UNOCAL Edmonds
TCP SIT 2.3.2
Background History
Report

Background History Report
UNOCAL Edmonds
Bulk Fuel Terminal

Edmonds, Washington

Prepared for

UNOCAL Corporation

February 15, 1994

Prepared by

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Project 0324-035.01

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1 INTRODUCTION

1.1 Purpose

Union Oil Company of California, dba UNOCAL, has entered into Agreed Order No. DE 92TC-N328 with the Washington State Department of Ecology (Ecology) to conduct environmental investigations at the UNOCAL Edmonds Bulk Fuel Terminal in Edmonds, Washington. The scope of the Agreed Order includes the following tasks:

- Facility background history review
- Remedial investigation/feasibility study
- Evaluation of existing free petroleum product recovery system

Specific to the historical review, the Agreed Order requires UNOCAL to conduct a background review of the historic UNOCAL operations at and adjacent to the facility, including but not limited to the bulk fuel terminal, the commercial development known as Harbor Square, offshore and tideland areas (including the facility pier/dock and city park), and the wetland area located north/northeast of the terminal. The approximate study areas are shown on Figure 1-1.

This document reports the scope and findings of the background history review. It was compiled by completing the following tasks:

- <u>Previous investigations</u> - Results of previous hydrogeologic investigations conducted at the bulk fuel terminal were reviewed.

- <u>Agency file review</u> - Available public agency files, i.e., Ecology's Northwest Regional Office files, and Ecology archives, and United States Environmental Protection Agency (USEPA) Region 10 files were reviewed.

- <u>Facility file review</u> - Available UNOCAL facility files (environmental, maintenance, and process) from Seattle, Edmonds, Portland, and Los Angeles offices were reviewed.

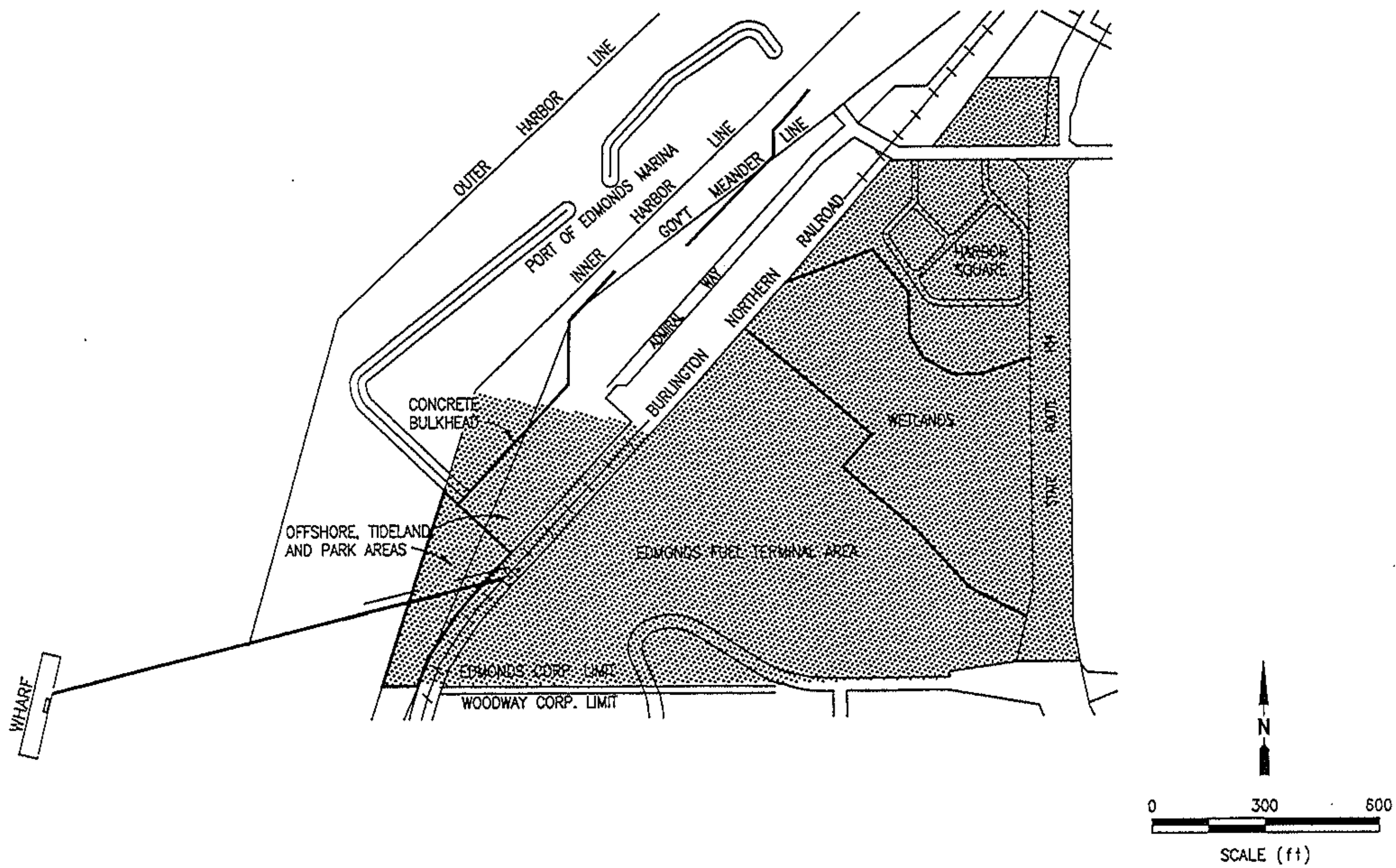

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Figure 1-1
UNOCAL EDMONDS
BULK FUEL TERMINAL
BACKGROUND HISTORY STUDY AREAS - CURRENT & FORMER UNOCAL PROPERTIES

- Aerial photographic review – Aerial photographs for the terminal and general site area were reviewed for the period from 1947 to 1992.

- Site reconnaissance – A reconnaissance of the terminal was conducted to verify information gathered during the file reviews and to document current site conditions.

- Employee interviews – Certain current and former UNOCAL Edmonds Fuel Terminal employees with knowledge of procedures, practices, or events regarding the environmental conditions and history of the site were interviewed.

The information collected during the background history review will be used in preparation of the remedial investigation (RI) workplan.

1.2 Document Organization

This report is organized into ten sections. A brief description of each section is presented below:

- **Section 2 – Background.** Section 2 includes the facility description, area land use, facility property history (purchases and leases), and general site settings.

- **Section 3 – Facilities and Operations.** Section 3 is a summary of UNOCAL operations including, but not limited to, dock, railcar, tank farms, piping systems, asphalt plant, warehouse, laboratory, maintenance, lessee operations, Dayton Street Depot (Harbor Square), and other non-UNOCAL operations.

- **Section 4 – Chemical Products Management.** Section 4 contains descriptions of the practices and procedures related to chemical products management as well as the types of chemicals involved.

- **Section 5 – Waste Management.** Section 5 includes descriptions of the practices and procedures of waste management, the types of wastes, and waste management areas.

- **Section 6 – Releases.** Section 6 includes recorded descriptions of spills to the environment at or in the vicinity of the terminal.

- **Section 7 – Environmental Investigations.** Section 7 contains a summary of previous investigations conducted at the terminal.

- **Section 8 – Environmental Cleanups.** Section 8 includes a description of underground storage tank cleanups, product recovery projects, spill cleanups, and miscellaneous related actions conducted at the facility.

- **Section 9 – Conceptual Site Model.** Section 9 includes a summary of potential sources, potential release mechanisms, and potential routes of exposure based on historical operations information and environmental studies at the site.

- **Section 10 – Facility Environmental Management Program.** Section 10 includes a description of inspection/testing programs for tanks and pipes and a Spill Prevention Control and Countermeasure (SPCC) plan.

2 BACKGROUND

2.1 Area Descriptions

UNOCAL currently owns the property described in Sections 2.1.1 and a portion of the property described in Section 2.1.2. The remaining properties, described in 2.1.3 and 2.1.4, were formerly owned by UNOCAL.

2.1.1 Terminal

The UNOCAL Edmonds Bulk Fuel Terminal (Terminal) is located at 11720 Unoco Road in Edmonds, Washington (Figure 2-1). The Terminal comprises approximately 44 acres of land on and adjacent to the northern slope of a hillside and lies within approximately 1,000 feet of the Puget Sound shoreline. The Terminal has two distinct areas, the upper yard (tank farm) area and the lower yard area (Figure 2-2).

The lower yard is approximately 29 acres, lying east of the Burlington Northern Railroad right-of-way, south of Union Oil Marsh, west of the Deer Creek Salmon Hatchery, and north of the upper yard. The lower yard consists of office buildings, two former truck loading racks, aboveground and underground piping, four aboveground storage tanks, seven underground storage tanks, a boiler, an area formerly known as "Lake McGuire" (Detention Basin No. 1), and a detention basin formerly known as "Mid-lake" (Detention Basin No. 2), two oil/water separators, a pier, and a dock. Previous operations included an air-blown asphalt plant, an asphalt packaging warehouse, and a railcar loading/unloading facility.

The upper yard is approximately 15 acres located immediately south of the lower yard. The upper yard consists of 23 aboveground storage tanks, two underground storage tanks, above-grade piping, a garage, and a warehouse.

2.1.2 Offshore, Tideland, and Park Areas

These areas comprise approximately 12 acres of property located on the Puget Sound shoreline (Figure 1-1). The Burlington Northern Railroad (BNRR) right-of-way serves as the eastern boundary of these areas, with the city of Edmonds and Woodway corporate

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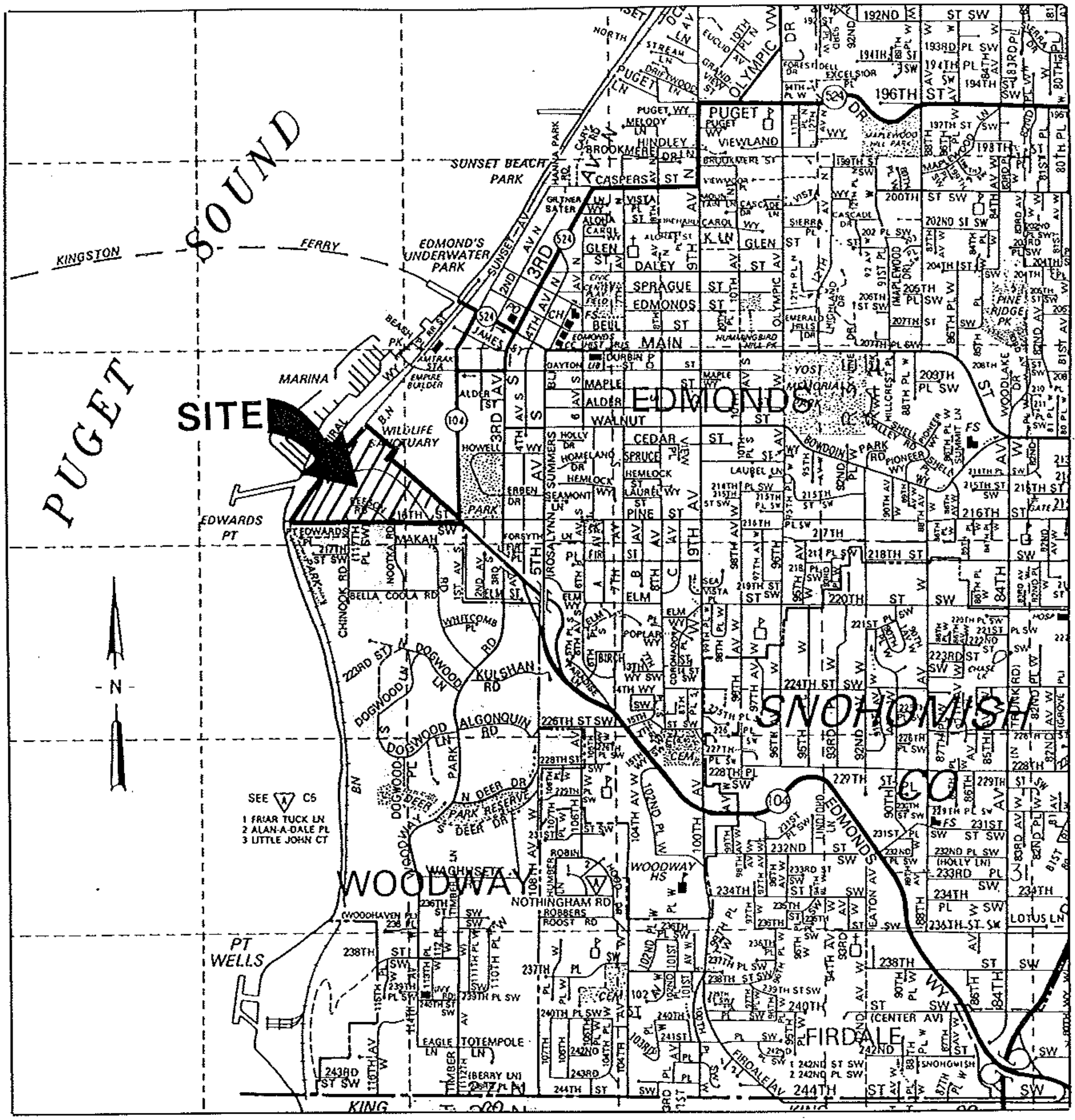

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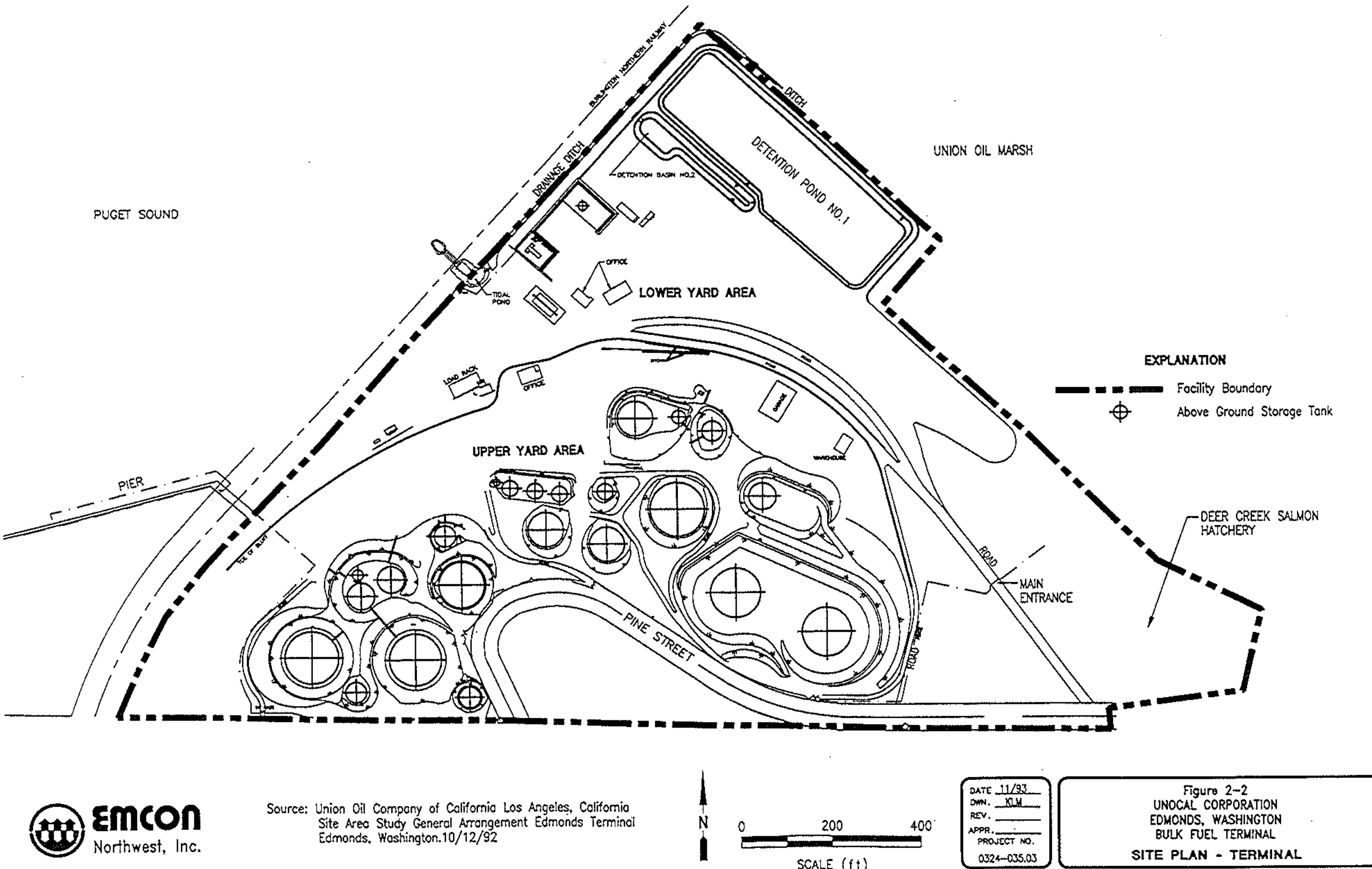
Figure 2-1

UNOCAL CORPORATION
EDMONDS BULK FUEL TERMINAL
EDMONDS, WASHINGTON

SITE LOCATION MAP



Source: Union Oil Company of California Los Angeles, California
Site Area Study General Arrangement Edmonds Terminal
Edmonds, Washington.10/12/92

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Figure 2-2
UNOCAL CORPORATION
EDMONDS, WASHINGTON
BULK FUEL TERMINAL
SITE PLAN - TERMINAL

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limit as the southern boundary, and the Puget Sound Inner Harbor Line as the western boundary.

The northern portion of these areas, approximately 9 acres, is owned by the Port of Edmonds and occupied by the Port of Edmonds marina. The remaining 3 acres, to the south of the marina, are owned by UNOCAL and leased to the city of Edmonds. The 3-acre area is bisected by the UNOCAL approach trestle and dock. That portion to the north of the approach trestle is occupied by a small park (Marina Beach Park), built by the city of Edmonds during construction of the Port of Edmonds marina in approximately 1969. That portion to the south of the approach trestle is undeveloped, with public access available along the shoreline by crossing under the trestle.

There is no documentation to suggest any UNOCAL operations were conducted on these properties, with the exception of the construction of the UNOCAL approach trestle and dock.

2.1.3 Wetland Area

The wetland area, designated as Union Oil Marsh, is approximately 1,500 feet by 750 feet in size. The marsh is located between Harbor Square, to the north, and the Terminal, to the south. The marsh is bound on the east by State Route 104, and on the west by Burlington Northern Railroad right-of-way. The property, now owned by the city of Edmonds, is undeveloped wetland and serves as a wildlife preserve.

There is no documentation to suggest any UNOCAL operations were conducted on this property.

2.1.4 Harbor Square

Harbor Square is a commercial development, approximately 400 feet by 600 feet in size, located on the southeast corner of the intersection of West Dayton Street and Burlington Northern Railroad right-of-way (Figure 1-1). The property is owned by the Port of Edmonds and is occupied by a commercial complex of four buildings. Tenants of Harbor Square include a motel, restaurants, offices, a church, an athletic club, engine and transmission repair shops, and a photograph developing establishment.

The square is bounded to the north by West Dayton Street, to the east, by State Route 104, to the south by Union Oil Marsh, and to the west by Burlington Northern Railroad right-of-way.

UNOCAL operations were conducted on a portion of the Harbor Square area, as described in Section 3.3.

2.2 Current Land Use

2.2.1 Terminal

UNOCAL stopped bulk fuel operations at the Terminal in 1991. The facility is currently used for UNOCAL Corporation offices. The two northern office buildings are leased to and occupied by Pacific Coast Hemphill Oil Company, a subsidiary of UNOCAL.

The Terminal is currently zoned as "waterfront commercial."

2.2.2 Surrounding Area

The Terminal is surrounded by the following operations and land use zoning designations (see Figure 2-3):

South. The Town of Woodway corporate limit serves as the southern boundary of the Terminal. Land use to the south of the UNOCAL facility is primarily single-family residential.

East. The Terminal is bound on the east by State Route 104. The Deer Creek Salmon Hatchery is located on Terminal property at the northeast corner, on the northwest corner of State Route 104 and 216th Street Southwest. The property lying to the east of State Route 104 is zoned under "multi-family" and "public use" designations.

