - BB-16
Burn Area

Boring Location	Sample No.	Depth (feet)	Compounds Tested For Compound Identified	Concentration
				(mg/kg)
BB-16	S-1	4-6	BNA's	
			Naphthalene	1
			2-Chloronaphthalene	2
			Phenanthrene	5
			Anthracene	1
			Fluoranthene	10
			Pyrene	6
			Benzo(a)Anthracene	4
			Benzo(b)Fluoranthene	7
			Benzo(a)Pyrene	3
			Pesticide/PCB's	
			Alpha-BHC	0.42
			Gamma-BHC (Lindane)	0.04 J
			Heptachlor	0.72
			Dieldrin	0.10
			4,4'-DDE	0.20
				(mg/kg)
	S-2	8-10	BNA's	
			Naphthalene	2
			Fluorene	1
			Phenanthrene	9
			Anthracene	2
			Fluoranthene	8
			Pyrene	6
			Benzo(a)Anthracene	3
			Chrysene	3
			Benzo(b)Fluoranthene	2
			Benzo(k)Fluoranthene	2
			Benzo(a)Pyrene	2

J = Compound identified below lower limit of detection; value shown is estimated.

Table L-17
(continued)

Boring Location	Sample No.	Depth (feet)	Compounds Tested For Compound Identified	Concentration
				(ug/kg)
BB-16	S-2 (continued)		VOA's	
			Methylene Chloride	8
			Acetone	134
			2-Butanone	15
			1,1,1-Trichloroethane	1 J
			Trichloroethene	2 J
			2-Hexanone	12
			Total Xylenes	1 J
				(mg/kg)
	S-3	13-13.5	BNA's	
			ND*	
			Pesticide/PCB's	
			ND*	
				(ug/kg)
			VOA's	
			Methylene Chloride	1 J
			Acetone	39
				(mg/kg)
	S-4	15-16	BNA's	
			ND*	

J = Compound identified below lower limit of detection; value shown is estimated.
*ND = Not detected above lower limit of detection.

Table L-18

Summary of Results - BB-17
Burn Area

Boring Location	Sample No.	Depth (feet)	Compounds Tested For Compound Identified	Concentration (mg/kg)
BB-17	S-1	6-10	BNA's	
			Phenanthrene	0.5 J
			Anthracene	0.2 J
			di-n-Butyl Phthalate	0.1 J
			Fluoranthene	0.8 J
			Pyrene	0.7 J
			Benzo(a)Anthracene	0.5 J
			Chrysene	0.5 J
			Benzo(b)Fluoranthene	0.3 J
			Benzo(k)Fluoranthene	0.3 J
			Benzo(a)Pyrene	0.4 J
			Pesticide/PCB's	
			ND*	
			VOA's	(ug/kg)
			Methylene chloride	2J
			Acetone	16
			Carbon disulfide	1J
			Total xylenes	2J
	S-2	10-12	BNA's	
			ND*	
	S-3	15.5-16	BNA's	
			ND*	
			VOA's	(ug/kg)
			Methylene chloride	5
			Acetone	125
			2-Butanene	12
			Trichloroethlene	1J
	S-4	16-17	BNA's	
			ND*	
			Pesticide/PCB's	
			ND*	
	S-4 (duplicate)	16-17	BNA's ND*	

J = Compound identified below lower limit of detection; value shown is estimated.
*ND = Not detected above lower limit of detection.

Table L-19

Summary of Results - BB-18
Burn Area

Boring Location	Sample No.	Depth (feet)	Compounds Tested For Compound Identified	Concen-tration
				(mg/kg)
BB-18	S-1	6-8	BNA's	
			Phenanthrene	0.4 J
			di-n-Butyl Phthalate	0.2 J
			Fluoranthene	0.7 J
			Pyrene	0.8 J
			Benzo(a)Anthracene	0.6 J
			Chrysene	0.5 J
			Benzo(b)Fluoranthene	0.5 J
			Benzo(k)Fluoranthene	0.4 J
			Benzo(a)Pyrene	0.5 J
			Pesticide/PCB's	
			ND*	
				(ug/kg)
			VOA's	
			Methylene Chloride	1 J
			Acetone	96
			Carbon Disulfide	1 J
			Benzene	1 J
			Toluene	1 J
			Chlorobenzene	2 J
			Total Xylenes	1 J
				(mg/kg)
	S-2	12-14	BNA's	
			ND*	
	S-3	16-17	BNA's	
			ND*	
			Pesticide/PCB's	
			ND*	

J = Compound identified below lower limit of detection; value shown is estimated.
*ND = Not detected above lower limit of detection.

Table L-19
(continued)

Boring Location	Sample No.	Depth (feet)	Compounds Tested For Compound Identified	Concentration
				(ug/kg)
BB-18	S-3 (continued)		VOA's	
			Methylene Chloride	17
			Acetone	91
			Carbon Disulfide	1 J
			1,1,1-Trichloroethane	2 J
			1,1,2,2-Tetrachloroethane	4 J
			Trichloroethene	2 J
			Trans-1,2-Dichloroethene	1 J
				(mg/kg)
	S-4	19-20	BNA's	
			ND*	

J = Compound identified below lower limit of detection; value shown is estimated.
*ND = Not detected above lower limit of detection.

Table L-20

Summary of Results - BB-19
Burn Area

Boring Location	Sample No.	Depth (feet)	Compounds Tested For Compound Identified	Concentration
				(mg/kg)
BB-19	S-1	2-4	BNA's	
			Hexachlorobutadiene	2
			Phenanthrene	2
			Fluoranthene	3
			Pyrene	2
			Benzo(a)Anthracene	1
			Chrysene	3
			Benzo(k)Fluoranthene	3
			Benzo(a)Pyrene	2
	S-2	8-10	BNA's	
			4-Methylphenol	0.4 J
			Naphthalene	0.3 J
			2-Chloronaphthalene	0.6 J
			Acenaphthene	0.1 J
			Dibenzofuran	0.1 J
			Fluorene	0.2 J
			Phenanthrene	0.9 J
			di-n-Butyl Phthalate	0.2 J
			Pyrene	0.9 J
			Benzo(a)Anthracene	0.5 J
			Chrysene	0.7 J
			Benzo(b)Fluoranthene	0.9 J
			Pesticide/PCB's	
			Heptachlor	0.26
			4,4'-DDE	0.14
			4,4-DDD	0.22
			VOA's	(ug/kg)
			Methylene chloride	2J
			Acetone	83
			Carbon disulfide	2J
			Benzene	1J
			Total xylenes	1J
				(mg/kg)
	S-3	14-15	BNA's	
			ND*	
			Pesticide/PCB's	
			ND*	

J = Compound identified below lower limit of detection; value shown is estimated.

*ND = Not detected above lower limit of detection.

Table L-20
(continued)

Boring Location	Sample No.	Depth (feet)	Compounds Tested For Compound Identified	Concentration
				(ug/kg)
			VOA's	
			Acetone	30
				(mg/kg)
	S-3	14-15	BNA's	
	(duplicate)		Acenaphthene	0.1 J
			Diethyl Phthalate	0.1 J
			Fluorene	0.1 J
			Phenanthrene	0.1 J
			Anthracene	0.1 J
			di-n-Butyl Phthalate	0.3 J
			Fluoranthene	0.1 J
			Pyrene	0.1 J
			Butyl Benzyl Phthalate	0.1 J
			Benzo(a)Anthracene	0.2 J
			Bis(2-Ethylhexyl)Phthalate	0.2 J
			Chrysene	0.2 J
			di-n-Octyl Phthalate	0.2 J
			Benzo(b)Fluoranthene	0.1 J
			Benzo(k)Fluoranthene	0.2 J
			Benzo(a)Pyrene	0.1 J
			Pesticide/PCB's	
			ND*	
				(ug/kg)
			VOA's	
			Methylene Chloride	1 J
			Acetone	68
				(mg/kg)
	S-4	15.5-16.5	BNA's	
			ND*	

J = Compound identified below lower limit of detection; value shown is estimated.
*ND = Not detected above lower limit of detection.

Table L-21

Summary of Results - BB-20
Burn Area

Boring Location	Sample No.	Depth (feet)	Compounds Tested For Compound Identified	Concentration
				(mg/kg)
BB-20	S-1	4-6	BNA's	
			1,4-Dichlorobenzene	2
			1,2-Dichlorobenzene	2
			Naphthalene	1
			Phenanthrene	4
			Fluoranthene	7
			Pyrene	4
			Benzo(a)Anthracene	2
			Chrysene	3
			Benzo(b)Fluoranthene	3
			Benzo(k)Fluoranthene	2
				(mg/kg)
	S-2	8-10	BNA's	
			ND*	
			Pesticide/PCB's	
			ND*	
				(ug/kg)
			VOA's	
			Methylene Chloride	43
			Acetone	123
			Carbon Disulfide	3 J
			1,1-Dichloroethane	1 J
			Trans-1,2-Dichloroethene	2 J
			Chloroform	1 J
			2-Butanone	10
			1,1,1-Trichloroethane	2 J
			Trichloroethene	5
			Benzene	2 J

J = Compound identified below lower limit of detection; value shown is estimated.
*ND = Not detected above lower limit of detection.

Table L-21
(continued)

Boring Location	Sample No.	Depth (feet)	Compounds Tested For Compound Identified	Concentration
				(ug/kg)
			VOA's (continued)	
			4-Methyl- 2-pentanone	52
			2-Hexanone	6 J
			Tetrachloroethene	3 J
			1,1,2,2-Tetrachloroethane	10
			Toluene	7
			Chlorobenzene	5
			Ethylbenzene	6
			Styrene	8
			Total Xylenes	14
				(mg/kg)
BB-20	S-3	16-16.5	BNA's	
			di-n-Butyl Phthalate	0.2 J
			bis(2-Ethylhexyl)Phthalate	0.2 J
			Pesticide/PCB's	
			ND*	
				(ug/kg)
			VOA's	
			Methylene Chloride	4 J
			Acetone	19
			Carbon Disulfide	1 J
				(mg/kg)
	S-4	17-19	BNA's	
			ND*	

J = Compound identified below lower limit of detection; value shown is estimated.
*ND = Not detected above lower limit of detection.

Table L-22

Summary of Results - BB-21
Burn Area

Boring Location	Sample No.	Depth (feet)	Compounds Tested For Compound Identified	Concen-tration
				(mg/kg)
BB-21	S-1	8-10	BNA's	
			ND*	
			Pesticide/PCB's	
			ND*	
				(ug/kg)
			VOA's	
			Methylene Chloride	2 J
			Acetone	60
			Carbon Disulfide	2 J
			4-Methyl- 2-pentanone	2 J
			Total Xylenes	2 J
				(mg/kg)
	S-2	10-12	BNA's	
			ND*	
	S-3	17-17.5	BNA's	
			NA*	
			Pesticide/PCB's	
			ND*	
				(ug/kg)
			VOA's	
			Methylene Chloride	4 J
			Acetone	36
			Carbon Disulfide	1 J
			2-Butanone	22
				(mg/kg)
	S-4	21-21.6	BNA's	
			ND*	

J = Compound identified below lower limit of detection; value shown is estimated.

*ND = Not detected above lower limit of detection.

Table L-23

Groundwater Sampling Results

Location	Compound	Concentration (ug/L)	
	BNA		
MW-7	Phenol	18	
	2-Methylphenol	9	J
	4-Methylphenol	28	
	2,4-Dimethylphenol	28	
	Naphthalene	6	J
	2-Methylnaphthalene	4	J
	Acenaphthylene	5	J
	Acenaphthene	3	J
	Dibenzofuran	5	J
	Fluorene	9	J
	Phenanthrene	34	
	Anthracene	12	J
	di-n-Butyl Phthalate	3	J
	Fluoranthene	37	
	Pyrene	28	
	Benzo(a)Anthracene	18	
	bis(2-Ethylhexyl)Pthalate	10	J
	Chrysene	13	J
	Benzo(b)Fluoranthene	22	
	Benzo(a)Pyrene	12	J
	Indeno(1,2,3-cd)Pyrene	9	J
	Dibenz(a,h)Anthracene	3	J
	Metals		
	Aluminum	1,100	
	Arsenic	44	
	Beryllium	21	
	Calcium	56,900	
	Iron	4,680	
	Magnesium	1,410	
	Manganese	44	
	Mercury	0.2	
	Potassium	106,000	
	Silver	144	
	Sodium	23,200,000	
	Thallium	2,100	
	Zinc	23	

Table L-23
(continued)

Location	Compound	Concentration (ug/L)
	VOA	
MW-8	Methylene Chloride	1 J
	Acetone	22
	Chlorobenzene	2 J
	BNA	
MW-9	Naphthalene	950
	2-Chloronaphthalene	14,400
	Phenanthrene	75 J
	Anthracene	25 J
	di-n-Butyl Phthalate	225 J
	Fluoranthene	50 J
	Pyrene	50 J
	Benzo(a)Anthracene	25 J
	bis(2-Ethylhexyl)Phthalate	650
	Chrysene	25 J
	Benzo(b)Fluoranthene	75 J
	Benzo(k)Fluoranthene	25 J
	Benzo(a)Pyrene	50 J
	VOA	
	Vinyl Chloride	28
	Methylene Chloride	1,180
	Acetone	15
	1,1-Dichloroethene	1 J
	1,1-Dichloroethane	4 J
	trans-1,2-Dichloroethene	97
	Chloroform	4,620
	1,2-Dichloroethane	59
	1,2-Dichloropropane	26
	trans-1,2-Dichloropropene	2 J
	Trichloroethene	60
	1,1,2-Trichloroethane	8
	Benzene	75
	Tetrachloroethene	39

Table L-23
(continued)

Location	Compound	Concentration (ug/L)
	VOA (continued)	
	1,1,2,2-Tetrachlorothane	3 J
	Toluene	46
	Chlorobenzene	312
	Total Xylenes	3 J
	Pesticide/PCB	
MW-12	Arochlor-1254	28.0

J = Compound detected below detection limit. The value is estimated.