West. The Terminal is bound to the west by the Burlington Northern Railroad right-of-way, the Port of Edmonds marina, and the Puget Sound shoreline. This property is zoned "waterfront commercial."

North. The property immediately north of the Terminal is designated "open space." Further to the north, Harbor Square is zoned "general commercial."

2.3 Property History

This section includes descriptions of purchases of the UNOCAL parcels (Parcels A, B, and C) (Figure 2-4). Leases, sales, and property easements during UNOCAL's ownership are also discussed. Table 2-1 provides a chronology of property history, and Table 2-2 provides a property history timeline. Additional property ownership and lease information is provided in Appendix A. Property history information was obtained from LeSourd & Patten, 1993.

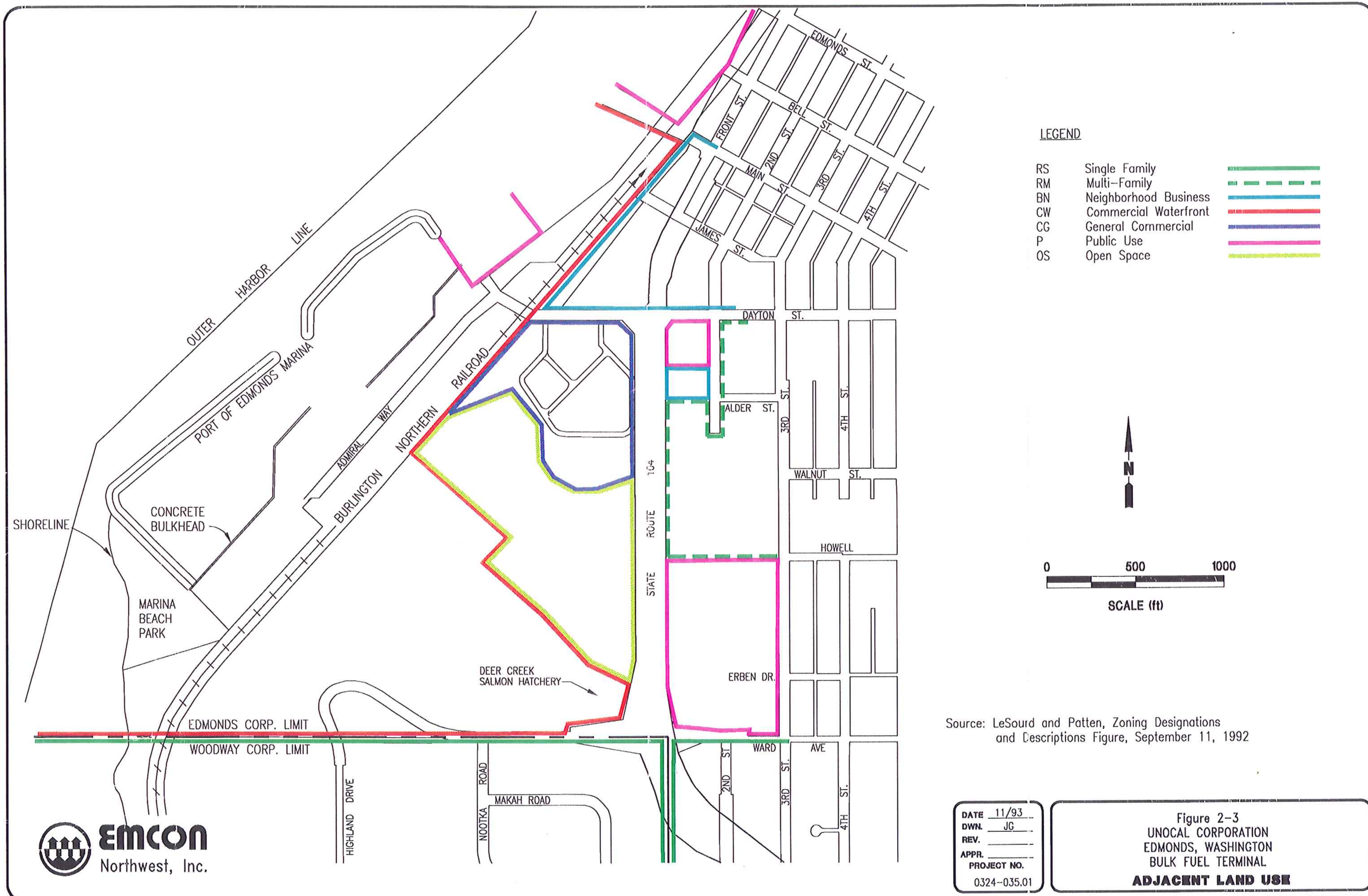

Figure 2-3
UNOCAL CORPORATION
EDMONDS, WASHINGTON
BULK FUEL TERMINAL
ADJACENT LAND USE

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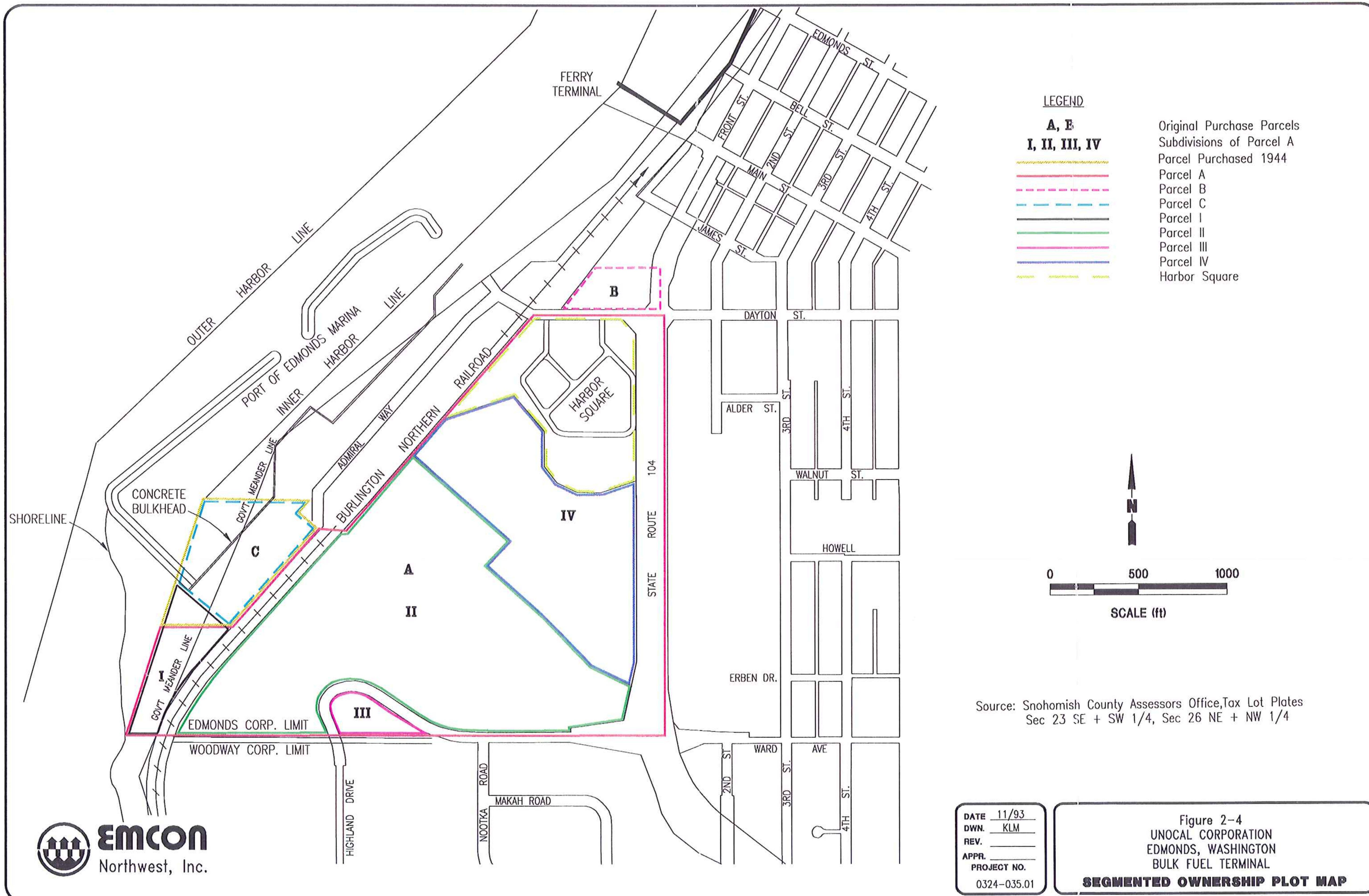

Figure 2-4
UNOCAL CORPORATION
EDMONDS, WASHINGTON
BULK FUEL TERMINAL
SEGMENTED OWNERSHIP PLOT MAP

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Table 2-1

Chronology of Property History
UNOCAL Terminal Sites
Edmonds, Washington

1920	The original purchase of large single tract of property south of Dayton Street (Parcel A, except the north portion of Parcel I) and smaller parcel north of Dayton Street (Parcel B) was made.
1923	UNOCAL acquired easement from Great Northern Railway for pipeline trestle.
1941	UNOCAL deeded 60-foot strip from Parcel B (north of Dayton Street) to city of Edmonds for street right of way.
1944	Great Northern Railway sold UNOCAL "all of Lot 1, Section 26, previously owned by the railroad except right-of-way."
	UNOCAL sold Parcel B to Mr. A.B. Miller and Mrs. Laura Miller.
1948	UNOCAL leased (10 years) Dayton Street Depot (Harbor Square Area) to General American Transportation Corporation.
1956	UNOCAL issued a license to Pacific Telephone & Telegraph to use the proposed road, bridge, and gate as a right-of-way (extension of road along west side of railroad right-of-way).
1957	UNOCAL sold Parcel C to Port of Edmonds. Parcel C (portion of Government Lot 1) lay west of railroad right-of-way and north of current ownership became Edmonds Boat Harbor.
	Harbor area was leased to UNOCAL from Department of Natural Resources (DNR). Lease was renewed in 1967, 1977, and 1987. (The 1987 lease is good until 2007).
1961	There was a public utility district (PUD) easement for power poles adjacent to railroad right-of-way.
1963	UNOCAL made a lease agreement with American Tar in July. The lease was canceled in November 1963.
	UNOCAL leased the Harbor Square area to Mr. Earl Joplin for 5 years. Rental use of property is not known. UNOCAL may have allowed Mr. Joplin to place fill dirt on site.
1964	UNOCAL leased 1/9-acre portion of Harbor Square Area to Mr. Roy Allen for 2 years. Property was used to store building materials and equipment.
1965	UNOCAL allowed Pacific Northwest Bell an easement for access to the wharf area. Easement terminated in 1983.
1967	Harbor area tidelands lease was renewed.
1969	UNOCAL leased north portion of tidelands to the city of Edmonds for development of a park. Lease was renewed in 1982 and was expanded to include south portion in 1986.
1971	The state of Washington condemned 10± acres for construction of rerouted SR 104. UNOCAL allowed easement to Department of Transportation (DOT) for storm sewer.

Table 2-1

Chronology of Property History
UNOCAL Terminal Sites
Edmonds, Washington

1977	Harbor area lease was renewed.
1978	UNOCAL sold Harbor Square property to the Port of Edmonds.
	Storm sewer easement was granted to DOT for access to harbor area UNOCAL leased from DNR.
1980	City of Edmonds annexed and zoned all the UNOCAL property.
	UNOCAL property (Parcels I, II, III, and IV) was subdivided.
1981	UNOCAL implemented a quit claim deed of Parcel IV (Union Oil Marsh) to the city of Edmonds.
1982	UNOCAL renewed lease of north portion of tidelands (Parcel I) to city of Edmonds.
1983	Easement was granted to city of Edmonds for water lines.
1984	UNOCAL leased property for salmon hatchery.
	UNOCAL approved of various easements to city of Edmonds for water lines.
1985	UNOCAL allowed easement to PUD for electrical power to salmon hatchery.
1986	UNOCAL renewed lease of north portion of Parcel I to city of Edmonds and amended lease to include south portion of Parcel I.
1987	UNOCAL renewed Harbor area lease with DNR to 2007.

Reference: LeSourd & Patten. *Property Ownership Records/Edmonds Terminal*. January 1993.

Table 2-2

Property History Timeline
UNOCAL Terminal Sites
Edmonds, Washington

	Original Purchase — January 30, 1920							
	Parcel A							
	Parcel I	Parcel II	Parcel III	Parcel IV	Harbor Square	Parcel B	Parcel C	Offshore Area Leases
1920s	1923 Great Northern Railroad easement to Union Oil for pipeline trestle							
1930s								
1940s	1944 Purchase of north portion of Parcel I by Union Oil				1948 Dayton St. Depot Union Oil lease to GATX	1941 60' strip to city of Edmonds for street; 1944 Sale by Union Oil to A.B. Miller	1944 Purchase of all of Parcel C by Union Oil	
1950s	1956 Agreement with Pacific Telephone & Telegraph regarding proposed road				1958 Union Oil lease to Earl Joplin (2.3 acres)		1957 Sale to Port of Edmonds	1957 Parcel lease
1960s	1965 Easement to Pac NW Bell from Union Oil (wharf area); 1969 Lease to city of Edmonds, north portion	1963 Union Oil lease to American Tar	1961 PUD easement for power poles	1961 PUD easement for power poles	1961 PUD easement for power poles; Union Oil lease to Tri-City, terminated in 1963. 1963 Union Oil lease to Earl Joplin renewed; 1964 Union Oil lease 1/9 acre to Roy Allen			1967 Lease renewal
1970s		1971 Easement to Dept of Transportation storm sewer; condemnation for SR 104		1971 Condemnation for SR 104	1971 Condemnation for SR 104; 1978 Sale to Port of Edmonds			1977 Lease renewal; 1978 Storm sewer easement to Dept. of Transportation
1980s	1980 Annexation to city of Edmonds; subdivided; 1982 Lease to city, north portion; 1984 Water easement; 1986 Lease to city, north and south portions	1980 Annexation to city of Edmonds; subdivided; 1983 Union Oil easement to city for water lines; 1984 Salmon hatchery lease, Union Oil easement to city for water lines; 1985 PUD easement for hatchery	1980 Annexation to city of Edmonds; subdivided	1980 Annexation to city of Edmonds; subdivided; 1981 Deed to city of Edmonds				1987 Lease renewal to 2007

NOTE: UNOCAL currently owns Parcels I, II, and III. The active portion of the site is Parcels II and III.
REFERENCE: LeSourd & Patten. *Propety Ownership Records/Edmonds Terminal*. January 1993.

2.3.1 Purchases

UNOCAL currently owns 47 acres of real property within the city limits of Edmonds, Washington. Historically, UNOCAL owned approximately 125 acres which it acquired in 1920 and 1944. The largest portion of that property is located south of Dayton Street and west of what is now State Route 104, with the Puget Sound shoreline on the property's western boundary. The southern property boundary is the northern limits of the town of Woodway. Two smaller portions of property purchased by UNOCAL in 1920 and 1944 are located north of Dayton Street, and north of the approach trestle along the Puget Sound shoreline.

The UNOCAL purchases have been segmented into three areas (Figure 2-4), referred to as "Parcels A, B, and C." Parcel A is the upland and tideland property south of Dayton Street and west of the railroad right-of-way, extending out to the inner harbor line in the vicinity of the approach trestle. Parcel B is the land north of Dayton Street. Parcel C lies to the north of the approach trestle.

There is no record of any UNOCAL activity on Parcel B from 1920 to 1944, when UNOCAL sold the parcel to two individuals. There is no record of any UNOCAL use of Parcel C from the date of purchase (1944) to 1957, when UNOCAL sold the parcel to the Port of Edmonds. It has since been developed as a major public marine facility (Port of Edmonds marina) with waterfront retail and commercial activities.

Most of UNOCAL's operations took place in the southerly portion of Parcel A. Soon after UNOCAL originally acquired the property in 1920, the company obtained an easement from the Great Northern Railway Company (now known as Burlington Northern Railroad), to construct and maintain a trestle over the railroad right-of-way. That easement still exists.

In 1971, a strip of land along the eastern edge of Parcel A was condemned by the state of Washington for construction of State Route 104. As a result of this highway project, a large storm sewer crosses the lower Terminal yard, documented in an easement recorded in 1971.

In 1978, a large portion of the northerly half of Parcel A, including the Dayton Street Depot area, was sold to the Port of Edmonds (the Port). The Port has since leased that land to private developers who have created a commercial office and retail complex known as Harbor Square.

In 1981, a large parcel located between Harbor Square and the Terminal at the southerly half of Parcel A was given to the city of Edmonds. This parcel is now known as the Union Oil Marsh. In 1980, as part of a comprehensive development plan for UNOCAL, and before the Union Oil Marsh was deeded to Edmonds, UNOCAL annexed all of its property (Parcel A) into the city and subdivided that land into four parcels (Parcels I, II, III, and IV). The Union Oil Marsh is Parcel IV on Figure 2-4.

Parcel I consists of about 3 acres of tideland, located west of the railroad right-of-way. Parcels II and III consist of approximately 44 acres of upland property. Parcel I has been leased to the city of Edmonds since 1969, with a modification in 1986.

2.3.2 Leases

In 1957, the same year Parcel C was sold to the Port, UNOCAL began leasing from the state of Washington the harbor area adjoining the southern portion of Parcel A. The original state leases for the harbor area were renewed for 20 years. An easement across a portion of the harbor area was granted in 1971 to the Department of Transportation.

In 1948, UNOCAL leased a portion of Parcel A to General American Transportation Corporation (GATX); how the property was used by GATX is unknown. There was leasing activity in that area in the late 1950s and early 1960s (e.g., 1958 lease to Mr. Earl Joplin, rental use of property unknown; however, lease documents indicate "hot mix plant operations;" and a 1964 lease to Mr. Roy Allen). A 1963 lease to American Tar may have been in that area; whether the property was ever actually used is unknown. The lease was only in effect for approximately three months. In 1961, UNOCAL leased approximately 2 acres of Parcel A, to the east of the Joplin property, to Tri-City Sand and Gravel. The property was used for a stockpile area for sand and gravel fill. The lease was terminated in 1963.

In the early 1980s, easements were granted to the city of Edmonds for water lines intended to more adequately service the public marina and other facilities along the waterfront. In 1984, UNOCAL leased a small portion of the site, near the entrance to the Terminal, to a non-profit organization for development and use as a salmon hatchery (Deer Creek Salmon Hatchery). The lease is for 20 years, with two 10-year options to renew. In 1985, an easement across a portion of the lower yard was granted to provide electrical power to the hatchery.

In 1986, UNOCAL renewed the city of Edmonds lease for the north portion of Parcel I with an amendment of the lease to include the south portion of Parcel I. In 1987, UNOCAL renewed the harbor area lease through 2007. See Table 2-2 for a timeline of property purchasing, leasing, and easement history.

2.4 Site Setting

The Terminal is located within 1,000 feet of the Puget Sound shoreline. The lower yard, offshore areas, and Harbor Square range from 0 to 15 feet above mean sea level (amsl). The upper yard ranges from 15 to 150 feet amsl.

2.4.1 Geology

Lower Yard. The lower yard was formerly a tidal marsh. Fill material, up to 11 feet thick, was placed to provide usable working surface or subgrade to support Terminal facilities. The fill material varies widely in composition and degree of compaction across the lower yard and consists of silty sand, clean sand, gravelly sand, and clayey silt (GeoEngineers, 1986).

Native soils vary across the lower yard; clean sand underlies the fill material at depths ranging from 8 to 11 feet below the ground surface.

Upper Yard. This area of the facility is located on the northern slope of a hillside. Aboveground storage tank elevations vary along the hillside.

The subsurface soil conditions consist of 1 to 7 feet of sandy silt, sand, and sandy gravel fill material, underlain by native interbedded glacial and interglacial sediments. The native soils include silt, sandy silt, silty sand, and sand (GeoEngineers, 1988a).

Offshore, Tideland, and Park Areas. The subsurface conditions of the shoreline and park area of the Edmonds facility have not been explored. Based on geological information compiled by the U.S. Geological Survey (Minard, 1983), the park and shoreline areas are defined as "modified land." Modified land consists of areas that have been excavated or filled. The nature of the fill in the nearshore area is not currently known.

Harbor Square. The Harbor Square area was formerly a tidal marsh. Fill material was placed to provide a usable working surface or subgrade to support the Harbor Square development. Fill material along the eastern two-thirds of the parcel consists of dredged sands placed at the site during the construction of the Port of Edmonds marina. Fill material along the western third was placed prior to 1924 and construction of the Dayton Street Depot. Native soil consists of clean sand underlying the fill material at depths ranging from approximately 6 to 10 feet.

2.4.2 Surface Water

A small creek originally bisected the former tidal marsh/lower yard of the Terminal, prior to the placement of imported fill. The creek was relocated by excavating a drainage ditch along the northern and northwestern limit of the lower yard prior to 1947. The drainage ditch carries surface water runoff collected from upland areas to the south and east of the facility. The drainage ditch flows into a tidal pond, located along the northwest property limit, then beneath the Burlington Northern Railroad right-of-way via a 48-inch-diameter culvert and on to Puget Sound. The surface water in the drainage ditch is hydraulically connected to the Sound and is influenced by tidal activity. During periods of high tide, no discharge occurs due to invert elevations and water-gate controls at the terminus (GeoEngineers, 1988b).

The facility storm drainage system is connected to the drainage ditch. During rainfall events, the system collects water in the upper and lower yards via catch basins; the water is pumped to the facility oil/water separator located to the south of Detention Basin No. 2. The collected surface water is then pumped to Detention Basin No. 2 and discharged into the drainage ditch via NPDES Outfall 002.

Detention Basin No. 1 lies in the northern corner of the facility and serves as an overflow detention pond during heavy rainfall events. Surface water collected in Detention Basin No. 1 is pumped through the oil/water separator and then on to Detention Basin No. 2 and the drainage ditch via NPDES Outfall 002.

Heavy rainfall events during very high tides sometimes prevents the use of Outfall 002. At these times collected surface water is discharged directly from the oil/water separator to the drainage ditch via NPDES Outfall 001.

The Marina Bay Park area is bounded to the west by the Puget Sound shoreline. No other surface water is present in the park.

No surface water is present on Harbor Square.

2.4.3 Hydrogeology

Most groundwater data for the Terminal were generated during site assessments conducted between 1986 and 1989.

Lower Yard. Unsaturated fill is found beneath the entire lower yard portion of the site. The unit reaches 11 feet in thickness, with groundwater encountered within 4 to 8 feet of the ground surface.

Saturated fill and native silt and sand sediments were explored to a maximum depth of 19 feet below ground surface (GeoEngineers, 1986). The saturated fill and native sediments are unconfined and primarily recharged by precipitation. Groundwater levels vary from about 4 to 8 feet below ground surface, or about 6 to 10 feet amsl, and vary as much as 2 feet with tide cycles. Groundwater elevations in the lower yard are highest along the toe of the hillside and at the northern corner of the site. The direction of shallow groundwater migration is reportedly toward the west-northwest, although the data collected to date are insufficient to precisely determine groundwater flow.

Upper Yard. Unsaturated fill is found in the vicinity of the aboveground storage tanks and within the bermed soil containment areas. The unit ranges in thickness from 1 to 7 feet below ground surface (GeoEngineers, 1988a).

Unsaturated and saturated dense glacial and interglacial sediments underlie the fill material to a maximum explored elevation of approximately 21 feet amsl. Groundwater elevations in the upper tank yard range from 35 to 104 feet above mean sea level (GeoEngineers, 1988a, 1993). Direction of groundwater migration beneath the upper tank yard is complex, with three possible migration directions in different areas. Subsurface exploration to date is insufficient to define groundwater migration directions (GeoEngineers, 1993). The presence of one or more perched groundwater zones is suspected.

Harbor Square. Unsaturated fill material is found beneath the site to a depth of 3 to 4 feet below ground surface. Saturated fill and native sediments were explored to a maximum depth of approximately 20 feet below ground surface. The saturated fill and native sediments are unconfined and primarily recharged by precipitation. Groundwater levels range from 3 to 6 feet below ground surface, or 6 to 9 feet amsl.

3 FACILITIES AND OPERATIONS

3.1 Terminal

Information used to prepare Section 3 was obtained primarily from UNOCAL files. A summary of aerial photos reviewed for purposes of this report, and copies of photos, are provided in Appendix B.

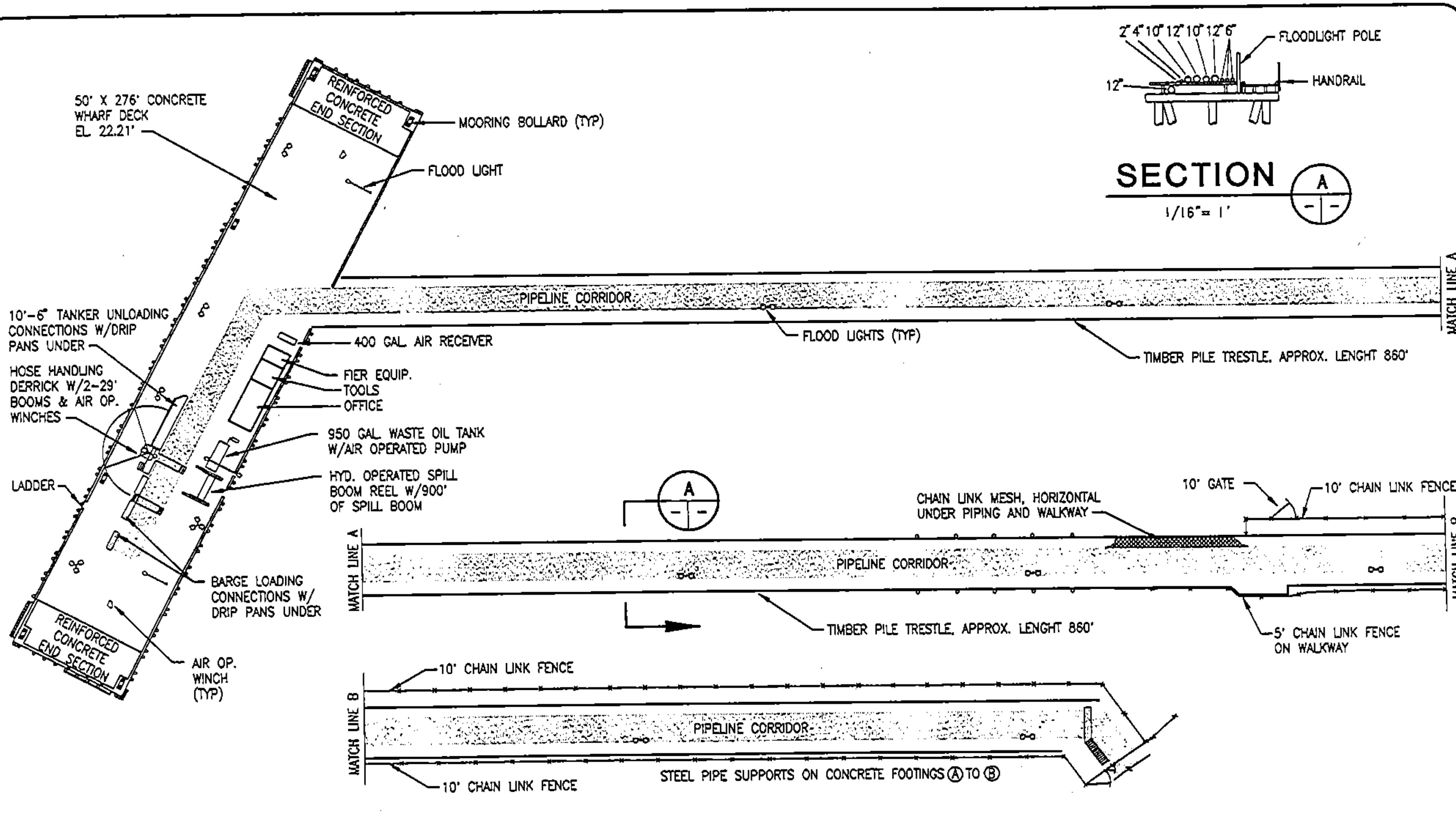
Historical operational areas at the Terminal include the dock, the railcar unloading areas, the aboveground tank farm, Detention Basin No. 1, piping systems, the air-blown asphalt plant, the asphalt warehouse, the laboratory, truck loading racks, the boiler, oil/water separators, underground storage tanks, maintenance operations, and storm drain and sewer systems. Remaining structures are shown on Figures 3-1, 3-2, and 3-3.

3.1.1 Dock Operations

UNOCAL owns a 275-foot-long by 50-foot-wide dock with an 860-foot by 20-foot approach trestle constructed in 1923. The dock and approach trestle are located in the southwest corner of the facility, extending westward from the southern corner of the lower yard out into Puget Sound (see Figures 3-3 and 1-1). The approach trestle extends out from the shoreline over a 3-acre area referred to in this report as Parcel I. Historically, UNOCAL did not use this property in its bulk fuel terminal operations. As previously noted, the land is leased to the city of Edmonds for use as a public park.

The dock is constructed of wood timbers set on wood pilings. The surface of the dock was subsequently finished with concrete about 1985. The dock has an office building with a fire equipment storage area, a tool room, a restroom, a telephone, a fog horn, navigation lights, and first aid equipment. Fire extinguishers and fire hoses are placed along the dock. The dock has an oil spill boom in its central portion. UNOCAL is a member of a cooperative spill cleanup organization (Clean Sound). Information regarding spill notification, contractors, and emergency procedures was routinely provided to employees on duty.

UNOCAL's dock loading/unloading facilities consist of a system of pipes and valves, each dedicated to a specific product. Ten 2-inch-diameter to 12-inch-diameter steel pipes run above-deck from the loading/unloading area (located about 850 feet from the inner harbor line) to the shoreline. All pipes are no longer in use and are in the process of



EMCON Northwest, Inc.

Source: Union Oil Company of California Los Angeles, California
General Arrangement Wharf, Edmonds Terminal
Edmonds, Washington. 4/6/82

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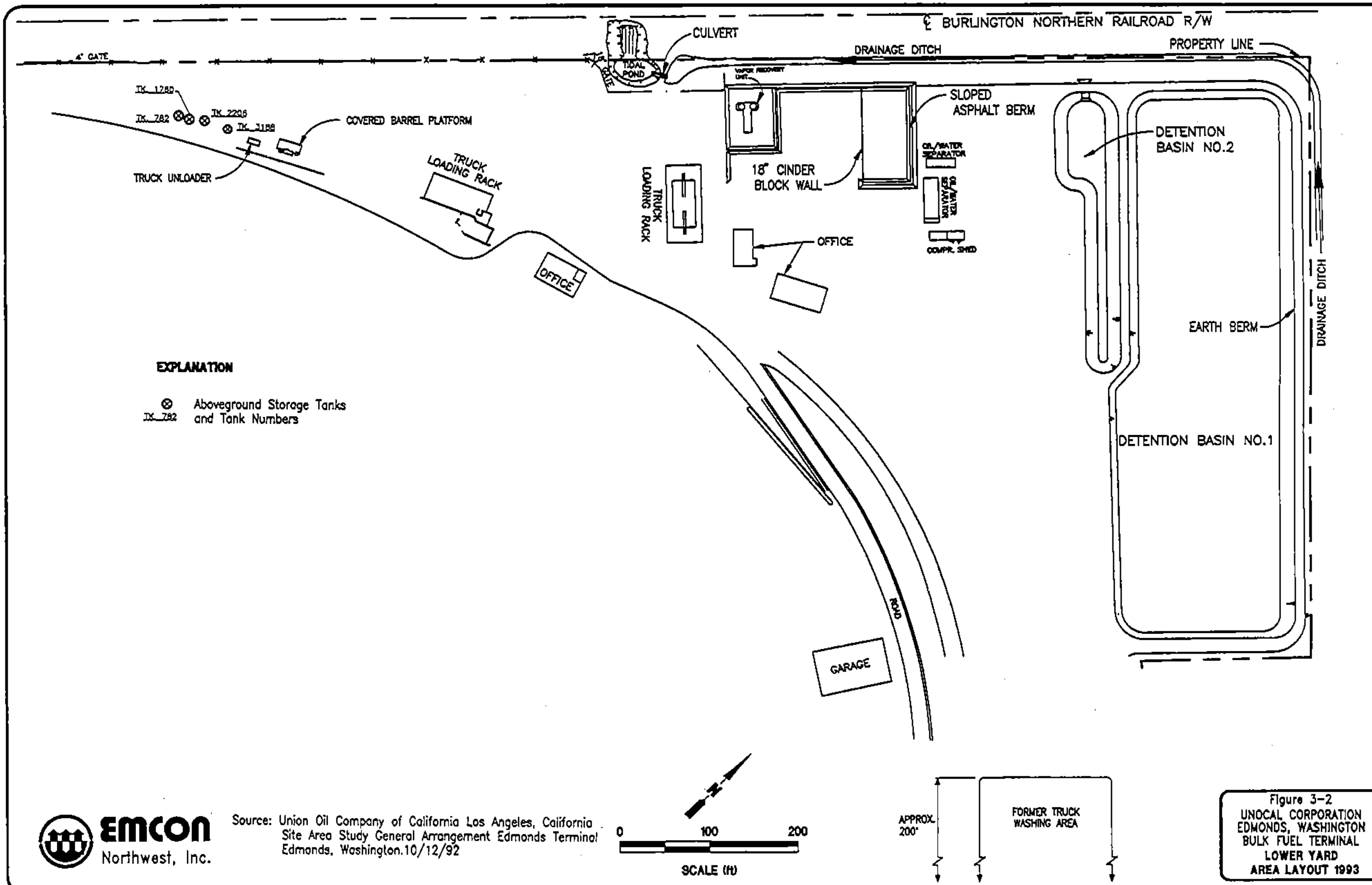
Figure 3-1
UNOCAL CORPORATION
EDMONDS, WASHINGTON
BULK FUEL TERMINAL
DOCK AND APPROACH TRESTLE LAYOUT (1993)

1= 40 11-22-93 0324\035\01C10

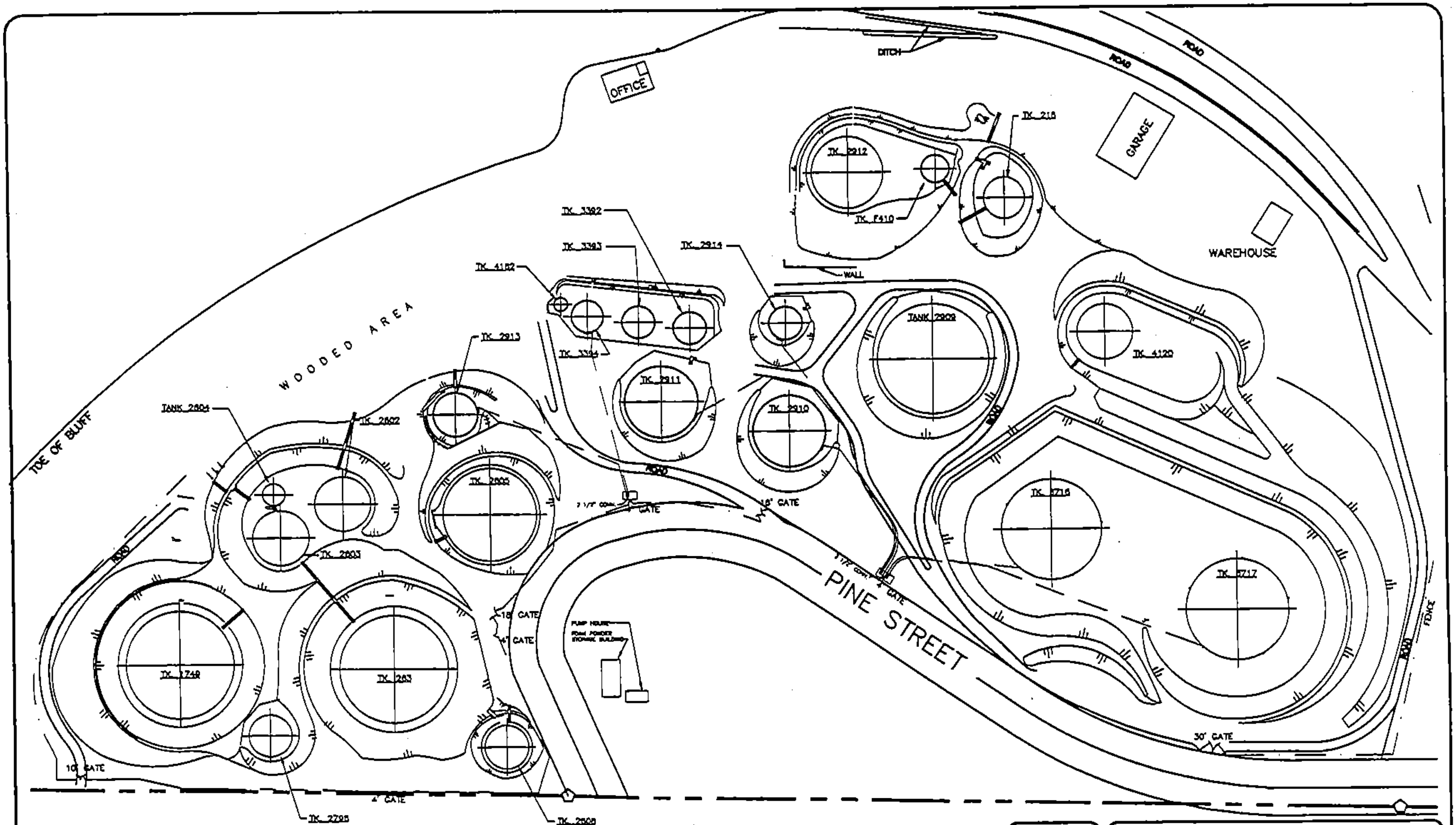


EMCON Northwest, Inc.

Source: Union Oil Company of California Los Angeles, California
Site Area Study General Arrangement Edmonds Terminal
Edmonds, Washington.10/12/92

Figure 3-2
UNOCAL CORPORATION
EDMONDS, WASHINGTON
BULK FUEL TERMINAL
LOWER YARD
AREA LAYOUT 1993

1=100 2-14-94 G:\DWG\0324\035\01C29



emcon Northwest, Inc.

Source: Union Oil Company of California Los Angeles, California
Site Area Study General Arrangement Edmonds Terminal
Edmonds, Washington. 10/12/92

N

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SCALE (ft)

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REV.
APPR.
PROJECT NO.
0324-035.01

Figure 3-3
UNOCAL CORPORATION
EDMONDS, WASHINGTON
BULK FUEL TERMINAL
UPPER YARD LAYOUT (1993)

1= 100 11-22-93 0324\035\01C05

being cleaned out. Eight of the pipes were used to transfer diesel, AV gas, unleaded and leaded fuel, SMV fuel oil, marine diesel oil, and marine fuel oil. At the Burlington Northern Railroad right-of-way, the approach trestle and piping system bend in a southeastern direction over the railroad tracks, into the shoreline manifold area in the southwest corner of the lower yard. A sloped containment pad lies beneath the black oil manifold and a metal containment tray underneath the sampling port of the light oil manifold. No other containment exists beneath the light oil manifold.

One steel tank, approximately 950 gallons in size, is located below deck to provide storm water and spill collection during unloading at the dock. The tank is located immediately south of the dock office building. The product from this collection tank was pumped to an aboveground tank in the upper yard.

Over the operational history of the dock loading/unloading area, the Terminal took daily delivery of gasoline, fuel oils, and crude oils. A review of historic drawings indicates that while the product mix may have changed slightly over time, a broad range of petroleum hydrocarbons has always been transferred through the dock. It also appears that the dock layout has been basically the same. Barge refueling did not occur during the latter years of Terminal operations, but it is not known whether refueling activities occurred in earlier years. Trained UNOCAL employees performed all sampling, gauging, dock, and tank valve operations following approved receipt procedures. Radio communication was employed among ship, dock, and tank farm to coordinate line changes and tank topping.