Table L-24

Summary of Results - Quality Assurance
Halowax Area (Soil)

Station	Parameter	Concentration (ug/L)
FB-1	BNA's ND*	
Field Blank	BNA's ND*	

Table L-25

Summary of Results - Quality Assurance
Burn Area (Soil)

Station	Parameter	Concentration (ug/L)
	BNA's	
BB-1	Di-n-Butyl Phthalate	3 J
	Bis(2-Ethyhexyl)Phthalate	7 J
	Pesticide/PCB's	
	ND*	
	VOA's	
	Methylene Chloride	1 J
	Acetone	8 J
	2-Butanone	9 J

Table L-26

Summary of Results - Quality Assurance
Buildings 35A/38A Area (Soil)

Station	Parameter	Concentration (ug/L)
	<u>Metals</u>	
Field Blank	Beryllium	25
	Copper	33
	Manganese	15
	Sodium	1,400

Table L-27

Summary of Results - Quality Assurance
(Groundwater)

Station	Parameter	Concentration (ug/L)
	VOA's	
Trip Blank	Methylene Chloride	2,900
	Metals	
Field Blank	Aluminum	140
	Arsenic	4.4
	Beryllium	21
	Potassium	1,020
	Sodium	14,900
	CN	
	ND	

APPENDIX M

PHASE II
CHAIN-OF-CUSTODY DOCUMENTATION

Custody Transfer Recor[illegible]ab Work Request

Received By
Date
Assigned to

Client
Client Contact
Phone

RFW Contact Bruce Benyish
Date Due 10-30-86
Project Number 0603-10-02

SAMPLE IDENTIFICATION HSL **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Matrix	Date Collected	Container/Preservative	BNA	Pest/PCB	VOA					
		BB-20, S-1 4-6'	S	10-9-86	1000ml AMBER	✓							
		BB-20, S-2 8-10'	S	10-9-86	1000ml Amber	✓	✓						
		BB-20, S-3, 16-16.5'	S	10-9-86	1000ml Amber	✓	✓						
		BB-20, S-4 17-19	S	10-9-86	1000ml Amber	✓							
		BB-20, S-2 8-10	S	10-9-86	40ml vial			✓					
		BB-20, S-3, 16-16.5	S	10-9-86	40ml vial			✓					
		BB-21, S-1 8-10	S	10-9-86	1000ml Amber	✓	✓						
		BB-21, S-2 10-12	S	10-9-86	1000ml Amber	✓							
		BB-21, S-3 17-17.5	S	10-9-86	1000ml amber	✓	✓						
		BB-21, S-4 21-21.6	S	10-9-86	1000ml amber	✓							
		BB-21, S-1 8-10	S	10-9-86	40ml vial			✓					
		BB-21, S-3 17-17.5	S	10-9-86	40ml vial			✓					

Matrix:
S- Soil
W- Water
O- Oil
DS- Drum Solids
DL- Drum Liquids
X- Other

Special Instructions: SAMPLES HAVE BEEN NOTED TO CONTAIN LOW LEVELS OF ORGANICS.

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
	Noreen Powers	Fed Exp	10-9-86	1240					
Analysis	Fed Exp	K.N. Schultz	10/10/86	1000					

RFW 21-21-001/A-3/86

1 of 2 sheets

WESTON

Custody Transfer Record/Lab Work Request

Received By ______
Date ______
Assigned to ______

Client Pennwalt
Client Contact ______
Phone ______

RFW Contact Bruce Benyik
Date Due 10/30/86
Project Number 0683-10-02

SAMPLE IDENTIFICATION | **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Matrix	Date Collected	Container/Preservative	BNA	PES/PCB	VOA					
~~B~~													
		BB-14, S-3, 13.5 14'	S	10/7/86	1000 ML AMBER	✓	✓						
		BB-14 S-3 13.5-14'	S	"	2 (40 ML VIALS			✓					
		BB-14 S-4 16-17'	S	"	1000 ML AMBER	✓							
		BB-15 S-1 4-6'	S	10/7/86	1000 ML AMBER	✓							
		BB-15 S-2 12-14'	S	"	"	✓	✓						
		BB-15 S-2 12-14'	S	"	2)40 ML VIALS			✓					
		BB-15 S-3 14.5-15'	S	"	"			✓					
		BB-15 S-3dup 14.5-15'	S	"	"			✓					
		BB-15 S-3 14.5-15'	S	"	1000 ML AMBER	✓	✓						
		BB-15 S-3 dup 14.5-15'	S	"	"	✓	✓						
		BB-15 S-4 18-18.5'	S	"	"	✓							
		Field Blank BB-1	W	10/7/86	1000 ML AMBER	✓	✓						
		Field Blank BB-1	W	"	2 (40 ML VIALS			✓					
		TRIP BLANK	W	"	2 (40 ML VIALS			✓					

Matrix:
S- Soil
W- Water
O- Oil
DS- Drum Solids
DL- Drum Liquids
X- Other

Special Instructions:

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
Soil	Bruce Benyik	Federal Exp	10/7/86	1700					
analysis	Federal Exp	K.N. Schultz	10/8/86	10:00					

RFW 21-2 [illegible] A-3/86

WEST[illegible]

Custody Transfer Reco[illegible]Lab Work Request

Received By
Date
Assigned to

Client PENNWALT
Client Contact
Phone

RFW Contact Bruce Benjamin
Date Due 10/30/86
Project Number

SAMPLE IDENTIFICATION HSC **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Matrix	Date Collected	Container/Preservative	BNA	Pst/PCB	VOA						
		BB-16, S-1 4-6'	S	10/7/86	1000 ML AMBER	✓	✓							
		BB-16, S-2 8-10'	S	11	11	✓								
		BB-16 S-2 8-10'	S	11	2 (40ML vials			✓						
		BB-16, S-3 13-13.5'	S	11	1000 ML amber	✓	✓							
		BB-16, S-3 13-13.5'	S	11	2 40ML vials			✓						
		BB-16, S-4 15-16'	S	11	1000 ML AMBER	✓								
		BB-17, S-1 6-10'	S	10/7/86	1000 ML AMBER	✓	✓							
		BB-17, S-2 10-12'	S	11	11	✓								
		BB-17, S-3 15-16'	S	11	11	✓	✓							
		BB-17, S-4 16-17'	S	11	11	✓								
		BB-17, S-4 dup 16-17'	S	11	11	✓								
E-3														
		BB-17, S-1, 6-10'	S	10/7/86	2 40ML vials			✓						
		BB-17, S-3, 15-16'	S	11	11			✓						

3

Matrix:
S- Soil DS- Drum Solids
W- Water DL- Drum Liquids
O- Oil X- Other

Special Instructions:

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
Soil	Bruce Benjamin	B.N. Schultz	10/7/86	1700					
		→	10/9/86	10^{00}					

RFW 21-21-001/A-3/86

WESTON

Custody Transfer Record/Lab Work Request

Received By
Date
Assigned to

Client Pennwalt
Client Contact
Phone

RFW Contact Bruce Benyish
Date Due 10/30/86
Project Number 0603-10-02

HSL

SAMPLE IDENTIFICATION						ANALYSES REQUESTED							
Sample No.	Client ID No.	Description	Matrix	Date Collected	Container/Preservative	BNA	PEST/PCB	VOA					
		SB-18, S-1, 6-8'	S	10/8/86	1000mL AMBER	✓	✓						
		BB-18, S-2 12-14'	S	"	"	✓							
		BB-18, S-3 16-17'	S	"	"	✓	✓						
		BB-18, S-4 19-22'	S	"	"	✓							
		BB-18, S-1 6-8'	S	"	2 40mL vials			✓					
		BB-18, S-3 16-17'	S	"	"			✓					
		BB-19, S-1	S	10/8/86	1000mL AMBER	✓							
		BB-19, S-2	S	"	"	✓	✓						
		BB-19, S-3	S	"	"	✓	✓						
		BB-19, S-3 dup	S	"	"	✓	✓						
		BB-19, S-4	S	"	"	✓							
		BB-19, S-2	S	"	2 40mL vials			✓					
		BB-19, S-3	S	"	"			✓					
		BB-19, S-3dup	S	"	"			✓					

H-4

14

Matrix:
S- Soil
W- Water
O- Oil
DS- Drum Solids
DL- Drum Liquids
X- Other

Special Instructions: Some samples contain low detectable levels of organics

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
Soil	Bruce Benyish	Federal Exp.	10/8/86	1700					
Analysis	Federal Exp.	K.N. Schultz	10/9/86	10^{00}					

Custody Transfer Reco[illegible]Lab Work Request

Received By N.N. Schultz
Date 9-29-86
Assigned to

Client Pennwalt
Client Contact
Phone

RFW Contact
Date Due 10/24/86
Project Number 0603-10-02

8609-64

SAMPLE IDENTIFICATION | **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Matrix	Date Collected	Container/Preservative	HSL BNA							
-10		BH-3, S-1, 4-6'	S	9/25/86	1000 ML AMBER	✓							
-11		BH-3, S-2, 14-16'	S	↓	↓	✓							
-12		BH-3, S-3, 19-20'	S	↓	↓	✓							
-13		BH-3, S-4 23-24'	S	↓	↓	✓							
-14		BH-6, S-2 12-14'	S	9/25/86	1000 ML AMBER	✓							
-15		BH-6, S-3 14-15'	S	↓	↓	✓							
-16		BH-6, S-4 17.5-18.5'	S	↓	↓	✓							
-17		BH-11 S-2 10-12'	S	9/26/86	1000 ML AMBER	✓							
-18		BH-11 S-3 15-16'	S	↓	↓	✓							
-19		BH-11 S-4 18-19'	S	↓	↓	✓							

11-5

Matrix:
S- Soil
W- Water
O- Oil
DS- Drum Solids
DL- Drum Liquids
X- Other

Special Instructions: Note some of these samples are expected to contain detectable amounts of BNA's care should be taken during extraction

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
	Bruce Bengel	Federal Exp	9/26/86	1740	Analysis	Federal Express	N.N. Schultz	9/29/86	10:00

RFW 21-21-001/A-3/86

WESTON

Custody Transfer Record/Lab Work Request

Received By N.N. Schultz
Date 9-29-86
Assigned to

Client Pennwalt
Client Contact
Phone

RFW Contact Bruce Benyish
Date Due 10/24/86
Project Number 0603-10-02

86-09-64

SAMPLE IDENTIFICATION | **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Matrix	Date Collected	Container/Preservative	HSL BNA							
-01		BH-4, S-1, 4-6'	S	9/25/86	1000 ML AMBER	✓							
-02		BH-4, S-2, 10-12'	S	↓	↓	✓							
-03		BH-4, S-3, 14-15'	S	↓	↓	✓							
-04		BH-4, S-4, 18-19'	S	↓	↓	✓							
-05		BH-9, S-1, 4-6'	S	9/26/86	1000 ML AMBER	✓							
-06		BH-9, S-2 8-10'	S	↓	↓	✓							
-07		BH-9, S-3 15-16'	S	↓	↓	✓							
-08		BH-9, S-4 17-18'	S	↓	↓	✓							
-09		FB-1 Field Blank	W	9/26/86	1000 ML AMBER	✓							

Matrix:
S- Soil
W- Water
O- Oil
DS- Drum Solids
DL- Drum Liquids
X- Other

Special Instructions: Note: low to no detectable BNA's were observed

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
Soil samples	Bruce Benyish	Federal Express	9/26/86	1800	analysis	Federal Exp	N.N. Schultz	9/27/86	10^{00}

Custody Transfer Rec[illegible]/Lab Work Request

Received By N.N. Schultz
Date 9-29-86
Assigned to
Client Pennwalt
Client Contact
Phone
RFW Contact
Date Due 10/24/86
Project Number 0603-10-02

86-09-64

SAMPLE IDENTIFICATION | **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Matrix	Date Collected	Container/Preservative	HSL BNA							
-10		BH-3, S-1, 4-6'	S	9/25/86	1000 ML AMBER	✓							
-11		BH-3, S-2, 14-16'	S	↓	↓	✓							
-12		BH-3, S-3, 19-20'	S	↓	↓	✓							
-13		BH-3, S-4 23-24'	S	↓	↓	✓							
-14		BH-6, S-2 12-14'	S	9/25/86	1000 ML AMBER	✓							
-15		BH-6, S-3 14-15'	S	↓	↓	✓							
-16		BH-6, S-4 17.5-18.5	S	↓	↓	✓							
-17		BH-11 S-2 10-12'	S	9/26/86	1000 ML AMBER	✓							
-18		BH-11 S-3 15-16'	S	↓	↓	✓							
-19		BH-11 S-4 18-19'	S	↓	↓	✓							