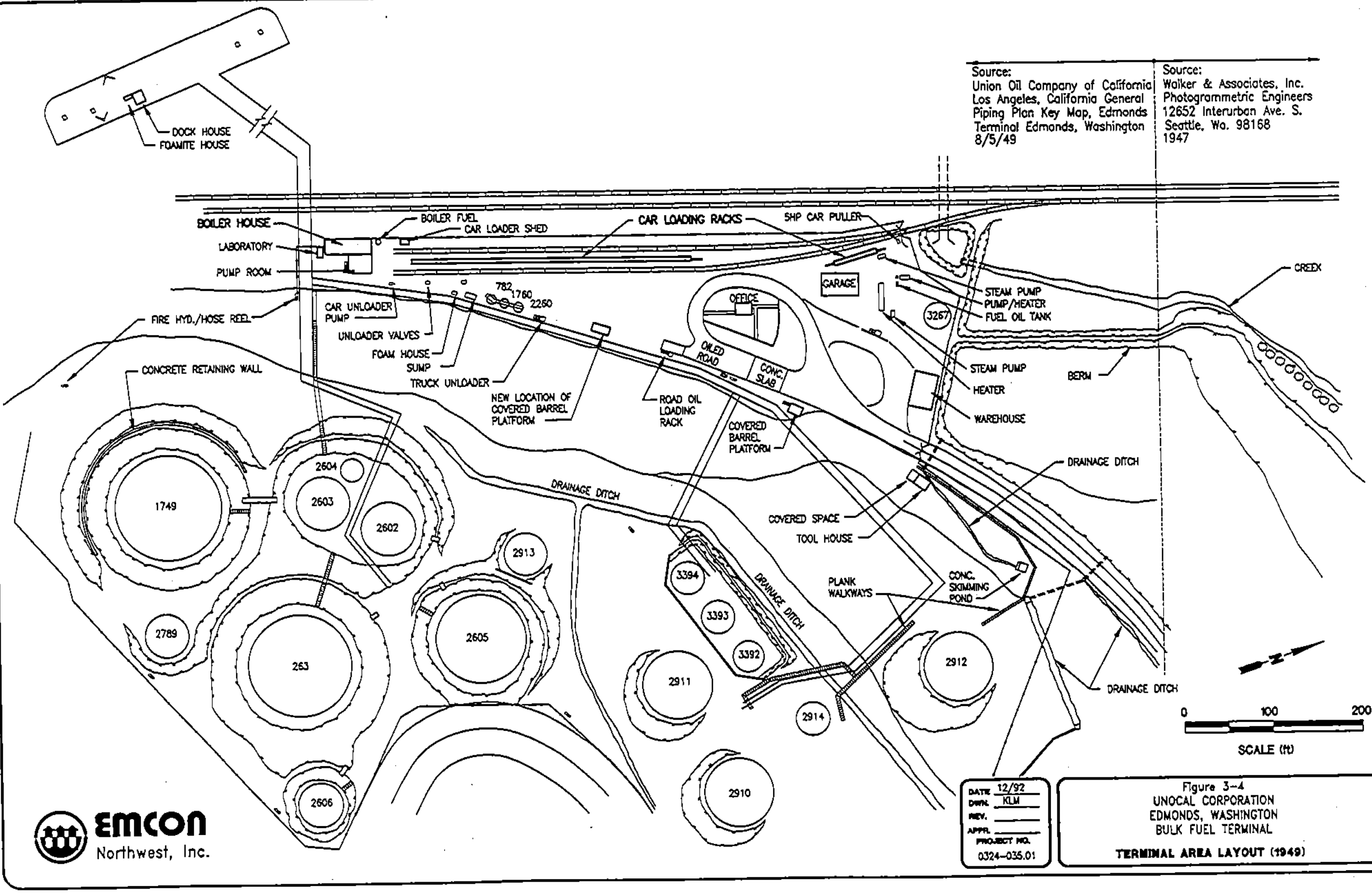
Bi-weekly dock loading activity took place over the last 10 years of Terminal operation. As part of a "through put" agreement with British Petroleum, black oils were received, stored, and shipped through the facility dock, only ("black oil" is a term generally used for darker-colored products such as marine fuel oil and marine diesel oil). The last shipment was completed in mid-1993.

3.1.2 Railcar Unloading Areas

Two railcar unloading areas at the Terminal were located in the southern portion of the lower yard along the western property limit (see Figure 3-4). Railcar service to the facility was discontinued in the 1960s and the railcar unloading areas were dismantled and regraded in 1974.

The southernmost railcar unloading area was approximately 40 feet wide by 310 feet long and was constructed in the early 1930s. The unloading area consisted of two parallel railroad track spurs with a loading/unloading rack lying between the two sets of tracks.

The northernmost railcar loading area was located on the east side of the easternmost railroad spur, immediately south of the tidal basin. The unloading area was approximately 10 feet wide by 70 feet long.



EMCON
Northwest, Inc.

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DWN.	KLM
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PROJECT NO.	0324-035.01

Figure 3-4
UNOCAL CORPORATION
EDMONDS, WASHINGTON
BULK FUEL TERMINAL

TERMINAL AREA LAYOUT (1949)

1= 100 02-17-93 0324\035\01C13

Table 3-1

Aboveground Storage Tanks
UNOCAL Bulk Fuel Terminal
Edmonds, Washington

Tank No.	Date Tank Installed	Product Handled	Tank		Storage Capacity (BBL)
			Dimensions (H x D)	Material	
1749	1923	Marine Fuel Oil	41'10" x 117'	riveted steel, concrete ring, exterior cone roof	80,000
2798	1937	Jet A/Heating Oil #1 Heating Oil #1 Sour Gas	41'3" x 48'	welded steel, concrete ring, exterior cone roof	13,200
2603	1931	Cutter Stock/MDO Fuel Oil Diesel	40'10" x 60'	riveted steel, concrete ring, exterior cone roof	20,500
2604	1931	Inactive Fuel Oil	29'6" x 24'	riveted steel, concrete ring, exterior cone roof	2,400
2602	1931	MDO/Cutter Stock Fuel Oil Fuel Oil	40'10" x 60'	riveted steel, concrete ring, exterior cone roof	20,500
263	1923	Fuel Oil/MFO Fuel Oil SMV Crude	41-10" x 117'	riveted steel, concrete ring, exterior cone roof	80,000
2605	1931	Out-of-Service Diesel Fuel Oil	40'8" x 102'	riveted steel, concrete ring, exterior cone roof	59,000
2606	1931	Out of Service Sour Gas Cutter Stock	35'3" x 48'	riveted steel, no automatic gauge, concrete ring, exterior cone roof	11,300
2910	1938	Super Unleaded Unleaded Stove Oil	48'2" x 78'	welded steel, concrete ring, floating pan roof	40,880
3716	1954	Unleaded Regular 76 SMV Crude	48' x 110'	welded steel, concrete ring, exterior floating roof	81,000
3717	1954	Unleaded Royal 76 SMV Crude	48' x 110'	welded steel, concrete ring, exterior floating roof	81,000
2914	1938	AV 80/87 Leaded Gas/AV 80/87 AV 80/87	36' x 36'	welded steel, concrete ring, floating pan roof	6,530

Table 3-1

Aboveground Storage Tanks
UNOCAL Bulk Fuel Terminal
Edmonds, Washington

Tank No.	Date Tank Installed	Product Handled	Tank Dimensions (H x D)	Tank Material	Storage Capacity (BBL)
2909	1938	Fuel Oil/MFO Oil Fuel Oil Feed Stock	42' x 120'	welded steel, concrete ring, exterior cone roof	84,670
4120	1960	Diesel #2 Diesel	48' x 60'	welded steel, concrete ring, exterior floating roof	20,500
218	1953	Slops Paving Asphalt Cut-back Asphalt Feed Stock	40' x 45'	welded steel, concrete ring, exterior cone roof	11,170
F410	1956	Slops RC Solvent	40' x 30'	welded steel, concrete ring, exterior cone roof	4,730
2912	1938	Diesel #2 Diesel SMV	42' x 78'	welded steel, concrete ring, exterior cone roof	35,770
2911	1938	Leaded Regular Leaded Gas Diesel	48'3" x 78'	welded steel, concrete ring, floating pan roof	40,880
2913	1938	Super Unleaded Unleaded Gas Fuel Oil	30'2" x 48'	welded steel, concrete ring, floating pan roof	9,680
3392	1950	Inactive Solvent Kerosene	36' x 35'	welded steel, concrete ring, exterior cone roof	6,170
3393	1950	Inactive Lead Gasoline AV 91/98	36' x 35'	welded steel, concrete ring, exterior cone roof	6,170
3394	1950	AV 80/87 Lead Gasoline AV 100/130	36' x 35'	welded steel, concrete ring, floating pan roof	6,170
4182	1962	Inactive Solvent	18' x 15'	welded steel, concrete ring, exterior cone roof	500
3188	1968	R212 (Gasoline Additive)	24' x 8'6"	welded steel, concrete ring, no automatic gauge, exterior cone roof	230

Table 3-1

Aboveground Storage Tanks
UNOCAL Bulk Fuel Terminal
Edmonds, Washington

Tank No.	Date Tank Installed	Product Handled	Tank Dimensions (H x D)	Tank Material	Storage Capacity (BBL)
2206	1947	Fuel Oil/MFO/MDO Fuel Oil	29'6" x 10'9"	riveted steel, concrete ring, no automatic gauge, exterior cone roof	480
1760	1942	MFO Fuel Oil	28'10" x 10'6"	welded steel, concrete ring, exterior cone roof	480
782	1939	Fuel Oil/MFO/MDO Fuel Oil	29'7" x 10'6"	riveted steel, concrete ring, exterior cone roof	480

NOTE: 1 BBL (barrel) = 42 U.S. gallons.
MDO = Marine diesel oil.
MFO = Marine fuel oil.
SMV = Santa Maria Vessel.
AV = Aviation fuel.

3.1.3 Aboveground Tank Farms

The last delivery of product to the Terminal was on November 23, 1991. The last commercial delivery of product from the Terminal was in June 1992. The aboveground tanks range in size from 9,726 gallons to 3,491,754 gallons. A listing of tank number, installation date, product handled, tank dimensions, tank construction materials and storage capacity is presented in Table 3-1 for each tank. All tanks, with the exception of Tanks 410 and 218, are currently empty and in the process of being cleaned out. A more detailed discussion of chemical products used at the Terminal is included in Section 4 of this report.

All product storage tanks are made of welded or riveted steel and have either fixed or floating (interior or exterior) roofs.

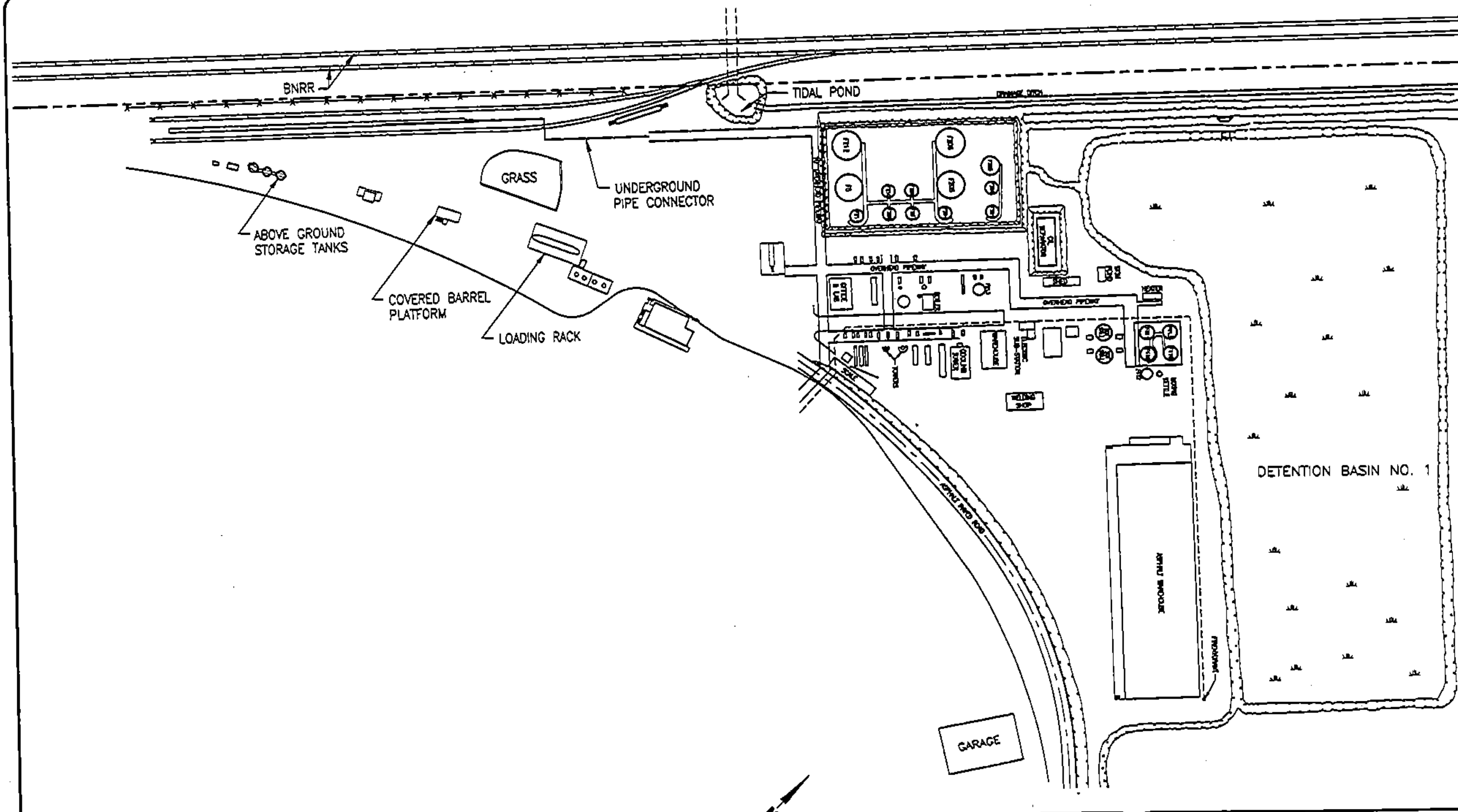
All aboveground storage tanks in the upper yard are contained within soil berms coated with an asphalt emulsion to prevent soil erosion. The four tanks in the lower yard are contained within a concrete catchment basin. With the exception of the entrance roads and the asphalted berms, the upper yard is unpaved and has a gravelly surface through which most precipitation infiltrates. Storm water runoff collects in a series of catch basins which subsequently drain to the oil/water separator in the lower yard. The catch basins are located throughout the upper yard within the bermed areas surrounding the aboveground tanks and along the drainage corridors of the access roads.

As previously noted, construction of the upper yard began in 1923, along with the main terminal and dock. Only Tanks 216 and 1749 were constructed at that time, and contained crude oil and gasoline, respectively. By 1940, 13 aboveground product storage tanks had been added to the upper yard (see 1949 layout in Figure 3-4). The remaining 12 aboveground storage tanks were all constructed by 1968.

3.1.4 Detention Basin No. 1

Detention Basin No. 1 is located in the northern corner of the lower yard, is roughly rectangular in shape, and is approximately 200 feet by 600 feet in size (Figure 3-1). Currently, Detention Basin No. 1 serves as a storm water detention pond during heavy rainfall events.

Detention Basin No. 1 was constructed in 1952. The original configuration was L-shaped with a footprint size of approximately 120,000 square feet (Figure 3-5). The area was originally occupied by a small pond, pasture, and marshland (GeoEngineers, 1988b). Dikes were constructed around the unlined impoundment area by dredging sediment from inside the dike containment area. A drainage channel was excavated around the northern and northwestern perimeters to carry the flow from a small creek



EMCON Northwest, Inc.

Source: Union Oil Company of California Los Angeles, California Site Area Study General Arrangement Edmonds Terminal Edmonds, Washington. 10/12/92

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PROJECT NO.	0324-035.01

Figure 3-5
UNOCAL CORPORATION
EDMONDS, WASHINGTON
BULK FUEL TERMINAL
LOWER YARD TERMINAL AREA LAYOUT (1961)

1= 100 11-11-93 0324\035\01C08

draining surface water from upland areas to the south and east of the facility. The Detention Basin No. 1 outfall into the drainage channel was on the northwestern side of the basin.

In the late 1960s, the basin was modified by cutting off the southern leg to create an impoundment to contain refinery and asphalt plant sludges and runoff. The northern portion of the basin was sized to provide sufficient retention capacity for 100 percent of the volume of the petroleum product contained in Tanks 3716 and 3717, located in the eastern portion of the upper yard.

Detention Basin No. 1 was modified to its present configuration in approximately 1974. The modifications included backfilling the sludge impoundment portion of the southern leg and constructing a PVC-lined outfall basin (Detention Basin No. 2) along the southern perimeter of Detention Basin No. 1. Outfall from the facility oil/water separator passes into Detention Basin No. 2, then on into the drainage channel. During heavy rainfall events, a spillway connects Detention Basin No. 2 with Detention Basin No. 1 for additional storage capacity. Surface water collected in Detention Basin No. 1 is pumped back through the facility oil/water separator, then on to Detention Basin No. 2.

Water levels in Detention Basin No. 1 have varied over time, with most fluctuations being seasonal. There are no reports of the basin overtopping its dikes, seepage, or leaks.

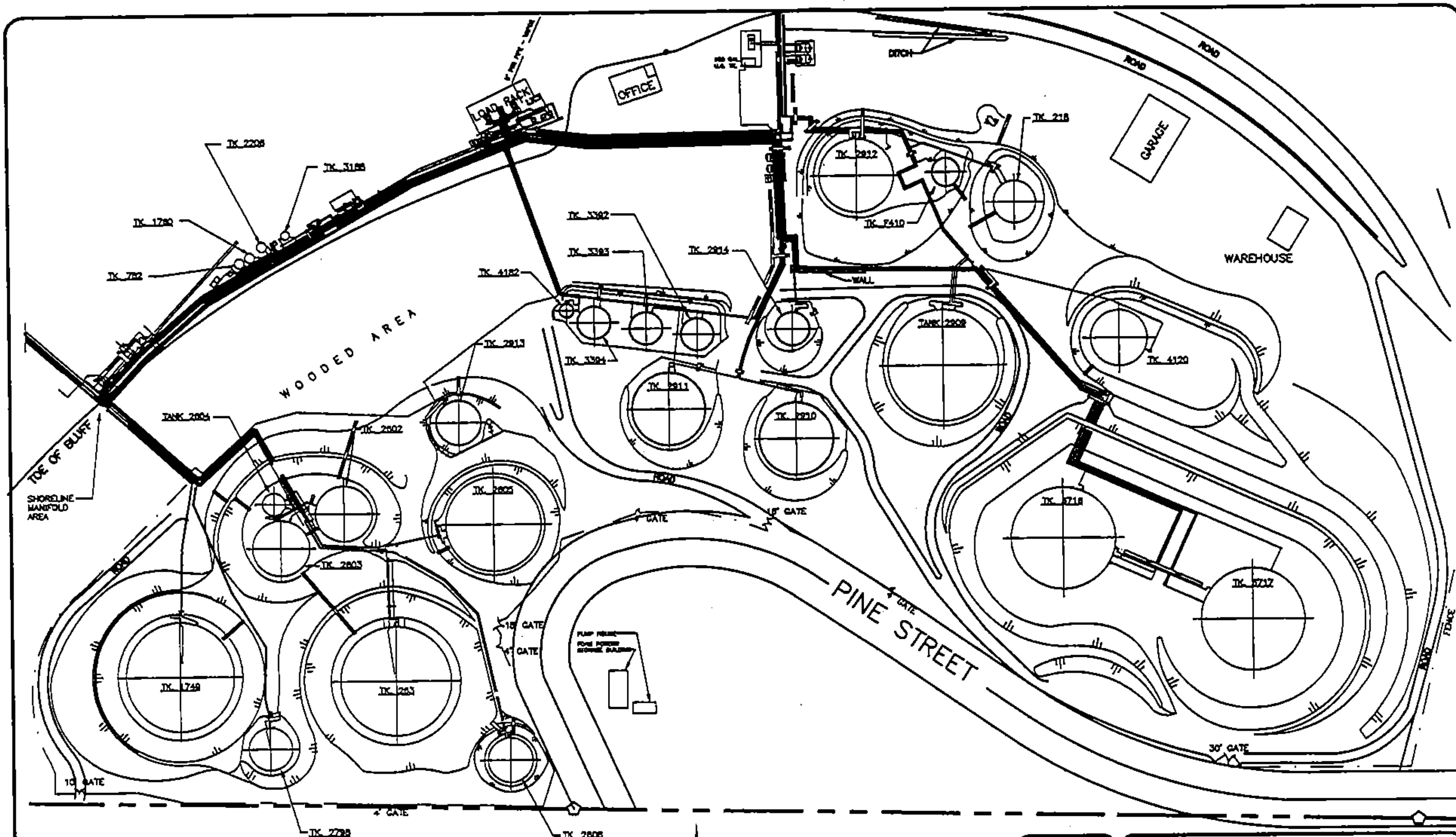
Since the construction of Detention Basin No. 1 and its auxiliary detention facilities, spills and unplanned releases of petroleum product have affected the area. These incidents are summarized in more detail in Section 6 of this report.