Matrix:
S- Soil
W- Water
O- Oil
DS- Drum Solids
DL- Drum Liquids
X- Other

Special Instructions: Note some of these samples are expected to contain detectable amounts of BNA's care should be taken during extraction

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
	Bruce Benzyik	Federal Exp	9/26/86	1740	Analysis	Federal express	N.N. Schultz	9/27/86	10^00

WESTON

Custody Transfer Record/Lab Work Request

Received By K.N Schultz
Date 9-29-86
Assigned to

Client Pennwalt
Client Contact
Phone

RFW Contact B. Benyish
Date Due 10/24/86
Project Number 0603-10-02

86-09-64

SAMPLE IDENTIFICATION | **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Matrix	Date Collected	Container/Preservative	HSL BNA	HSL VOA						
-20-22 KS		BH-10 S-1, 4-6'	S	9/26/86	1000 ml amber	✓							
-21		BH-10 S-1, 4-6'	S	9/26/86	40 ml vial		✓						
		—	—	—	—								
-22 20 KS		BH-11 S-1, 4-6'	S	9/26/86	1000 ml amber	✓							
		—	—	—	—								
		~~BH-6 S-1, 6-8'~~	~~S~~	~~9/25/86~~	J.G.S								
-23		BH-6 S-1, 6-8'	S	9/25/86	1000 ml amber	✓							

Matrix:
S- Soil
W- Water
O- Oil
DS- Drum Solids
DL- Drum Liquids
X- Other

Special Instructions: Note: Samples may contain medium to high levels of BNA caution should be used.

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
Soil samples	Jim Spratt	[illegible]	9/26/86	1710	Analysis	Fed. Exp.	K.N. Schultz	9/29/86	10⁰⁰

RFW 21- A-3/86

WESTON

Custody Transfer Reco[illegible] Lab Work Request

86 09 60

Received By K.N. Schultz
Date 9-26-86
Assigned to

Client Pennwalt
Client Contact
Phone

RFW Contact Bruce Benyish
Date Due 10/17/86
Project Number 0603-10-02

SAMPLE IDENTIFICATION **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Matrix	Date Collected	Container/Preservative	HSL BNA							
-01		BH-2, S-1 4-6'	Soil	9/24/86	1000 ML AMBER	✓							
-02		BH-2, S-2 8-10'	↓		w/ice ↓	✓							
-03		BH-2, S-3 16-17'	↓		↓	✓							
-04		BH-2, S-4 19-21'	↓		↓	✓							
-05		BH-5, S-1 0-2'	Soil	9/23/86	1000 ML AMBER	✓							
-06		BH-5, S-2 6-8'	↓	↓	w/ice ↓	✓							
-07		BH-5, S-3 10-12'	↓	↓	↓	✓							
-08		BH-5, S-4 15-16'	↓	↓	↓	✓							

M-3

Matrix:
S- Soil DS- Drum Solids
W- Water DL- Drum Liquids
O- Oil X- Other

Special Instructions: Note: Care should be taken when extracting samples from containers, detectable low amounts of organic vapors were observed.

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
Soil samples	Bruce Benyish	K.N. Schultz KS	9/24/86	1700					
analysis	Federal Express	K.N. Schultz	9/26/86	11:00					

WESTON

Custody Transfer Record/Lab Work Request

86 09 60

Received By K.N. Schultz
Date 9-26-86
Assigned to

Client PennWALT
Client Contact
Phone

RFW Contact Bruce Renyish
Date Due Oct. 17, 1986
Project Number W.C.# 0603-10-02

SAMPLE IDENTIFICATION | **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Matrix	Date Collected	Container/Preservative	HSL BNA							
-09		BH-1, S-1, 4-6'	S	9-24-86	1000 ml amber	✓							
-10		BH-1, S-2, 16-18'	S	9-24-86	1000 ml Amber	✓							
-11		BH-1, S-3, 19.6-20.6'	S	9-24-86	1000 ml Amber	✓							
-12		BH-1, S-4, 22-24'	S	9-24-86	1000 ml Amber	✓							
-13		BH-1, S-4 dup, 22-24'	S	9-24-86	1000 ml Amber	✓							
-14		Field Blank	W	9-24-86	1000 ml Amber	✓							

M-10

Matrix:
S- Soil
W- Water
O- Oil
DS- Drum Solids
DL- Drum Liquids
X- Other

Special Instructions: ENVIRONMENTAL SAMPLES, NO CONTAMINANTS OBSERVED

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
soil samples	Noreen Powers	Federal Exp	9-24-86						
analysis	Federal Exp	K.N. Schultz	9-26-86	1100					

RFW 21-21 3/86

Custody Transfer Reco[illegible] Lab Work Request

88 10 18

Received By K.N. Schultz
Date 10-7-86
Assigned to

Client Pennwalt
Client Contact
Phone

RFW Contact Bruce Benyish
Date Due 10/30/86
Project Number 0603-10-02

SAMPLE IDENTIFICATION **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Matrix	Date Collected	Container/Preservative	HSL BNA	HSL VOA	P:B/Pest					
-01	8	BH-12, S-1, 4-6'	S	10/6/86	1000 ML AMBER	✓							
-02		BH-12, S-2, 8-10'	S	11	11	✓							
-03		BH-12, S-2A, 10-12'	S	11	2) 40 ML VIALS		✓						
-04		BH-12, S-3, 14.5-16'	S	11	1000 ML AMBER	✓							
-05		BH-12, S-3 dup 14.5-16'	S	11	11	✓							
-06		BH-12, S-3, 14.5-16'	S	11	2 40 ML VIALS		✓						
-07		BH-12, S-4 18-18.5'	S	11	1000 ML AMBER	✓							
~~-0~~													
-08		BH-13, S-1, 4-6'	S	10/6/86	1000 ML AMBER	✓							
-09		BH-13, S-2, 10-12'	S	11	11	✓							
-10		BH-13, S-3, 14-14.5'	S	11	11	✓							
-11		BH-13, S-4, 17-17.5'	S	11	11	✓							
-12		BB-14 S-1 0-2'	S	10/6/86	1000 ML Amber	✓							
-13		BB-14 S-2, 8-10'	S	11	11	✓		✓					
-14		BB-14 S-2, 8-10	S	11	2) 40 ML VIALS		✓						

Matrix:
S- Soil
W- Water
O- Oil
DS- Drum Solids
DL- Drum Liquids
X- Other

Special Instructions: These samples are not expected to contain high concentrations of contaminates

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
Soil	Bruce W Benyish	K.N. Schultz	10/6/86	1700					
		→	10/7/86	1000					

RFW 21-21-001/A-3/86

WESTON

Custody Transfer Record/Lab Work Request

Received By
Date
Assigned to

Client Pennwalt
Client Contact
Phone

RFW Contact Bruce Bongish
Date Due 10/24/86
Project Number 0603-10-02

SAMPLE IDENTIFICATION | **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Matrix	Date Collected	Container/Preservative	HSL BNA	HSL metals						
		BH-7, S-1, 0-2'	S	9/29/86	1000ml Amber	X							
		BH-7, S-1 Dup, 0-2'	S			X							
		BH-7 S-2, 10-12	S			X							
		B-7, S-3, 15-16.5	S			X							
		BH-7, S-4, 17.5-18.5	S			X							
		BH-8, S-1 4-6	S			X							
		BH8, S-3 15-16	S			X							
		BH8, S-4, 17.5-18.5	S	9/29/86		X							
		SS-16, S-1, 0.5-1.0'	S	9/25/86			✓						
		SS-17, S-1, 0.5-1.0'	S				✓						
		SS-17, S-2, 1.0-1.5'	S	9/25/86			✓						
		SS-18, S-1, 0.5-1.0	S	9/29/86			✓						
		SS-18, S-2, 1.0-1.5	S	9/29/86	1000ml Amber		✓						
		Field Blank, SS	W	9/30/86	1000ml Amber		✓						

M-12

Matrix:
S- Soil
W- Water
O- Oil
DS- Drum Solids
DL- Drum Liquids
X- Other

Special Instructions: Caution some low level BNAs

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
	Jim Sorath	FED EXP	9/30/86	1455					
Analysis	FED EXP	K.N. Schultz	10/1/86	10:00					

RFW 21- A-3/86

WESTON

Custody Transfer Reco[illegible] Lab Work Request

Received By
Date
Assigned to

Client Pennwalt
Client Contact
Phone

RFW Contact Bruce Benyish
Date Due 10/24/86
Project Number 0603-10-02

SAMPLE IDENTIFICATION / **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Matrix	Date Collected	Container/Preservative	Voa	CN	P/PCB	HSL metals	HSL BNA	Hg		
		MW-8 (2/sample)	W	9/30/86		✓							
		MW-7	W	9/30/86			✓		✓	✓			
		MW-7	W	9/30/86							✓		
		MW-12	W	9/29/86				✓					
		TRIP BLANK (2/sample)	W	9/30/86		✓							
		FIELD BLANK	W	9/30/86			✓		✓				

M-13

Matrix:
S- Soil
W- Water
O- Oil
DS- Drum Solids
DL- Drum Liquids
X- Other

Special Instructions:

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
	Jim	FED. EXPRESS	9/30/86	1920					
analysis	FED EXP.	N. Schultz	10/1/86	1000					

RFW 21-21-001/A-3/86

WESTON

Custody Transfer Record/Lab Work Request

Received By

Date

Assigned to

Client PENNWALT

Client Contact

Phone

RFW Contact Bruce Benyish

Date Due 10-24-86

Project Number W.C.# 0603-10-02

SAMPLE IDENTIFICATION

HSL VOA **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Matrix	Date Collected	Container/Preservative	BNA							
		* BH-8, S-2, 10-12'	S	9-29-86		✓							
		MW-9	W	9-30-86		✓	✓						

Matrix:
S- Soil
W- Water
O- Oil
DS- Drum Solids
DL- Drum Liquids
X- Other

Special Instructions: CAUTION, SAMPLES Are expected to contain high levels of organics. * RUSH - Quick Turnarou

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
	Norma Pereira	FEDERAL EXP.	9-30-86	1720					
analysis	FEDERAL EXP.	Y. N. Schultz	10/1/86	1000					

RFW 21[illegible]A-3/88

APPENDIX N

GREAT LAKES WATER LEVEL DATA
(NOAA, CORPS OF ENGINEERS)

National Oceanic Atmospheric Administration (NOAA)
Great Lakes Water Levels

Station 4030: Wyandotte, Michigan on Detroit

1960 through 1986
1986 January through September

. S. DEPARTMENT OF COMMERCE
AA - NOS   ROCKVILLE, MARYLAND
REAT LAKES WATER LEVELS, C234

MONTHLY AND ANNUAL AVERAGE ELEVATION
WATER LEVELS IN FEET, IGLD (195

tation 4030 : Wyandotte, Michigan on the Detroit River

EAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUA AV
960	570.93	570.86	571.47	572.11	572.38	572.74	572.83	572.88	572.65	572.21	571.65	571.56	572.0
961													-
962				571.66	571.75	571.88	571.82	571.72	571.43	571.19	571.15	570.68	571.4
963	570.38	569.82	570.14	571.16	571.38	571.35	571.17	571.04	570.91	570.55	570.13	570.15	570.6
964	569.68	569.59	570.08	570.66	570.90	570.89	570.78	570.65	570.42	569.97	569.68	569.71	570.2
965	569.59	569.75	570.32	570.68	571.16	571.28	571.15	571.04	571.01	570.70	570.45	570.73	570.6
966	570.84	570.89	571.12	571.61	571.85	571.92	571.86	571.63	571.39	570.77	570.82	571.24	571.
967	571.28	571.04	571.15	571.90	572.18	572.32	572.38	572.24	571.96	571.71	571.49	571.81	571.7
968	571.94	572.26	572.05	572.35	572.56	572.73	572.82	572.71	572.49	572.07	571.87	571.82	572.
969	572.28	572.33	572.23	572.91	573.35	573.58	573.89	573.69	573.29	572.77	572.49	572.47	572.
970	571.72	571.91	572.21	572.66	572.88	573.09	573.07	573.00	572.80	572.63	572.39	572.41	572.
971	572.46	572.29	572.64	572.94	573.12	573.35	573.25	573.17	573.08	572.80	572.33	572.40	572.
972	572.55	572.68	572.77	573.21	573.62	573.61	573.83	573.75	573.71	573.49	573.54	573.64	573.
973	573.75	573.83	574.22	574.50	574.41	574.60	574.69	574.45	574.03	573.68	573.24	573.32	574.
974	573.76	573.80	574.22	574.36	574.57	574.54	574.50	574.25	573.82	573.33	573.12	573.25	573.
975	573.27	573.34	573.69	573.83	573.95	574.14	574.01	573.93	573.94	573.56	573.10	573.09	573.
976	573.25	573.01	574.01	574.15	574.22	574.19	574.17	574.04	573.55	573.07	572.39	572.24	573.
977	572.10	572.27	572.37			572.97	572.98	572.91	572.88	572.72	572.37	572.76	572.
978	572.95	573.10	572.95	573.45	573.56	573.47	573.32	573.08	572.89	572.57	572.31	571.95	572.
979	572.51	572.29	572.48	573.25	573.53	573.62	573.67	573.59	573.54	573.11	572.84	572.92	573.