3.1.5 Piping Systems

A series of aboveground and underground pipelines, valves, and manifolds at the Terminal were used to move product between areas of receipt, storage tanks, blending kettles and tanks (asphalt operation), packaging operations, and distribution areas. Figure 3-6 presents the 1992 upper yard piping layout.

All product pipes and valves are made of steel and were dedicated to specific products. Product pipes from the dock enter the tank farm at two locations; the western side is near Tank 2604, and the north-central area is near Tank 2912 (Figure 3-6). Product pipelines exit the tank farm in the north-central area for distribution via the two truck loading racks.

Product was received via barge, ship, railcar, or truck. Product was distributed off site by maritime tanker, barge, truck (bulk), drums, cartons, and rail. Each product had a dedicated pipeline from the dock and railcar unloading areas to dedicated storage tanks



EMCON Northwest, Inc.

Source: Union Oil Company of California Los Angeles, California Site Area Study General Arrangement Edmonds Terminal Edmonds, Washington.10/12/92

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PROJECT NO.	0324-035.01

Figure 3-6
UNOCAL CORPORATION
EDMONDS, WASHINGTON
BULK FUEL TERMINAL
UPPER YARD TANK FARM
ABOVE GROUND PIPING LAYOUT (1992)

1= 100 01-25-94   0324\035\01C12

in the upper yard. Similarly, each product had its own dedicated pipeline from tankage to the blending or distribution facilities. Piping was also dedicated between blending kettles/tanks or finished product storage tanks and the filling operations. All product pipes were made of steel and range from 1.5 to 12 inches in diameter.

Pipelines from the dock run aboveground to the shoreline manifold area in the southwest corner of the lower yard (Figure 3-6). From the shoreline manifold area, the aboveground piping runs southeast up the hillside, into the southwest portion of the upper yard, and northeast along the toe of the hillside to the north central portion of the upper yard.

Overhead pipelines to a vapor recovery system and northern truck loading rack exit the upper tank yard in the vicinity of the boiler and extend north toward the laboratory building. The vapor recovery system was located along the northwest property limit.

A series of overhead pipelines were associated with the former air-blown asphalt plant, supplying charge stocks to aboveground storage tanks and stills, transporting asphalt products through the unit, and delivering finished products to the former packaging warehouse and northern truck loading rack. The overhead piping was removed when the asphalt plant was dismantled around 1980.

3.1.6 Air-blown Asphalt Plant

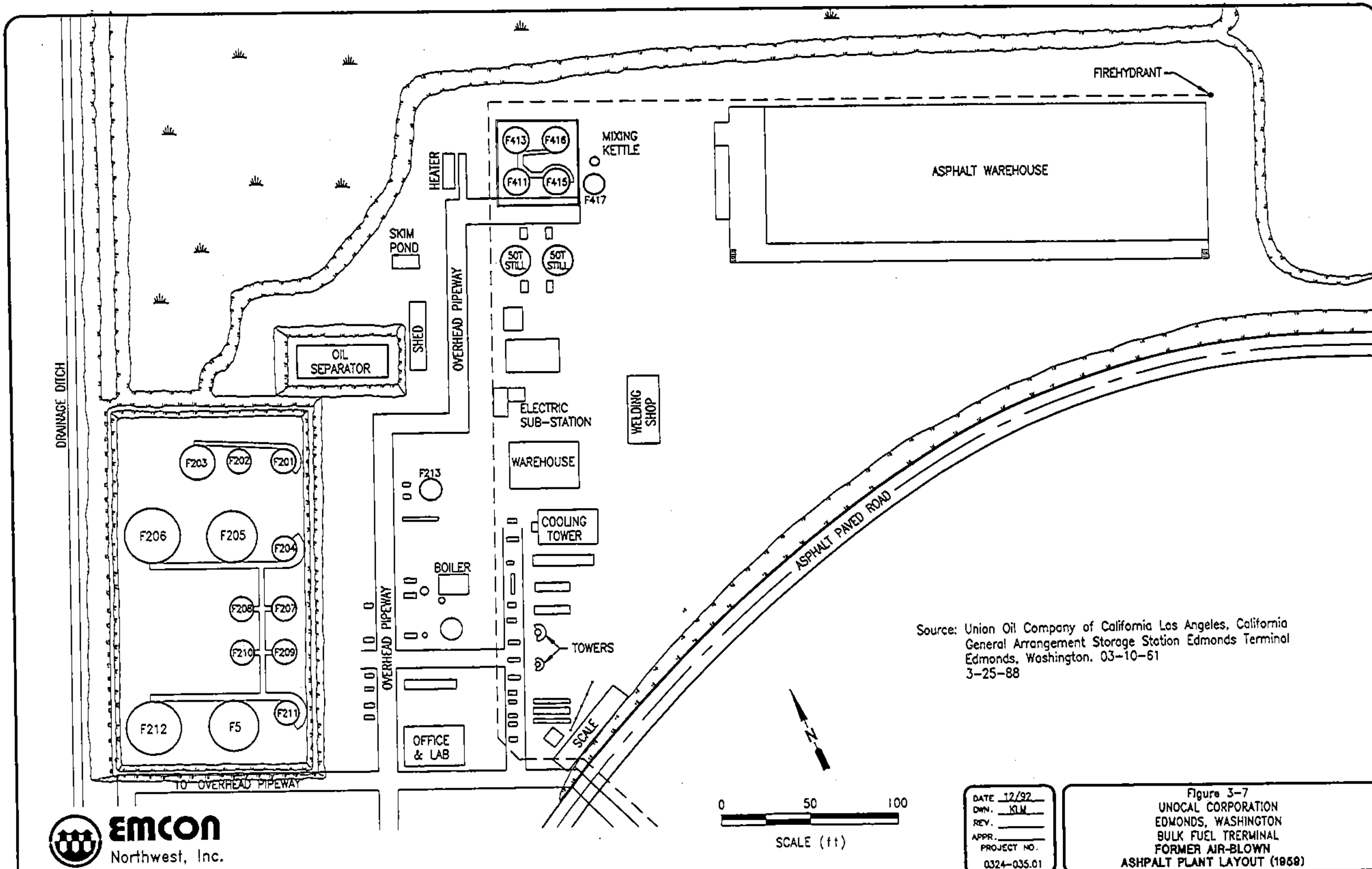
The air-blown asphalt plant was constructed in about 1953. A 1959 layout is provided as Figure 3-7. "Unolox 1-B," "1-C, 2-A," "2-B," "2-C," crack pouring compound, sub-sealing compound, and canal lining asphalt were manufactured at the facility. The plant was designed to produce approximately 100 tons of air-blown asphalt per day. Air-blown asphalt products were packaged into 100-pound cartons or steel drums for shipment, or bulk shipments were made using tank trucks.

Limited refining was conducted in conjunction with the air-blown asphalt plant activities. The facility produced various grades of air-blown asphalts. Charge stock consisted of tank bottom material from the existing crude distillation column and a flux oil. Flux oil was shipped from Seattle by tanker or rail.

The processing equipment consisted of the charger heater, two 50-ton blowing stills, off-gas scrubber, air compressors, and pumps. Auxiliary equipment consisted of feed tanks, product tanks, and facilities for packaging and product storage.

The asphalt refining process flow through the unit was as follows:

- Charge stock and flux oil were pumped from Tanks 2912 and F202, respectively, to Feed Tank F411 and stills.



Source: Union Oil Company of California Los Angeles, California
General Arrangement Storage Station Edmonds Terminal
Edmonds, Washington. 03-10-61
3-25-88

EMCON Northwest, Inc.

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PROJECT NO.
0324-035.01

Figure 3-7
UNOCAL CORPORATION
EDMONDS, WASHINGTON
BULK FUEL TRERMINAL
FORMER AIR-BLOWN
ASHPALT PLANT LAYOUT (1959)

1= 50 1-13-93 0324\035\01C07

- From Tank F411, the air-blown charge was pumped to either of the stills D-401 or D-402.
- When the proper level in the still was reached, the charge stock was circulated through Fired Heater B-410, to the still, and back to B-401, until the desired temperature was reached.
- At that point, air was admitted to the blowing still, and off-gases from the still were scrubbed and condensed in Scrubber D-403.
- Condensed oil from D-403 was collected in Skim Pond F-413 and pumped to the refinery fuel oil system.
- Upon completion of the air-blown operation, the still contents were pumped to cooling Tanks F414, F415 and F416.
- From the cooling tanks, the finished asphalt was pumped to the packaging warehouse, where it was loaded into 100-pound cartons.
- If necessary, the finished asphalt was pumped directly to an existing loading rack, immediately south of the laboratory/office, for bulk shipment in tank trucks.

Table 3-2 provides a list of former aboveground storage tanks associated with the air-blown asphalt plant.

3.1.7 Asphalt Warehouse

The asphalt warehouse was a steel-frame building with floor dimensions of 80 feet by 280 feet. The structure was built in 1953, along with the air-blown asphalt plant, and was demolished in about 1984.

The warehouse served as an asphalt packaging facility. Asphalt was pumped from cooling tanks into a 6-inch-diameter header line, located in a trench in the warehouse floor, which ran the length of the building near the centerline. Four loading arms were connected to the 6-inch header line along the trench line; they were equipped with swing joints and counterbalances for ease of handling. Empty 100-pound cartons were lined in double rows at right angles to the trench and filled from a loading arm. The floor area covered by one loading arm was approximately 640 square feet. The packaged asphalt was then distributed off-site via truck and trailer.

Table 3-2

Former Asphalt Plant Aboveground Storage Tanks
UNOCAL Bulk Fuel Terminal
Edmonds, Washington

Tank No.	Date Tank Installed	Product Handled	Tank		Storage Capacity (BBL)
			Dimensions (H x D)	Material	
F201	1951	RC-Solvent	18' x 15'	steel	565
F202	1951	300 Neutral Oil	18' x 15'	steel	565
F203	1951	MC-Solvent	24' x 20'	steel	1,339
F204	1951	Cut-Back Asphalt	18' x 15'	steel	565
F205	1951	Cut-Back Asphalt	24' x 30'	steel	3,020
F206	1951	Cut-Back Asphalt	24' x 30'	steel	3,020
F207	1951	Cut-Back Asphalt	18' x 15'	steel	565
F208	1951	Cut-Back Asphalt	18' x 15'	steel	565
F209	1951	Paving Asphalt	18' x 15'	steel	565
F210	1951	Paving Asphalt	18' x 15'	steel	565
F211	1951	Paving Asphalt	18' x 15'	steel	565
F212	1951	Paving Asphalt	24' x 30'	steel	3,020
F213	1951	Fuel Oil	18' x 10'	steel	251
F5	1947	Paving Asphalt	23'11" x 30'	steel	2,988
F411	1956	0-250 Stock	23'9" x 15'	steel	743
F413	1956	Unolox 170	23'11" x 15	steel	746
F415	1956	Unolox 140	23'11" x 15'	steel	746
F416	1959	Unolox 190	23'11" x 15'	steel	746
F417	1960	MC-3000R Blending	24' x ?	steel	240
F418	1963	Cut-Back Asphalt, MC-3000	18' x 15'	steel	565

NOTE: Storage tank information was obtained from job specifications for painting of UNOCAL asphalt facilities at marketing terminal, Project 1-34-72, dated June 27, 1972.
1 BBL (barrel) = 42 U.S. gallons

3.1.8 Laboratory

Historically, the facility laboratory was located in a single-story building in the southern corner of the lower yard (Figure 3-4). While specific operations at the former laboratory site are unknown, the purpose of the lab was to verify quality of product delivered to the facility to ensure the tender was within specification. The building was constructed in approximately 1923 and demolished in approximately 1955.

A new laboratory building was constructed in 1953 or 1954, in conjunction with the air-blown asphalt plant. The laboratory was in a single-story building immediately north of the northernmost truck loading rack (Figure 3-1). It consisted of one vented work station, one small office, a sample storage area, and an office storage area. There were two sink areas, one near the vented work station, and the other in the restroom. No wastes were disposed of at these locations.

The laboratory was used for quality control of products received, stored, and distributed at the Terminal. All petroleum products received were sampled, then archived for approximately three months. All petroleum product-related wastes and outdated samples were collected in PVC buckets and pumped to Tank F410 in the aboveground tank farm.

3.1.9 Truck Loading Racks

The structural shells of two truck loading racks still remain in the lower yard. One was used for gasolines and diesels and one was capable of loading all refined products at the facility (Figure 3-1). The gasoline and diesel loading rack is immediately south of the laboratory/office building and includes two bottom-loading lanes, each equipped with dedicated product-loading arms. The second rack is located to the south of the two-story office building along the toe of the hillside and includes a single lane bottom loading rack. Diesel additives, from a 500-gallon underground storage tank to the north of the rack, were mixed with the fuel during loading from the rack.

Each of the two truck loading racks were converted from top loading to bottom loading service in approximately 1977. The conversion minimized the potential for accidental release and product loss during loading.

Each loading rack was equipped with a vapor recovery system. The loading racks were connected to the facility vapor recovery system via underground recovery pipelines. The vapor recovery system and condensate tanks are still located to the northeast of the tidal pond. Spill containment controls at each rack consisted of a concrete pad, concrete curbs, and strip drains that lead to a 10,000-gallon underground API separator tank.

A company vehicle refueling station is still located to the east of the garage, along the access road to the lower yard. Product was delivered to the refueling station from aboveground tanks in the upper tank farm. The underground fuel storage tanks at the refueling station were installed in 1982 and 1984.

3.1.10 Boiler

Historically, the facility boiler was located in an enclosed building in the southern corner of the lower yard (Figure 3-4). The fuel supply to the old boiler unit was contained in an aboveground tank located on the north side of the building. It is believed that the boiler was installed in about 1923; the dismantling date is unknown.

The existing boiler, located immediately south of the laboratory building across the paved entrance road in the lower tank yard, was installed in the 1950s. It provided steam for heating viscous petroleum products. A 5,000-gallon underground diesel tank (see Section 3.1.12) provided burner fuel for the boiler. The main oil use was from the diesel tank through a meter to the boiler.

3.1.11 Oil/Water Separators

Two oil/water separators are located in the lower yard, approximately 150 feet south of the Detention Basin No. 2 (see Figure 3-2). The separators are used to remove oil from Terminal wastewater prior to its discharge to the drainage channel and on to Puget Sound.

The main oil/water separator was constructed in about 1950 and is approximately 45 feet long, 18 feet wide, and 11 feet deep. The separator is a concrete vault with baffles or skimmers to remove oil product as wastewater passes through the tank. Product skimmed from the main oil/water separator is pumped to the aboveground storage Tank F410. Residual water is drained back into the first compartment of the main oil/water separator.

Most surface drainage at the Terminal currently flows to the main oil/water separator. This includes drains in the upper tank farm and the lower yard.

The smaller oil/water separator is located immediately northwest of the main oil/water separator. When required, this unit provides secondary treatment to meet NPDES discharge standards. The unit consists of four cells in series and is equipped with a full length float skimmer discharge, launder connecting flanges, and a dart type pneumatic liquid-level control. The unit was installed in approximately 1973/1974, when Detention Basin No. 2 was constructed.

UNOCAL has found no documentation regarding the facility's wastewater treatment/ disposal practices prior to the installation of the oil/water separator in 1950.

3.1.12 Underground Storage Tanks

Ten underground storage tanks (USTs), numbered 0200-3, 0200-4, 0200-5, 0200-9, and 0200-10A through 0200-10F, have been in operation at the Terminal (Figure 3-8). Seven of them are located in the lower yard, two are in the vicinity of the garage, and one tank was removed in 1990. Four of the existing underground tanks served as collection areas for the vapor recovery system and spill recovery at each truck loading rack. A letter was sent to Ecology in December 1990 notifying the agency of the operation status of the four tanks. A summary of facility underground storage tanks is provided in Table 3-3.

On June 15, 1990, Tank 0200-10B was removed. This 1,200-gallon fiberglass tank served as a petroleum slops tank into which incoming and outgoing fuel trucks drained delivery lines. Excavation and removal activities were conducted by J.V.E. Mechanical, Inc., and shipped off site by Chemical Processors in Kent, Washington. A Checklist For Permanent Closure of Underground Storage Tanks was sent to the Ecology UST section on December 12, 1990. A site assessment was not conducted during the closure activities.

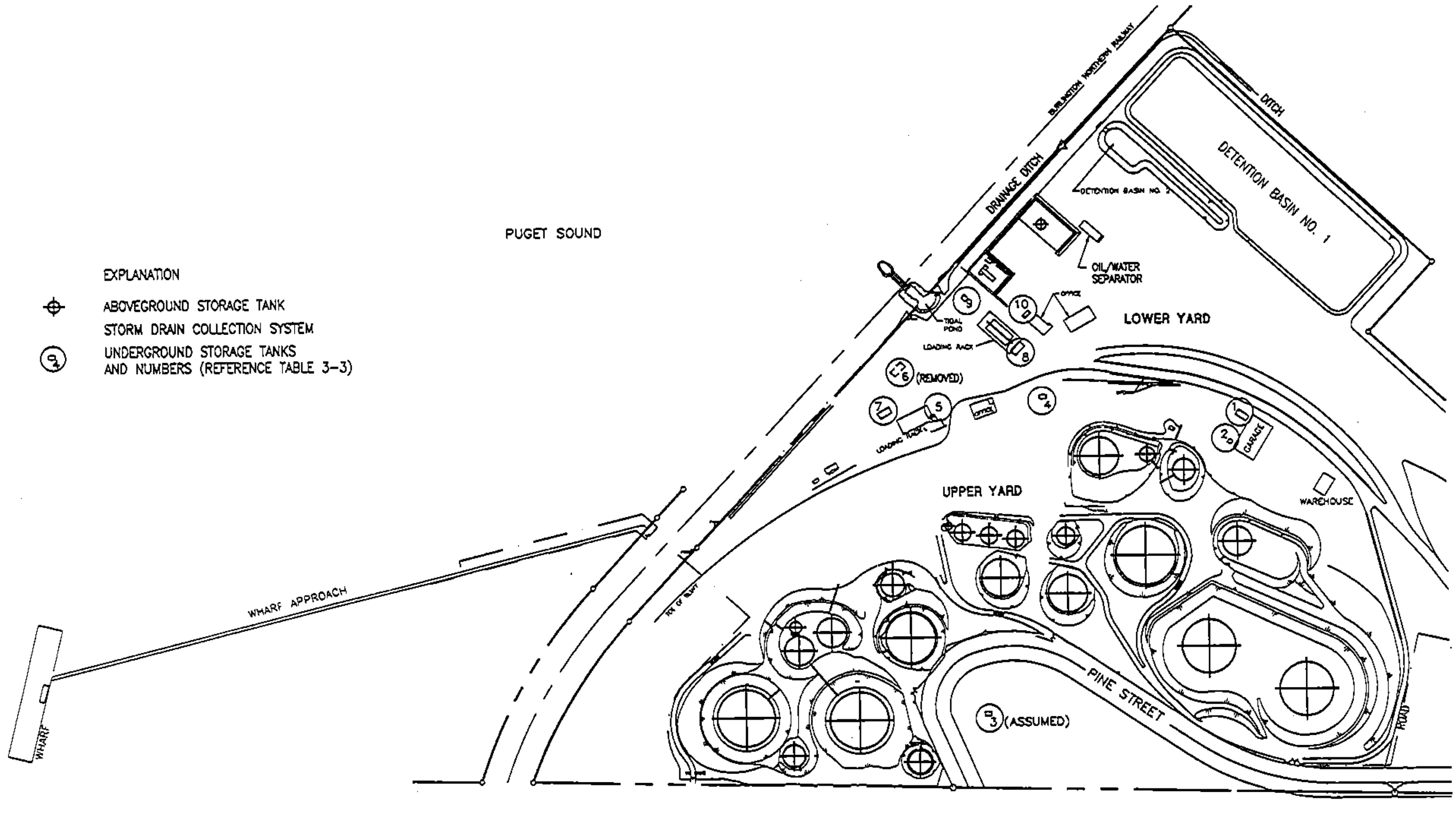
Tanks 0200-3 and 0200-4 are located near the garage. Tank 0200-3 is a 10,000-gallon welded steel tank installed in 1982. The tank stored diesel used to fuel Terminal delivery trucks. The tank received product from the aboveground tank farm by truck via the terminal loading racks. Tank 0200-4 is a 300-gallon used oil/lube slop tank, installed in 1984. It is not known whether Tank 0200-4 replaced an older tank; no records were found regarding an earlier tank.