MONTHLY AND ANNUAL AVERAGE ELEVATIO
WATER LEVELS IN FEET, IGLD (195

ation 4030 : Wyandotte, Michigan on the Detroit River

AR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNU A
'80	573.07	573.11	573.04	573.73	573.74	573.84	573.83	573.92	573.70	573.07	572.69	572.59	573.
'81	571.90	572.46	572.65	572.90	573.30	573.47	573.66	573.51	573.39	573.21	572.92	572.68	573.
'82	572.64	572.84	573.16	573.47	573.52	573.58	573.51	573.21	572.89	572.59	572.52	572.79	573.
'83	572.86	572.86	573.02	573.41	573.88	574.01	574.03	574.01	573.54	573.25	573.02	573.32	573.
'84	573.24	573.22	573.61	573.00	573.61	573.98	573.96	573.86	573.64	573.46	573.12	572.96	573.
'85	573.28	573.70	574.30	574.68	574.64	574.59	574.50	574.29	574.12	573.78	574.23	574.28	574,
'86 →													
'87													
'88													
'89													
'90													
'91													
'92													
'93													
'94													
'95													
'96													
'97													
'98													
'99													

.S. Depart[illegible]t of Commerce
OAA, NOS [illegible]kville, Maryland
reat Lakes [illegible]ter Levels, N/OMA12

1986 Daily Mean Water Levels
Water Levels in Feet, IGL[illegible]1955)
[illegible]D2,f6

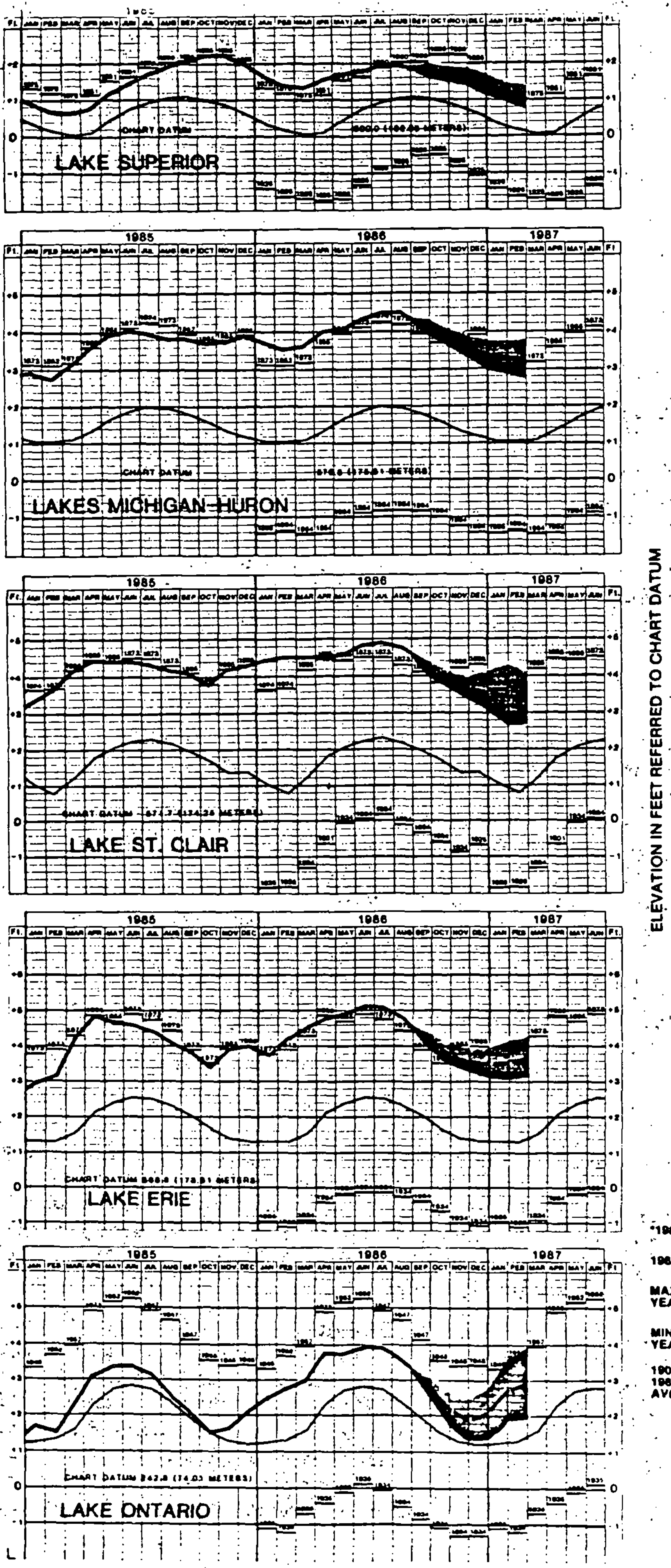
tation 4030 : Wyandotte, Michigan on Detroit River