Tank 0200-5 is a 400-gallon welded steel tank located north of the foam shed in the upper yard. The exact date of installation is unknown, and the specific use is unclear. Ecology UST records show the tank age at more than 30 years. Based on UNOCAL records reviewed, the tank may have been used between the 1950s and 1977 to store fuel for engines that ran a fire suppression system. The tank has been permanently out of service since May 1984.

Tank 0200-9 is a 5,000-gallon diesel fuel tank immediately southeast of the terminal boiler. The welded steel tank was installed in 1977 and stores burner fuel for the terminal boiler.

Tank 0200-10A is a 500-gallon welded steel diesel-additive tank located to the north of the southern truck loading rack. The tank was installed in 1979 and received gasoline additives via tanker truck.

Tanks 0200-10C and 0200-10D are 10,000-gallon welded steel spill-recovery tanks located at each of the truck loading racks. The tanks were installed in 1976 and 1978, respectively, and collect precipitation and spilled petroleum product which may have been



EMCON Northwest, Inc.

Source: Union Oil Company of California Los Angeles, California
Site Area Study General Arrangement Edmonds Terminal
Edmonds, Washington. 10/12/92

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Figure 3-8
UNOCAL CORPORATION
EDMONDS, WASHINGTON
BULK FUEL TERMINAL
LOCATION OF TERMINAL
UNDERGROUND TANKS (1993)

1= 200 11-11-93 0324\035\01C30

Table 3-3

Summary of Underground Tanks
UNOCAL Bulk Fuel Terminal
Edmonds, Washington

	Tank No.	Capacity (gallons)	Construction Type	Date Installed	Products Stored	Regulatory Classification	Current Status	Comments/ Location
1	0200-3	10,000	Welded steel	1982	Diesel	Registered	In compliance	Northwest of garage
2	0200-4	300	Welded steel	1984	Used oil/lube slop	Registered	In compliance	West of garage
3	0200-5	400	Welded steel	1950?	Leaded gasoline/fuel	Abandoned	Out of service May 1984	Southeast of foam shed in upper yard
4	0200-9	5,000	Welded steel	1977	Diesel #1-4	Registered	In compliance	South of facility boiler
5	0200-10A	500	Welded steel	1979	Additive	Registered	In compliance	North of southern truck loading rack
6	0200-10B	1,200	Fiberglass	1985	Delivery truck slops	Removed	No site assessment conducted	Removed 06/15/90
7	0200-10C	10,000	Welded steel	1976	Truck rack overflow	Exempt	Not applicable	West of southern truck rack
8	0200-10D	10,000	Welded steel	1978	Truck rack overflow	Exempt	Not applicable	Under canopy of northern truck rack
9	0200-10E	500	Welded steel	1980	Vapor recovery	Exempt	Not applicable	Immediately west of office (former laboratory)
10	0200-10F	300	Welded steel	1980	Vapor recovery	Exempt	Not applicable	Immediately west of office (former laboratory)

NOTE: All underground storage tanks on site reportedly contain <1 inch of product/fluid.

released during truck loading activities. Petroleum product collected in these tanks was recovered for reuse, and water was pumped into the facility oil/water separator.

Tanks 0200-10E and 0200-10F are welded steel vapor recovery tanks located immediately west of the former laboratory/office building. The tanks are 500 and 300 gallons in size, respectively, and were installed in 1980. The tanks were part of the facility vapor recovery system. An underground vapor recovery line connects the two truck loading racks to the vapor recovery unit; each line drained any condensed liquids to a dropout tank. All accumulated liquid was stored in Tanks 0200-10E and 0200-10F.

Tanks 0200-3, 0200-4, 0200-9, and 0200-10A were temporarily closed and a Temporary Closure Checklist was submitted to Ecology UST Section on August 28, 1992. The temporary closure period has been extended through June 1994. The four tanks were closed by Veco, Inc., of Everett, Washington, and reportedly contain less than one inch of fluid.

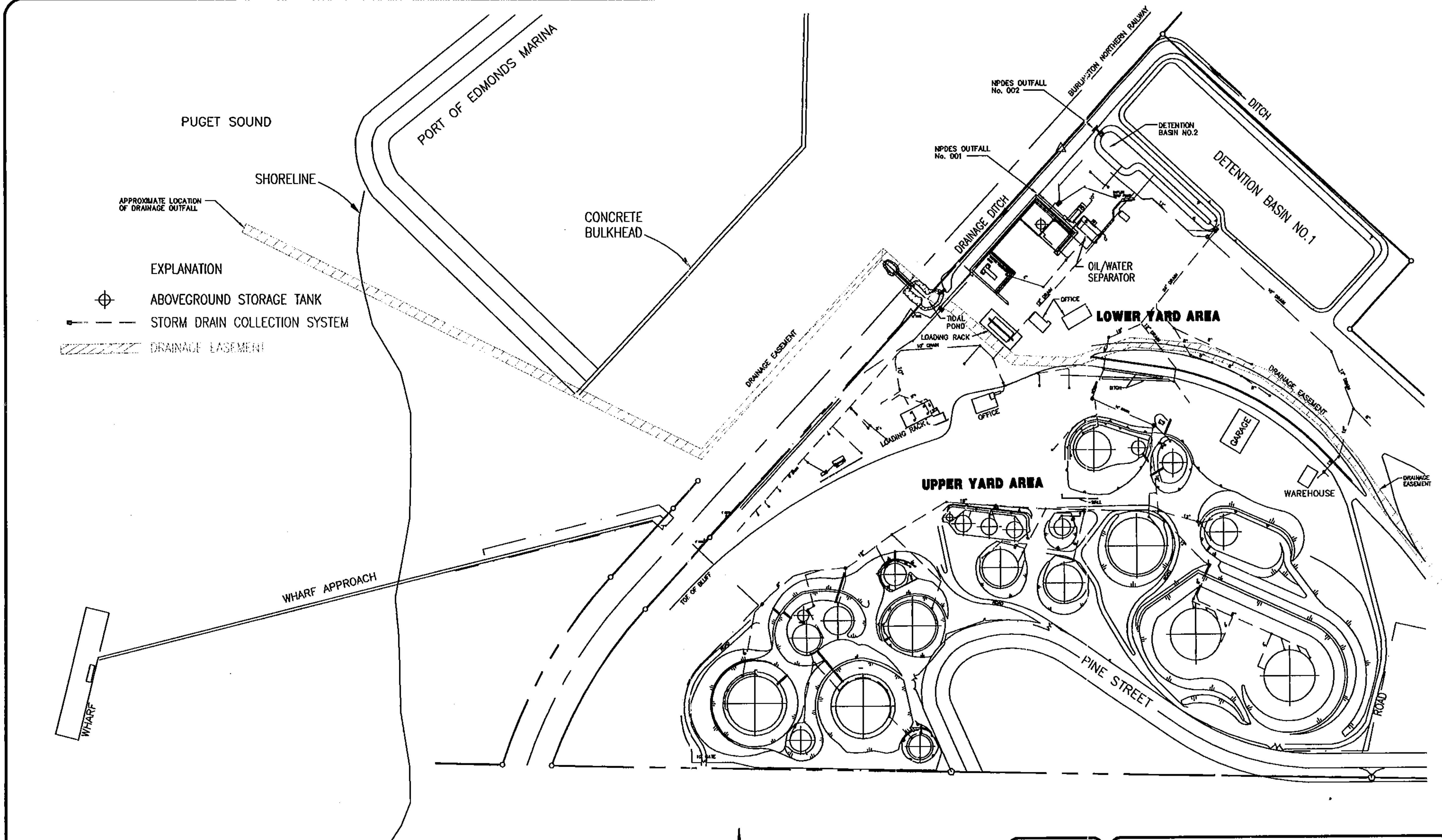
Petro-tite underground storage tank integrity testing was conducted on Tanks 0200-3, 0200-4, 0200-9, 0200-10A, and 0200-10B in August 1988 and May 1990. Tank 0200-10B failed during the 1988 test. Repairs were made to tank distribution lines and the tank passed a second test. The tank failed again in 1990 and was removed from the ground.

3.1.13 Maintenance Operations

Product delivery trucks were maintained in the garage located along Unoco Road in the eastern portion of the Terminal (Figure 3-1). The garage was built in approximately 1955. The building contains three service bays, a restroom, a drive-through truck wash, and office space. The truck wash bay drained to the terminal storm drain system. Truck washing activities at the garage were discontinued in the 1970s due to detergents entering the facility oil/water separators and emulsifying oil. Since the 1970s, product delivery trucks were washed by a sub-contractor in the gravel parking area in the eastern portion of the lower yard (Figure 3-2). Waste oil was stored in an underground storage tank located in the west side of the garage. A second underground storage tank, containing diesel fuel, is also located along the west side of the building. Wastewater generated at the garage drained to a 500-gallon septic tank and 4-inch-diameter drain line extending from the southwest corner of the building along the west side of the garage.

3.1.14 Storm Drain and Sewer Systems

A storm drain collection system serves the lower yard and upper yard (Figure 3-9). The storm drain system consists of a series of catch basins connected by underground concrete pipes. All catch basins in the upper yard and lower yard areas drain into a duplex sump area located between the main oil/water separator and Detention Basin



EMCON
Northwest, Inc.

Source: Union Oil Company of California Los Angeles, California
Site Area Study General Arrangement Edmonds Terminal
Edmonds, Washington. 10/12/92

DATE 11/92
DWN. KLM
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PROJECT NO.
0324-035.01

Figure 3-9
UNOCAL CORPORATION
EDMONDS, WASHINGTON
BULK FUEL TERMINAL
STORM DRAIN COLLECTION SYSTEM

1= 200 11-22-93 0324\035\01C31

No. 2. The duplex sump area is the lowest point in the storm drain collection system. From the sump, storm water is pumped to the main oil/water separator. If the system exceeds capacity, storm water is routed through Detention Basin No. 2 to Detention Basin No. 1 through a spillway. Storm water is then pumped from Detention Basin No. 1 back through the main oil/water separator. From Detention Basin No. 2, all storm water is discharged via NPDES Outfall 002 into the drainage ditch at the northwest end of Detention Basin No. 2, and on to Puget Sound.

During very high tides and heavy rainfall events, the discharge of storm water via Outfall 002 may be prevented due to its elevation. During these conditions, storm water is discharged directly from the oil/water separator to the drainage ditch via NPDES Outfall 001.

The storm drain system in the lower yard was installed in the 1950s, with the construction of Detention Basin No. 1, the air-blown asphalt plant, and the installation of the main oil/water separator.

The sewer system at the facility consists of three separate septic tanks and drain lines. The two-story office building near the southern truck loading rack and the laboratory/office building are connected to the same septic tank and drain lines, located in the lawn area to the northeast of the two-story office building. The system was installed when the two buildings were constructed in the early 1950s. The second septic system is immediately west of the office building to the northeast of the former laboratory/office. The system was installed around 1982 when the building was constructed. The third septic system is located beneath the paved parking area to the west of the maintenance garage south of Unoco Road and was installed in the 1950s. Each of the septic systems consists of a 500-gallon septic tank with 4-inch-diameter drain lines. The systems collect wastewater from employee sinks and restrooms in the offices, laboratory, and garage.

During construction of State Route 104 to the east of the Terminal in the early 1970s, the Washington State Department of Highways obtained a drainage easement along Unoco Road and across the central portion of the lower yard to the tidal pond (Figure 3-9). The easement contains a 48-inch-diameter concrete line, with a starting invert elevation of approximately 31 feet above mean sea level at the southeast property limit. As the drainage line departs the property, in the vicinity of the tidal pond, the drainage line elevation is approximately 5 feet below mean sea level (Washington State Department of Highways, 1971).

3.2 Offshore, Tideland, and Park Areas

As previously noted, these areas are located immediately north and south of the UNOCAL dock approach trestle. Snohomish County tax lot maps, dated 1921, show the 12 acres (referred to in this report as Offshore, Tideland, and Park areas) bound to the north by the Pennsylvania Iron and Steel Company, to the east by the Great Northern Railroad right-of-way, and the west by Puget Sound.

The property was never used by UNOCAL, with the exception of constructing the dock and approach trestle in 1923.

In 1957, the northern 9-acre portion of the area was sold to the Port. The Port began construction of the Port of Edmonds marina shortly thereafter. Construction of the southern portion of Port of Edmonds marina, the area that was previously owned by UNOCAL, was completed by 1965.

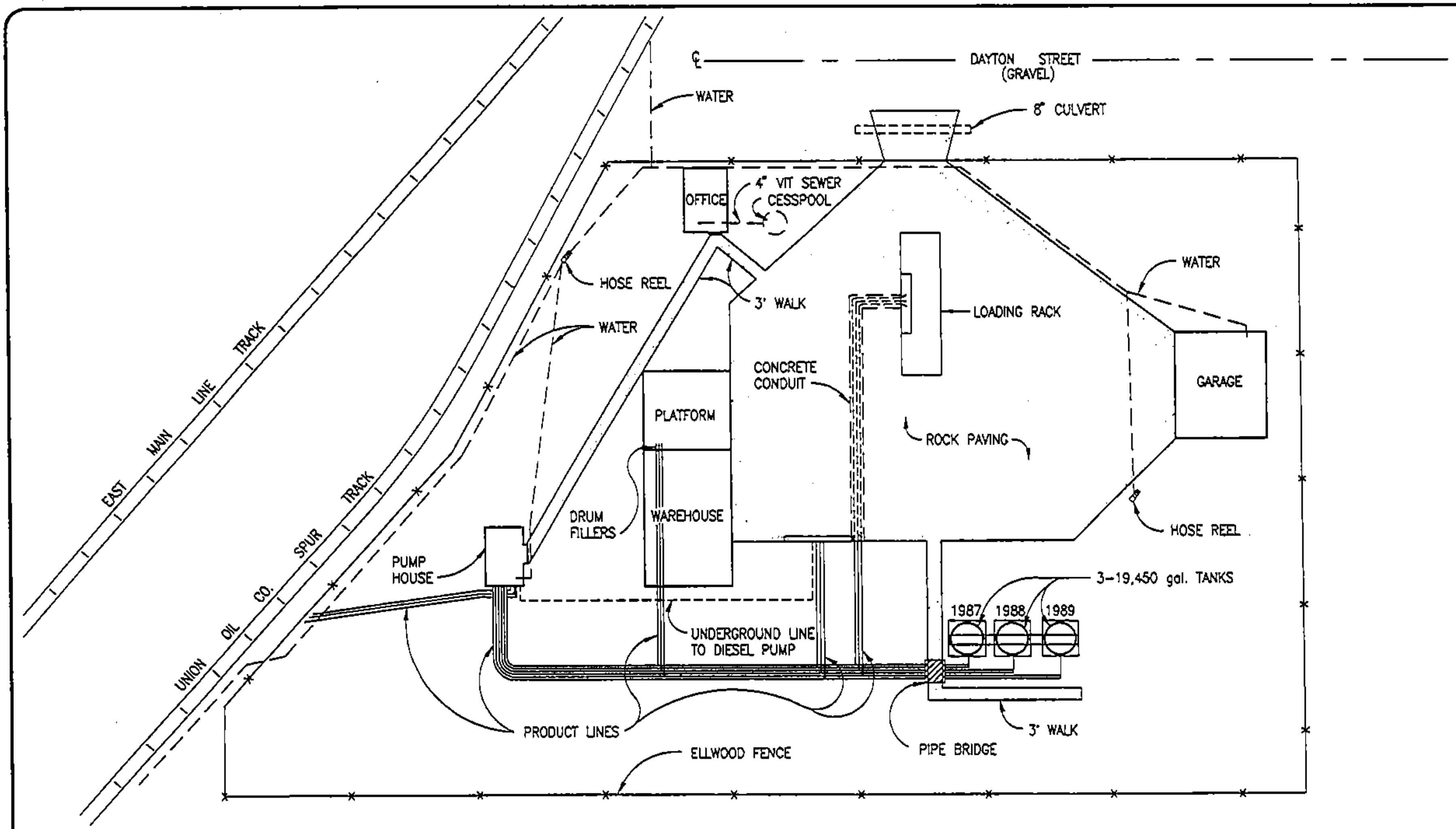
The remaining 3 acres of property have been used as a public park (Marina Beach Park).

3.3 Dayton Street Depot

The first documented use of the Dayton Street Depot occurred in 1924 when UNOCAL established a small substation of its larger oil terminal on Dayton Street (Figure 3-10). The Dayton Street Depot property is a portion of the property currently known as Harbor Square and is discussed in Section 2.1.4. The substation, designated Dayton Street Depot, consisted of a railcar loading/unloading rack, a filling shed, an oil pumphouse, a 26- by 63-foot warehouse, a 26- by 32-foot auto garage, an office building, a truck loading rack, and three 20,000-gallon aboveground storage tanks. The facility received gasoline, kerosene, and diesel petroleum products via railcar for storage only. The product was unloaded at the railcar unloading rack along the western portion of the site. Dedicated 3-inch-diameter steel product lines transferred product from the railcar via the pumphouse to dedicated aboveground storage tanks.

Product was shipped off site by tanker truck. The trucks were loaded at a single-lane loading rack in the north central portion of the substation. All transfer of petroleum product through the substation was discontinued in the 1940s. Vehicle access to the facility was from Dayton Street along the northern property limit. The vehicular traffic areas of the substation were paved.

Records indicate that the garage did not have a concrete floor; it did not have a subsurface pit area or floor drain system. It is believed that the garage floor was gravel. Based on historical UNOCAL authorization-for-expenditure records, dated July 1940, the garage structure was dismantled and transported to the lower yard of the Terminal. The structure is believed to have been erected as a "consignee warehouse" near the Terminal garage along Unoco Road.



Source: Union Oil Company of California Los Angeles, California
General Arrangement Sub-Station
Edmonds, Washington. 10/12/92

EMCON Northwest, Inc.

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Figure 3-10
UNOCAL CORPORATION
EDMONDS, WASHINGTON
BULK FUEL TERMINAL
DAYTON STREET DEPOT (1924)

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Wastewater generated at the office structure restroom was drained to a cesspool approximately 20 feet east of the office building. The entire substation was constructed on approximately 3 to 4 feet of imported fill material, with the aboveground storage tanks and warehouse building constructed on a pile foundation.

The depot is visible in aerial photographs dated 1947 and 1955. The railroad spur serving the site is visible in each photograph, and split off the Burlington Northern Railroad main line at a point north of the site near the intersection of the main line and Dayton street. The spur extended along the western edge of the site, paralleling the main line. Between 1955 and 1967, the northern portion of the spur was removed to a point just west of existing Building 4 of Harbor Square (Section 7.9). The spur was completely abandoned and removed in 1981-82.

The portion of the Dayton Street Depot site that comprises what is now known as Harbor Square was filled with sands and silts dredged from the Port of Edmonds marina basin in the mid-1960s. In a letter to UNOCAL dated May 23, 1969, Reid Middleton & Associates explained that approximately 182,860 cubic yards was excavated from the boat harbor. Approximately 176,850 cubic yards were used for construction fill, roughly 4,000 cubic yards were used for parking areas, and the remainder was placed in a staging area on the UNOCAL property, immediately east of the Dayton Street Depot site.

Harbor Square, which consists of several commercial and service-oriented businesses, was constructed on the expanded Dayton Street Depot site in 1983. Information contained in the Port of Edmonds Master Plan (1979), and the Harbor Square Environmental Impact Statement (1980), indicate that the site was used by city of Edmonds for reported "dumping," parking, and storage of city maintenance crew equipment prior to the construction of Harbor Square. The site was also used by NORSOL, a crab pot manufacturer, for crab pot storage.

3.4 Non-UNOCAL Operations

UNOCAL has leased several portions of its Edmonds property since its purchase in 1920. Two portions of the property UNOCAL currently leases are the tidelands (Parcel I) to the city of Edmonds for use as a public park, and the salmon hatchery to a private organization. Refer to Section 2.3.2 for details of UNOCAL's leasing history.

4 CHEMICAL PRODUCTS MANAGEMENT

This section describes the handling and management of petroleum products and other chemicals at the Terminal; offshore, tidelands, and park areas; and Dayton Street Depot. The five general categories of chemicals that the Terminal managed included petroleum products, additives, asphalt products, laboratory chemicals, and maintenance shop chemicals. The practices and procedures used during the receipt, on-site handling, and shipment of the product or chemical is described for each of these categories.

4.1 Petroleum Products

The Terminal handled two types of petroleum products: light and heavy oils. Heavy oils consisted primarily of crude oil and marine fuel oils (Bunker C). Light oils included three grades of motor gasoline, aviation gasoline, jet fuel, and middle distillates (e.g., diesel #2 and marine diesel oil). The facility stored and distributed light oil products since it opened in approximately 1923 and until its closure in 1991.

Table 4-1 lists the light and heavy oil materials historically handled at the Terminal. Light oils were received by maritime tanker, barge, and rail, stored on site, and shipped via truck. Light and heavy oils were also shipped via rail. Appendix C contains the list of available material safety data sheets (MSDSs) for these materials on file at the facility.

As described in Section 1.1, numerous sources were investigated to obtain historical information on the Terminal. Discussions were also held with UNOCAL personnel in the Refining and Marketing Division, and Sciences and Technology Group. Chromatograms, analytical results, and descriptions beyond those provided in this report on the petroleum products historically handled at the Terminal are not available. No additional information was found concerning types of solvents used, stored, or distributed from the Terminal or the chemical constituents of additives used or stored on site. No information is available in UNOCAL files concerning BP black oils. A generic figure showing petroleum hydrocarbon ranges for different types of petroleum products is provided in Appendix C, as well as a table listing the available product specific gravities.

The following discussion of petroleum product receipt procedures is based primarily on receipt records at the Terminal. Except where noted below, little or no documentation is available concerning product handling procedures in the early years of the Terminal (e.g., 1920s to 1960s).

Table 4-1

Petroleum Products Handled On Site
UNOCAL Bulk Fuel Terminal
Edmonds, Washington

Gasolines
- High Performance 92
  Unleaded Gasoline
- Unleaded Plus 87 M/H Grade
  Unleaded Gasoline
- 76 Unleaded Gasoline
- 76 Performance Plus 89
- 76 Leaded Regular Gasoline
- 76 Aviation Gasoline 80/87
- 76 Aviation Gasoline 100/130
- 76 Unleaded Plus Gasoline RM/2 89
- Super 76 Unleaded Gasoline

Mid-Distillates Fuels
- 76 Aviation Fuel Jet A
- Diesel #2
- Heating Oil #1
- Heating Oil #2
- Automotive Diesel
- Diesel #1

Fuel Oils/Residual Fuels
- IFO 1750
- Bunker Fuel Oil
- Residual Fuel Oil
- Jet A — Jet A-1/BPNap
- Marine Diesel Oil/BPNap
- Marine Gas Oil/BPNap
- Residual Fuel Oil/BPNap
- Light Cycle Oil/BPNap
- Cutter Stock/BPNap

Lubricating Oils
- A-Grease 2
- Unoba IP Grease 1 & 2
- Cable Lube
- MP Automotive Grease 2
- Moly H.D. Grease
- Low Temp. Grease

Engine Oils
- Guardol 40
- Guardol 50
- Guardol 15Wx40
- Super 10-40
- Unimix Two Cycle Oil
- Premium 30
- Heavy Duty 30
- Custom 30
- Premium 20w/20

Transmission Oils
- ATF Dexron (R) Undyed
- ATF Type F

Industrial Oils
- Steaval B
- Turbine Oil 150
- Umax AW 46
- Turbine OilxD32
- Multipurpose ATF
- Private Brand MP Trans Fd.
- Steaval B 110a

Gear Oils
- MP Gear Lube LS 85V/140
- MP Gear Lube LS 800W/90
- MP Gear Lube LS 75W

4.1.1 Receipt

All petroleum products stored at the Terminal were received by barge or marine tanker through the dock loading/unloading terminal. All pipeline valves at the Terminal were coded according to the American Petroleum Institute as follows:

Red	—	76 Super (Premium Gasoline)
Blue	—	Leaded Regular 76 (Regular Gasoline)
White with Black Crosses	—	76 Unleaded (Unleaded Gasoline)
Yellow	—	Union Diesel #2/Heating Oil #1 (Diesel Fuel)
Brown	—	Union Kerosene/Automotive Diesel (Kerosene)
Purple and Yellow	—	Union Automotive Diesel/Heating Oil #1 (No. 1 Fuel)
Black with White Text	—	Union Turbine Fuel (Aviation Jet A Fuel)
Red with White Text	—	Union Aviation Gasoline Grade 80/87 (Aviation Gasoline Grade 80/87)
Red with White and Green	—	Union Aviation Gasoline Grade 100/130 (Aviation Gasoline Grade 100/130)

Petroleum products received from the dock were routed through the shoreline manifold area in the southern end of the lower yard. Product was then pumped to the designated aboveground storage tank in the upper yard. Prior to off-loading of any petroleum product at the facility, UNOCAL employees sampled and analyzed the product for specific gravity, flashpoint, and lead content (for leaded gasoline product only). Delivery was refused if the product did not pass UNOCAL specifications.

During the last decade of operation, the Terminal received black oils from British Petroleum (BP) as part of a "through-put" agreement. The black oils were received through the dock facility only. BP leased several aboveground storage tanks in the upper yard for the storage of their black oil products. Approximately 1,000,000 barrels of BP product were handled on an annual basis. Information specific to the BP black oil was not found; however, product characteristics were comparable to UNOCAL black oil.

4.1.2 On-site Handling

Once received, bulk petroleum products were stored in numerous aboveground storage tanks in the upper yard. Section 3.1.3 provides details on the number, size, and construction of the tanks. Table 3-1 also provides information on the contents of each of the tanks. Historically, all types of light oil and black oil products were stored in the upper yard. Black oil was stored in Tanks 1749, 2909, 263, 2602, 2603, and 2604 in the upper yard and in Tanks 1760, 782, and 2206 in the lower yard.

On-site handling procedures for light oil products consisted of storage in aboveground tanks until shipment off-site. Shipment procedures are described below. On-site handling procedures of BP black oils included mixing specific volumes of cutter stocks or diesels with the BP black oils per BP's request. Mixing took place in the leased aboveground storage tanks.

4.1.3 Shipment

After petroleum products were received, stored, and handled as described above, they were shipped off site to distributors and customers.

Light oils were shipped off site via tank truck. Until the late 1960s, light oils may also have been shipped off site by railcar. Light oils were loaded onto tanker trucks at the two truck loading racks. The northern loading rack was equipped with two bottom-loading lanes. The southern loading rack was equipped with a single bottom-loading lane. Each of the lanes was equipped with dedicated product loading arms connected to the truck by a dry-break manifold. Once the manifold was connected, the product was pumped into the tanker compartment.

The light oil loading racks were equipped with a vapor recovery system that collected the vapor, condensed it into a liquid, and stored it in an underground storage tank. The recovered vapor was blended back to leaded regular gasoline.

All black oils received during the BP through-put agreement were shipped off site via marine tanker or barge. Black oil was gravity fed to the dock and transferred to the tanker through the same lines that received the product.

4.1.4 Dayton Street Depot

Detailed historical information regarding receipt, storage, and shipment of petroleum products to the Dayton Street Depot is unavailable. Section 3.3 discusses operations at the substation based on UNOCAL general arrangement plans dated February 1924.

4.2 Additives

The Terminal used several additives in the blending of both light oil and lubricating products. These additives were generally detergents, anti-rust compounds, lubricants, viscosity index removers, anti-foaming agents, and gasoline additives. A review of MSDSs indicates that neither ethylene dibromide nor ethylene dichloride were components of the additives most recently used on-site. Although ethylene dibromide or ethylene dichloride could historically have been used as additives at the Terminal, no records have been found to indicate their use. The most recently used additives include:

- AMOCO 547-D anti-gelling agent
- Chevron R224 gas additive
- Chevron R224W gas additive
- UNOCAL R-212-D gas additive

Available documentation does not contain information concerning historical additives types or quantities used.

4.2.1 Receipt

Additives were received by tanker/trailer truck, generally in 5,000-gallon loads. Additives for diesel arrived on site via flat-bed tractor/trailer trucks in 55-gallon drums.

4.2.2 On-site Handling

The R224 and R224W gas additives were metered into the receiving pipeline with the gasoline as it was transferred from the fuel barge to the holding tanks in the upper yard. The R224 gas additive was stored in Tank #3188 prior to use. Approximately 32 gallons of additive were added to 1,000 barrels of product.

The AMOCO anti-gel additive was added by in-line injection while tanker trucks were filled from holding tanks. Approximately 1 gallon of additive was added to 4,000 gallons of diesel.

4.2.3 Shipment

All additive products were shipped out as a final gasoline or diesel products as described in Section 4.1.3.

4.3 Asphalt Products

As previously noted, between the early 1950s and the late 1970s, air-blown asphalt products were manufactured at the Terminal. The asphalt products manufactured included "Unolox 1-B", "Unolox 1-C", "Unolox 2-A", "Unolox 2-B", "Unolox 2-C", crack pouring compound, sub-sealing compound, and canal lining asphalt. Sections 3.1.6 and 3.1.7 describe the manufacturing process and product handling and shipment procedures in more detail. Available documents indicate that the asphalt plant operations did not generate any different intermediate products or potential contaminants.

4.4 Laboratory Chemicals

The Terminal operated a small laboratory on site for conducting quality assurance and quality control tests for lead concentrations in gasoline or diesel products. During routine analytical testing procedures, this lab used a limited number of chemicals in small quantities. Table 4-2 lists the chemicals that were stored in the laboratory. Since only flashpoint and specific gravity analyses were performed on diesel and heavier fuels, test reagents were not used for testing these products. It is not known how the asphalt products were tested and whether reagents other than those listed for the unleaded gasoline tests were used.

4.4.1 Receipt

All the chemicals used in the lab were delivered to the Terminal via motor freight in relatively small containers (e.g., 1 gallon) on an infrequent basis.

4.4.2 On-site Handling

All laboratory chemicals were stored in the laboratory building/room in their shipping containers. Estimated usage for most chemicals was approximately 1 gallon of chemical reagent in five years.

4.4.3 Shipment

No laboratory chemicals were shipped off site as a neat product. Management practices for lab wastes are presented in Section 5.

4.5 Maintenance Shop Chemicals

Antifreeze, petroleum naphtha, and engine oil were used in conjunction with the Maintenance Shop (truck garage). The petroleum naphtha was used as a degreasing solvent to clean parts.

4.6 Ammonia Product

Between 1954 and 1969, the Brea Chemicals Company leased Tank No. 2603 to store aqua ammonia. This material was sold to Scott Paper Company for use in processing paper.

Aqua ammonia is gaseous ammonia dissolved in water. The aqua ammonia was delivered to the Terminal via marine tanker. Records indicate that typical delivery amounts were approximately 9,800 barrels. The aqua ammonia was stored in Tank

Table 4-2

Laboratory Chemicals
UNOCAL Bulk Fuel Terminal
Edmonds, Washington

Unleaded Gasoline Test Reagents

- Trichloroethane
- 1,4-Dioxane
- Potassium Bromate
- Hydrochloric Acid
- Trichloroethylene
- Sodium Sulfite, Anhydrous
- Diphenylthiocarbazone Hydrazide

No. 2603 and was handled by Brea Chemicals personnel. It was delivered to Scott Paper Company via tanker truck by Brea Chemicals personnel.

4.7 Other

Solvents were stored in some aboveground tanks at the Terminal. Available information is provided in Table 3-1.

The Terminal was not used for the manufacture, storage, or distribution of herbicides or other pesticides.

5 WASTE MANAGEMENT

5.1 Waste Management Procedures

The Terminal was and continues to be classified as a Small Quantity Generator of dangerous waste (i.e., generates less than 100 kilograms of dangerous waste/month). The Terminal historically did not treat or dispose of dangerous waste on site. Wastes generated primarily included laboratory wastes or wastes that were part of cleanup operations (e.g., oil/water separator tanks). In a June 29, 1987, letter to Ecology & Environmental, Inc., UNOCAL outlined their waste disposal records. The letter is summarized as follows:

- 1928 to 1974 - No available files exist for this period. UNOCAL did have knowledge of asphalt waste material placed in Detention Basin No. 1.

- 1974 to 1980 - No available records exist for this time period. However, UNOCAL stated that an employee familiar with the terminal during this time period believed that any waste material disposed of during these years was transported off site. The employee was not named in the letter. In June of 1980, several hundred cubic yards of gasoline-contaminated soil were brought to the Terminal and spread out in a lift approximately 6 inches deep. The material came from an underground gasoline storage tank leak at one of UNOCAL's service stations. The material was landfarmed between Detention Basin No. 1 and the entry gate to the terminal. In the summer of 1981, UNOCAL cleaned Tank #2919, which contained asphalt material. Crosby and Overton, Inc., cleaned the tank and disposed of the material off site. UNOCAL had no records of this tank cleaning and found no additional information through Crosby & Overton.

- 1980 to 1987 - Records for three instances of waste generation are in UNOCAL's files. In May 1983, UNOCAL cleaned Tank #2798 and shipped 11,200 gallons of waste oil and water via Crosby and Overton, Inc. In September 1983, UNOCAL cleaned Tank #2606 and shipped 1,400 gallons of waste water via Chemical Processors, Inc. In December 1985, UNOCAL cleaned the oil/water separator and shipped approximately 15,000 gallons of liquid waste via Crosby and Overton. None of these three events included any listed hazardous waste.

Wastes or recycled materials generated at the Terminal included waste petroleum naphtha, waste antifreeze, waste diesel and gasoline, tank bottom sludge (including tank scale), and diesel-contaminated absorbent pads. Generator Annual Dangerous Waste reports are prepared by UNOCAL and submitted to Ecology listing any dangerous waste generated over the previous year. No dangerous wastes have been generated since the Terminal closure in 1991.

The types of wastes generated at the Terminal, as well as the practices used by UNOCAL to manage each waste stream, included:

- Wastewater
- Oil/water separator wastes
- Tank bottoms
- Laboratory wastes (non-wastewater)
- Maintenance shop wastes (waste antifreeze)
- Paint wastes/sandblasting grit
- Spill residual
- Off-specification or waste oils
- Spent degreasing solvent
- General solid waste

For each of these wastes, a discussion of the generation, on-site management practices, and final disposition is provided below.

5.2 Wastewater

The Terminal generated several wastewater streams that were, depending on the particular source, discharged to the sanitary system or to surface water.

5.2.1 Sanitary Sewer Discharges

The Terminal has three septic tanks. One tank is adjacent to a two-story office building approximately 200 feet southwest of the lab/office building; its capacity is 500 gallons. The second septic tank is adjacent to an office building approximately 80 feet northeast of the lab/office building. Its capacity is approximately 285 gallons. The third septic tank is on the west side of the garage; its capacity is approximately 500 gallons. The wastewater sources included lab bottle washwater and normal sanitary wastewater from the various buildings at the Terminal (e.g., offices and restrooms). The septic tanks are pumped out and cleaned on an as-needed basis.

5.2.2 Surface Water Discharges

Historically, wastewater streams discharged to surface water included wash-down water from the loading rack area, tank water bottoms, storm water, and boiler blowdown. All these waste streams were treated through an oil/water separator. The treated water was subject to the conditions of an NPDES permit, with the primary discharge point from Detention Basin No. 2 to the drainage ditch via NPDES Outfall 002. As described in Section 3.1.14, water was discharged via NPDES Outfall 001 under certain rainfall and tide conditions.

Characteristics and estimated rates of generation for each of the waste streams identified above are as follows:

- **Loading Rack Area Wash-down Water** - Approximately 150 gallons/day of wastewater was generated from washing down the loading rack area.

- **Storm Water** - Storm water runoff discharges to the main oil/water separator during rainfall. The volume of rainwater discharged depends on the intensity and duration of the rainfall event. Potential storm water runoff contaminants are limited primarily to petroleum hydrocarbons.

- **Boiler Blowdown** - Approximately 4 gallons/day of boiler blowdown was discharged to the oil/water separator when last operated in 1990.

Wastewaters were discharged in accordance with an NPDES discharge permit. UNOCAL records indicate that permits were issued in October 1970 (No. 3526), January 1975 (No. WA-000177-5), August 1979 (same No.), and October 1984 (same No.). It appears that an earlier permit (No. 2194) was issued prior to the October 1970 permit; its issuance date and discharge conditions are unknown. The 1970 permit contained a qualitative limitation for total oil and grease ("no visible sheen") and a pH limitation (between 6.5 and 8.5). Beginning with the 1975 permit, and continuing to the most current permit (1984), the total oil and grease limitation was modified to add a daily average and daily maximum limit of 10 mg/l and 15 mg/l, respectively. The pH limitation remained unchanged.

5.3 Oil/Water Separator Wastes

Two main waste streams generated at the main oil/water separator include waste oil and sludge. The oil collected in the separator is skimmed off and pumped to Tank 218 or F410. The accumulated oil is sold to a petroleum products recycler.

Sludge that collects in the bottom of the separator is cleaned out on an as-needed basis. The sludge is a mixture of water, sand, oil, grease, and other materials that settle out.

As mentioned in Section 5.1, the oil/water separator was last cleaned out in 1985 by Chemical Processors, Inc. At that time, approximately 15,000 gallons of sludge were removed and transported off site. Historically, sludge has been removed approximately every 6 to 10 years.

5.4 Tank Bottoms

Tank bottoms consisted of residual solids, sludge, and product that remained in a tank after it had been pumped out prior to cleaning, painting, or other maintenance activities. Depending on which tank was being cleaned out, the tank bottoms may have been dangerous waste based on flammability, metals content (e.g., lead), and/or benzene content.

5.5 Laboratory Wastes (Non-wastewater)

The Terminal's quality control laboratory generated several waste streams (in addition to the bottle washing wastewater described in Section 5.1.1) including spent solvents and waste product or additive samples. Historically waste management practices in the lab included storing all laboratory waste in 5-gallon buckets. The waste material was then transferred to the oil/water separator sump and pumped to Tank 218 or F410.

5.6 Paint Waste/Sandblasting Grit

Aboveground storage tanks and other facility structures were painted periodically for corrosion control. As necessary, the tanks were sandblasted to remove old paint, rust, and dirt prior to painting. The hillside pipeline was sandblasted and painted in 1986.

Sandblast grit typically was left on the ground near the structure requiring restoration. No information is available on the type of sandblasting grit used, and no records of grit analyses were found.

5.7 Spill Residuals

Over the operational life of the Terminal, there have been spills of petroleum products in different areas of the facility. See Section 6 for a detailed discussion of product spills.

5.8 Off-Specification and Waste Oils

Petroleum-related wastes (slops) were stored in Tanks F410 and 218. This material included any waste collected at the oil/water separators and during product transfers at the facility loading and unloading areas. Waste waters and product were pumped to one of the two tanks, the water portion was drained off, and it was sent back through the oil/water separator. The slops were sold to heating oil recycling companies in the Puget Sound area. Shipment off site was conducted through the truck loading racks to fuel delivery vehicles.

As noted in Section 3.1.12, Tank 0200-4, installed in 1984, was used to store used oil generated at the garage (maintenance shop). It is not known whether this tank replaced an earlier tank. No records were found regarding an earlier tank or pertaining to garage waste oil handling procedures prior to installation of Tank 0200-4.