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	574.76	574.70	574.26	574.58	574.34	574.78	575.15	574.86	574.70			
2	574.86	574.60	574.29	574.67	574.53	574.95	575.00	574.90	574.72			
3	574.75	574.65	574.34	574.74	574.58	574.96	575.06	574.85	574.74			
4	574.88	574.71	574.21	574.88	574.66	574.79	574.97	574.90	574.55			
5	574.38	574.66	574.29	574.82	574.59	574.96	574.94	574.90	574.38			
6	574.26	575.06	573.93	574.63	574.64	575.04	574.93	575.00	574.50			
7	574.43	575.31	573.93	574.61	574.73	574.98	574.92	574.90	574.46			
8	574.34	575.14	574.36	574.53	574.72	574.88	574.98	574.85	574.38			
9	573.96	575.00	574.38	574.37	574.93	575.04	575.07	574.84	574.46			
10	574.13	574.97	574.31	574.45	574.81	574.97	575.09	574.88	574.43			
11	574.21	574.98	574.15	574.54	574.76	575.00	575.27	574.80	574.25			
12	574.16	574.91	574.75	574.71	574.83	574.96	575.07	574.91	574.15			
13	574.22	574.73	574.74	574.70	574.83	575.05	574.90	575.00	574.42			
14	574.22	574.73	574.69	574.94	574.81	575.15	574.91	574.90	574.62			
15	574.16	574.63	574.61	574.62	574.72	575.22	575.13	574.79	574.68			
16	574.10	574.77	574.69	574.65	574.63	574.96	575.07	574.85	574.73			
17	574.15	574.71	574.71	574.74	574.75	575.18	575.07	574.88	574.82			
18	574.31	574.74	574.84	574.76	574.72	575.10	575.00	574.90	574.57			
19	574.32	574.75	574.46	574.74	574.85	575.05	575.06	575.03	574.64			
20	574.14	574.54	574.71	574.76	574.81	575.18	575.09	574.97	574.55			
21	574.42	574.39	574.75	574.59	574.85	575.25	575.16	574.88	574.62			
22	574.04	574.53	574.67	574.79	574.91*	575.02	575.11	574.99	574.68			
23	574.20	574.21	574.57	574.84	574.86	575.05	575.09	574.56	574.61			
24	574.36	574.34	574.78	574.86	574.91	574.94	575.04	574.70	574.67			
25	574.14	574.33	574.70	574.86	574.90	575.08	574.97	574.79	574.86			
26	574.02	574.58	574.59	574.85	574.98	575.02	574.99	574.66	574.70			
27	573.73	574.38	574.57	574.86	574.94	574.92	575.06	574.61	574.89			
28	573.95	574.22	574.64	574.77	574.88	574.95	575.00	574.65	574.87			
29	574.43		574.59	574.60	574.85	575.01	574.83	574.71	574.84			
30	574.46		574.54	574.76	574.80	575.10	574.96	574.70	574.75			
31	574.58		574.72		574.79		575.02	574.74				
EAN	574.29	574.69	574.51	574.71	574.77	575.02	575.03	574.84	574.61			
AX.	574.97	576.02	575.27	575.37	575.22	575.59	575.51	575.35	575.27			
	1400/04	0300/07	1500/11	2000/14	2400/26	0500/17	2100/11	2000/06	1300/30			
IN.	573.58	573.97	573.37	574.07	573.83	574.42	574.55	574.22	573.64			
	0200/27	0400/23	0600/11	1000/11	1700/01	0100/13	0700/14	0300/27	1200/12			

* Indicates Less than 90% of the Hourly Data Available.
/ Indicates No Data.

U.S. Army Corps of Engineers

Monthly Bulletins of Lake Levels for the Great Lakes



US Army Corps of Engineers
Detroit District

MONTHLY BULLETIN OF LAKE LEVELS FOR THE GREAT LAKES

AUGUST 1986

Recorded levels for the previous year and the current year to date and the probable levels for the next six months are shown in red. The shaded red area shows the probable range of levels (one standard deviation of the long-term average predictive error) over the next six months dependent upon weather variations.

These are compared with the 1900-1985 average and extreme levels which are shown in black.

LEGEND

LAKE LEVELS

RECORDED

PROBABLE †

1900—1985 AVERAGE

MAXIMUM 1985 1985 1973 1973

MINIMUM 1936 1934 1926 1934

Hydrographs are in feet above (+) or below (-) Chart Datum, the plane on each lake to which navigation chart depths and Federal navigation improvement depths are referred.

Chart Datum and all other elevations are in feet above the mean water level at Father Point, Quebec (International Great Lakes Datum 1955). To convert feet to meters, multiply feet by 0.30480.

AUGUST MEAN LAKE LEVELS

	Superior	Mich.-Huron	St. Clair	Erie	Ontario
*1986	601.90	581.28	576.46	573.37	246.37
1985	601.92	580.60	575.88	572.66	245.28
MAX. YEAR	602.02 1950	580.99 1973	576.03 1973	573.03 1973	247.45 1947
MIN. YEAR	599.15 1926	575.97 1964	571.60 1934	568.36 1934	242.26 1934
1900-1985 AVG.	601.02	578.76	573.88	570.90	245.16

* provisional

† The forecast takes into account the emergency actions authorized by the International Joint Commission.

☆ U.S. GOVERNMENT PRINTING OFFICE 1986-641-087/40011

US Army Corps
of Engineers
North Central Division

GREAT LAKES LEVELS
UPDATE, NO. 14
4 SEPTEMBER 1986

Rainfall on the Great Lakes basin was again above average during the month of August and the lakes still brim with waters accumulated during more than a year of high supplies. At the risk of sounding like a cracked record, we must again note that new record high monthly levels for August were set on Lakes Michigan-Huron, St. Clair and Erie. For St. Clair, it has been a full year now that record monthly highs have been set and for Lakes Michigan-Huron, it was the eleventh month straight. The Lake Erie level has been less than its record monthly high only once, in April, since October 1985. While Lake Superior again did not set a new monthly record for August, it remains extremely high with an August 31st level of 601.81 feet. The attached bulletin shows that all the Great Lakes except Lake Ontario are predicted to remain extremely high through the end of February 1987. Riparian property owners should be alert to take necessary precautions in advance of the fall storm period.

The International Joint Commission (IJC) is continuing to direct the outflows for the two Great Lakes that are regulated. The Lake Superior outflow is at its specified Plan 1977 outflow setting, but the Lake Ontario outflow is being regulated under an emergency action, known as Criterion (k) and provided for in the IJC's Orders of Approval. The emergency action in August increased the outflow by more than 17,000 cfs which reduced the Lake Ontario level 0.25 foot below that level that would have occurred usi the regulation plan outflows. The emergency action has been in effect throughout 1986 and has reduced the Lake Ontario level by about 2.3 feet. Without the emergency action, Lake Ontario would have broken its all-time record high level (248.06 feet) in May 1986. Shipping interests have been informed of the higher St. Lawrence River velocities and strong cross-currents created by the overdischarges dictated by the emergency action.

On August 1, 1986, the Governments of Canada and the United States issued a new Reference to the IJC for a comprehensive, multi-year study of methods to alleviate the adverse consequences of fluctuating Great Lakes water levels. The Governments asked for an interim report by one year after the study begins and for a final report by May 1, 1989.

A recent barge accident at the head of the Niagara River is having a small, adverse effect on the levels of Lakes Erie, St. Clair and Michigan-Huron. The barge, lodged against the center pier of the Peace Bridge, is impeding the flow of the river by 6,000-7,000 cubic feet per second. The owner of the barge is currently formulating a plan for its removal. If the owner cannot safely remove the barge, the Corps of Engineers will use an emergency authority to do the work.

The Corps of Engineers has authority under Public Law 84-99 to carry out preventive work prior to a flood threat to life and improved property. This program, known as Advance Measures, is applicable to areas threatened with inundation. There is no similar authority applicable to shore erosion threats. In Michigan, construction of five approved Advance Measures projects is now substantially complete: Luna Pier, Estral Beach, Detroit Beach in Frenchtown Township, and Labo Island and Milleman in Brownstown Township. A sixth project, the Grodi Road area in Erie Township, is under construction. A seventh project, the Village of Quanicassee in Tuscola County, was recently approved and is be