During the last ten years of operation at the Terminal, all black oils received at the facility were stored and shipped under a "through put" agreement with British Petroleum (BP). The black oils consisted of marine diesels and fuel oils. At BP's direction, in the event that a specific blend of black oil was required for shipment, UNOCAL employees would add small quantities of light oils to the aboveground storage tanks containing BP black oils. The aboveground storage tank served as a blending kettle for these operations which were conducted at BP's request.

5.9 Spent Degreasing Solvent

The Terminal historically used a small Safety-Kleen® parts degreaser located in the truck garage. The solvent used in this degreaser was a petroleum naphtha. Safety-Kleen® changed the solvent periodically and took the spent solvent to their facilities for reprocessing. The truck garage has not been in operation since 1990.

5.10 Maintenance Shop Wastes (Waste Antifreeze)

Prior to 1990, waste antifreeze generated in the truck garage was disposed to the ground. After 1990, all waste antifreeze was stored in a 55-gallon drum. The vapor recovery unit, when in operation, required antifreeze additions.

5.11 General Solid Waste

Filter cartridges used on the gasoline and diesel fuel tanks were changed as needed, approximately every three years. Diesel-contaminated absorbent pads, used to clean up small spills, were squeezed of all fuel oil and allowed to air dry. Used cartridges and absorbent pads were disposed of into an on-site trash bin as a solid waste.

6 RELEASES

6.1 Introduction

A summary of known releases to air, soil, and water is presented in this section.

6.2 Spills to Environment

Ten spills to the environment of 1 barrel (42 gallons) or greater have been documented at the facility between the 1950s and 1990. The spills ranged in magnitude from a few gallons to 80,000 gallons and involved fuel oils, heavy fuel oils, gasolines, off-specification emulsified asphalt, and diesel. Other minor releases have occurred on land but have not entered water. A description of the documented releases is presented below.

6.2.1 1954 Skim Pond Release

Approximately 250 to 300 barrels of fuel oil spilled into Detention Basin No. 1 in 1954, when the original detention pond (whose location is not known) was overfilled. Most of the spilled product was recovered in the cleanup that followed (GeoEngineers, Inc., 1988b).

6.2.2 Early 1960s Tank 206 Release

Approximately 500 barrels of heavy fuel oil were released from Tank F206 in the early 1960s. The product spilled into the oil/water separator, with some fuel oil overflowing into Detention Basin No. 1. The product was not recovered (GeoEngineers, Inc., 1988b).

6.2.3 1966/1967 Release to Detention Basin No. 1

Approximately 10,000 gallons of gasoline were accidentally siphoned from a tank and released into Detention Basin No. 1. The product was not recovered (GeoEngineers, Inc., 1988b).

6.2.4 Mid-1960s Emulsified Asphalt Release

An unknown quantity of off-specification emulsified asphalt was dumped in barrels along the southern edge of Detention Basin No. 1 and drained into the basin. The product and some of the barrels were not removed (GeoEngineers, Inc., 1988b).

6.2.5 1974/1975 Emulsified Asphalt Release

Approximately 15,000 to 20,000 gallons of off-specification emulsified asphalt was applied to the dikes in the upper tank yard area. The asphalt did not set up properly, and approximately 12,000 to 16,000 gallons drained into Detention Basin No. 1 (GeoEngineers, Inc., 1988b).

6.2.6 September 9, 1972, Bunker C Release to Puget Sound

Approximately 500 gallons of Bunker C oil was released to Puget Sound on September 9, 1972, when a ¾-inch by-pass line ruptured. All recoverable product was cleaned up to the satisfaction of Ecology and the U.S. Coast Guard. Wharf upgrades in approximately 1974 corrected all product-related pipelines on the dock.

6.2.7 Late 1970s Diesel Release to Detention Basin No. 1

Approximately 80,000 gallons of diesel drained into Detention Basin No. 1 when a diesel tank was overfilled in the late 1970s. The spill was contained within the diked area of Detention Basin No. 1. Approximately 8,000 gallons of product were not recovered (GeoEngineers, Inc., 1988b).

6.2.8 June 1988 AV Gas 100/130 Release

In June 1988, approximately 100 gallons of aviation gasoline 100/130 were released to the ground from Tank 3394 due to a failed tank bottom. The product was not recovered. A "water" bottom was added to the tank to prevent further immediate product loss. The tank bottom was replaced by Evans Construction in September 1988.

6.2.9 March 5, 1990, Marine Diesel Release

Approximately 350 to 400 gallons of marine diesel was released to the ground on March 5, 1990, when a sump overflowed in the southwest corner of the fuel terminal yard. The incident was reported to Ecology on the same day, and most of the spilled product was recovered. Laboratory analytical results for soil samples obtained from the spill area indicated petroleum hydrocarbon concentrations above MTCA Method A Cleanup Levels were present 2.5 to 3.5 feet below ground surface (GeoEngineers, 1990).

6.3 Process Area Releases

Periodic product releases, approximately 0.2 to 2 gallons, have occurred within the tank farm and loading facilities. Complete records for such events are not available. Additionally, periodic minor releases have occurred from valves, flanges, and pumps within the facility piping systems and tank farm.

6.4 Non-UNOCAL Releases

6.4.1 Burlington Northern Derailment Release

On December 4, 1971, a derailment occurred on the Burlington Northern Railroad tracks along the shoreline immediately south of the overhead oil transfer lines and UNOCAL approach trestle. Of the 28 railcars and 2 engine units, several lost all or portions of their cargo. Engine Unit #6633 suffered a ruptured fuel tank resulting in the loss of an undetermined amount (less than 2,000 gallons) of diesel fuel. The release spread approximately 2 miles north along the Edmonds shoreline, and was observed to extend approximately ¼ mile out from the beach. No information regarding cleanup or containment of the release was located.

6.4.2 Chevron Point Wells Release

In August 1990, a release of approximately 4,000 barrels of asphalt cutter stock occurred at the Chevron U.S.A. Point Wells facility located approximately one mile south of the UNOCAL Terminal. The release reportedly occurred when an aboveground storage tank failed due to overfilling. Reportedly, approximately 100 barrels of product entered the waters of Puget Sound and spread north to the UNOCAL Terminal shoreline and other adjacent areas. All UNOCAL, Chevron and Clean Sound Co-op personnel assisted in controlling and cleaning up the release.

7 ENVIRONMENTAL INVESTIGATIONS

Nine environmental investigations have been performed to date at the Terminal. Areas investigated have included the lower yard, the upper yard, Detention Basin No. 1, and Harbor Square. Environmental investigations have not been performed in the offshore areas, the tidelands, or the wetlands to the northeast of Detention Basin No. 1. This section summarizes the environmental investigations performed to date and discusses the existing data quality.

7.1 Phase 1 Site Assessment – 1986

A Phase 1 Site Assessment was conducted in the fall of 1986 (GeoEngineers, 1986). The purpose of the site assessment was to explore the extent of subsurface hydrocarbon contamination in the lower yard and provide recommendations for subsurface cleanup operations. The Phase 1 activities included:

- Installation of 27 monitoring wells
- Determining the water table elevation and product thickness in representative wells during a full tide cycle
- Measuring concentrations of flammable vapors in each monitoring well and testing potential presence of gasoline vapors in two monitoring wells located near the septic tank drain field
- Obtaining samples of product from representative wells and conducting API Gravity and flash point analyses
- Obtaining shallow sediment/sludge samples from Detention Basin No. 1 for analyses
- Preparing a site map showing relevant former and existing facilities, and monitoring well locations
- Developing design schematics and material specifications for a subsurface hydrocarbon recovery system

Monitoring well locations are shown in Figure 7-1. Boring logs are provided in Appendix D.

The findings of the Phase 1 Site Assessment indicated floating product in ten of the monitoring wells. Three separate free product plumes were reported to exist: a Slops Pond Plume, a Refinery Plume, and a Tidal Pond Plume. Product thickness ranged from a trace in wells MW-5 and MW-11 to 3.18 feet in well MW-21.

The presence of flammable gas vapors was tested in all monitoring wells and ranged from nondetected to greater than 100 percent of the lower explosive limit (LEL). Wells S-1 through S-3 in the Slops Pond Plume contained no flammable vapors, even though free product was present in these wells. In the Refinery Plume, Well MW-17 had a vapor concentration of only 5 percent of the LEL, despite the presence of free product in the well. All wells in the Tidal Pond Plume contained high concentrations of flammable vapors. Some wells located a considerable distance from free product plumes (wells MW-1, MW-2, MW-13, and MW-14) contained relatively high vapor concentrations.

The depth to groundwater varied from 3 to 8 feet below ground surface. Groundwater was reported to flow to the northwest. Groundwater levels near the tidal pond were found to be lower than the adjacent surface water levels in the creek and pond. It was postulated that a leaky drain pipe from a pumping system may have been responsible for this reversal in groundwater flow. No visible product was reported in the surface tidal pond.

It was recommended that:

- A subsurface hydrocarbon recovery program be implemented in each of the three product plumes.

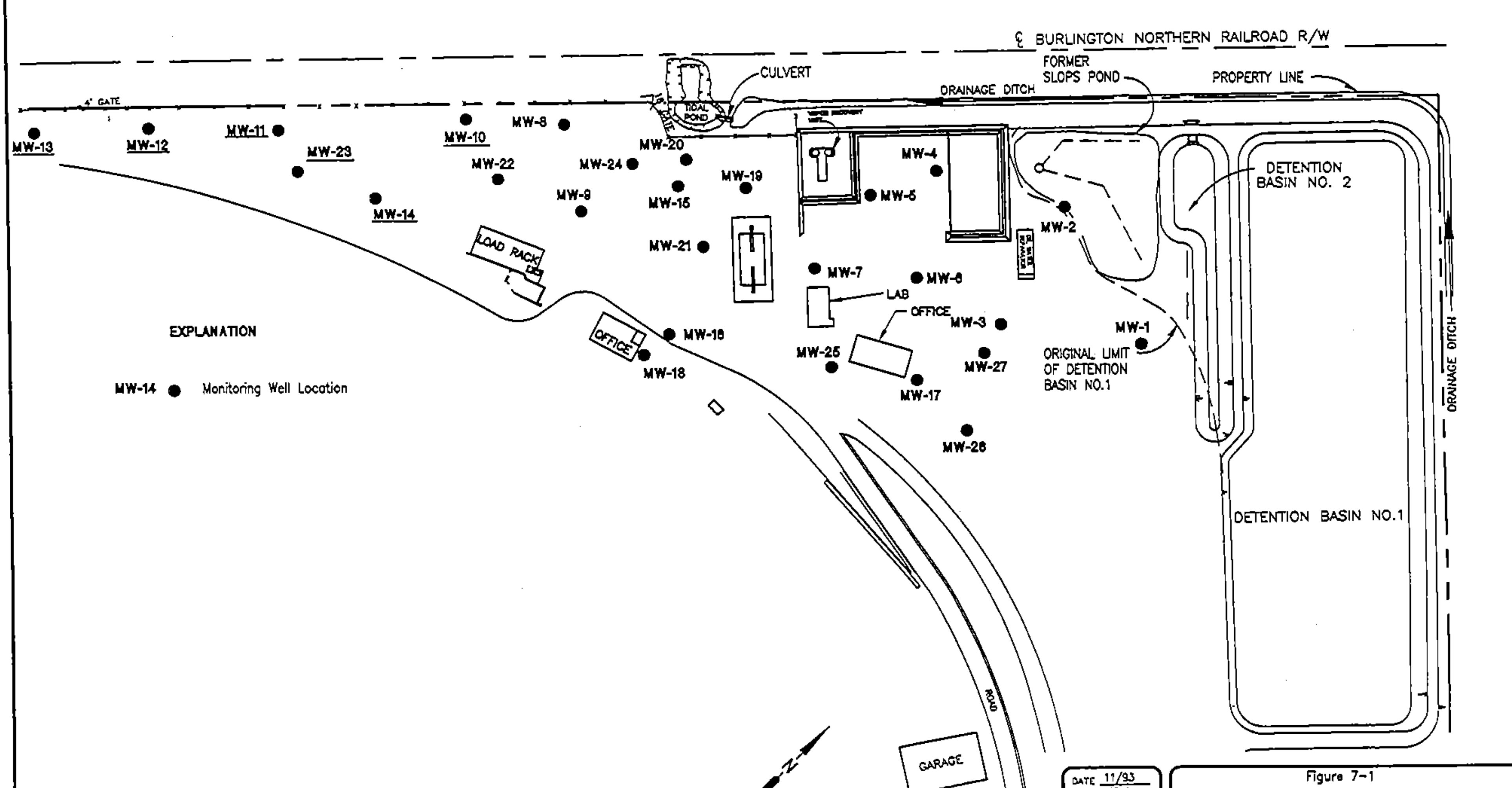
- The integrity of all active drain lines in the vicinity of the Tidal Pond Plume be determined to identify the possible source of the free product in this area and the possible cause of the groundwater flow reversal near the tidal pond.

- A trench-type hydrocarbon recovery system be installed in the Slops Pond Plume and the Tidal Pond Plume.

7.2 Subsurface Contamination Study, Upland Fuel Tank Area – 1988

A subsurface contamination study was conducted in February 1988 (GeoEngineers, 1988a) to determine conditions within a portion of the upper yard. The study included:

- Drilling and sampling six hollow-stem auger borings (see Figure 7-2)



EMCON Northwest, Inc.

Source: GeoEngineers, Inc. Bellevue, washington
Phase I Site Assessment Report
Edmonds, Washington.12/04/86

DATE 11/93
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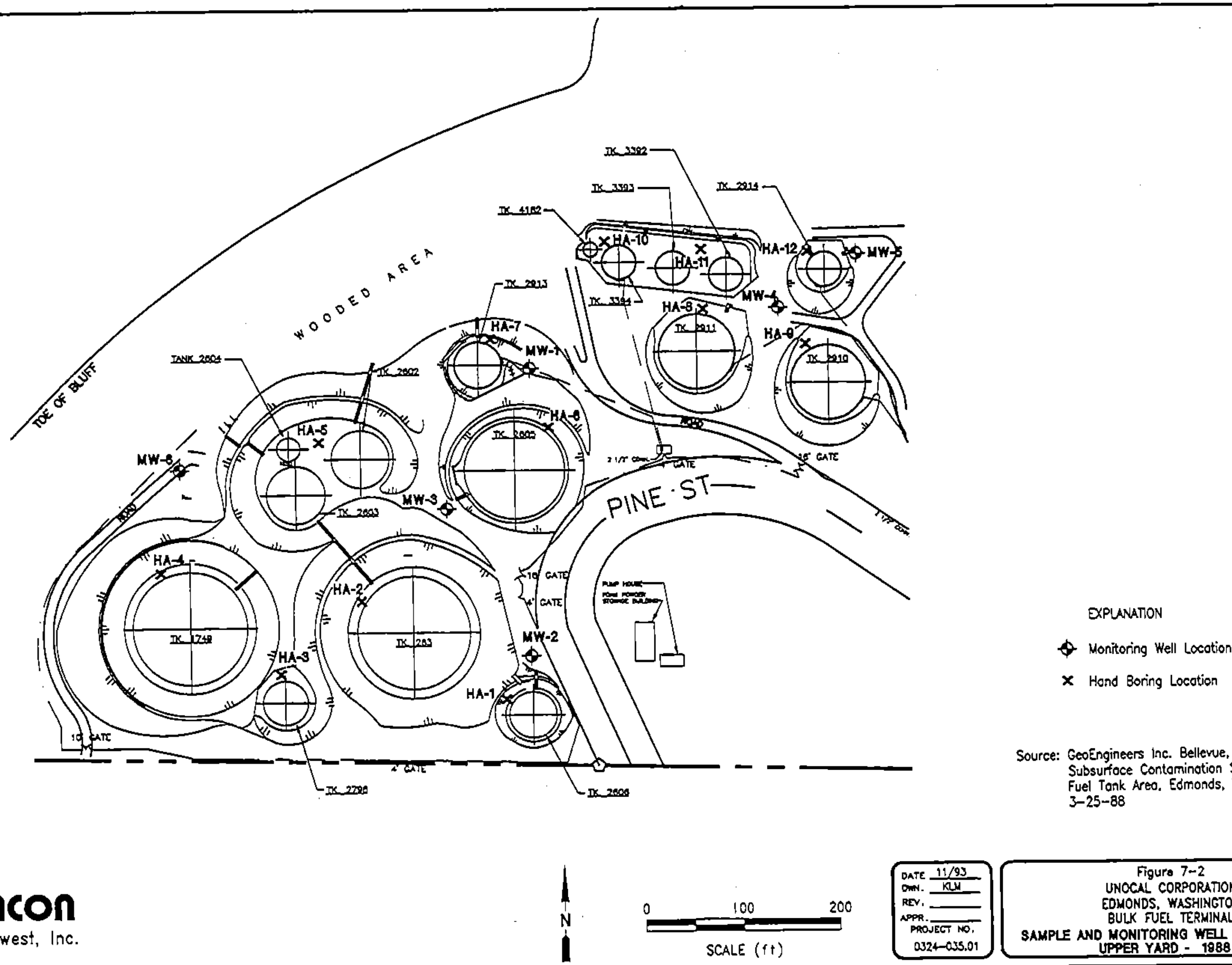
PROJECT NO. 0324-035.01

Figure 7-1
UNOCAL CORPORATION
EDMONDS, WASHINGTON
PHASE I SITE ASSESSMENT
MONITORING WELL LOCATIONS - 1986

1= 100 11-22-93 0324\035\01C21



Source: GeoEngineers Inc. Bellevue, Washington
Subsurface Contamination Study Upland
Fuel Tank Area, Edmonds, Washington
3-25-88

DATE 11/93
DWN. KLM
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APPR.
PROJECT NO.
0324-035.01

Figure 7-2
UNOCAL CORPORATION
EDMONDS, WASHINGTON
BULK FUEL TERMINAL
SAMPLE AND MONITORING WELL LOCATIONS, UPPER YARD - 1988

EMCON Northwest, Inc.

1= 100 11-11-93 0324\035\01C23

- Hand auguring 12 borings inside the containment berms and obtaining at least two soil samples from each boring

- Analyzing one soil sample obtained from each hollow-stem auger boring and two soil samples from each hand auger boring for the presence of fuel hydrocarbon and total petroleum hydrocarbons; analyzing soil samples obtained from borings near tanks known to have contained leaded gasoline for total lead

- Installing groundwater or vapor monitoring wells in the hollow-stem auger borings and in two hand auger borings

- Developing each groundwater monitoring well, measuring water table elevations for each groundwater monitoring well, and sampling each well for the potential presence of free (floating) hydrocarbons

- Measuring the air space in each well casing for hydrocarbon vapors

- Obtaining groundwater samples from each monitoring well for laboratory analysis of benzene, toluene, ethylbenzene, and xylene (BTEX) and for total petroleum hydrocarbons (TPH); analyzing two groundwater samples for volatile chlorinated hydrocarbons (solvents)

TPH (by USEPA Method 418.1) varied from non-detected to 12,000 mg/kg. It was concluded that contamination consisted primarily of heavy fuel hydrocarbons present at shallow depths in the upper yard. Free product was not detected in any of the monitoring wells investigated during this study. Laboratory analysis of groundwater samples obtained from the monitoring wells resulted in no detectable levels of BTEX, except MW-4, which had a benzene concentration of 10 μg/L.

It was recommended that:

- The contaminated soil be excavated and disposed of during tank removal operations.

- Soil be excavated in the area of MW-1 as a result of moderate concentrations of hydrocarbon vapors detected in the well casing.

- The monitoring wells be sealed and abandoned in accordance with state law within one year of the date of the report.

7.3 Phase 1 Site Assessment, Detention Basin No. 1 – 1988

The purpose of the Phase 1 Site Assessment of Detention Basin No. 1, conducted in August 1988, was to research the history of the basin and to characterize select chemical constituents in basin water and sediment (GeoEngineers, 1988b). The Phase 1 study included:

- Observing Detention Basin No. 1 and choosing sampling locations
- Reviewing aerial photography of the site
- Interviewing UNOCAL personnel familiar with the site
- Collecting "worst case" samples of tar, soil, and surface water and analyzing them for broad-scan chemical testing (see Figure 7-3 for sample locations)

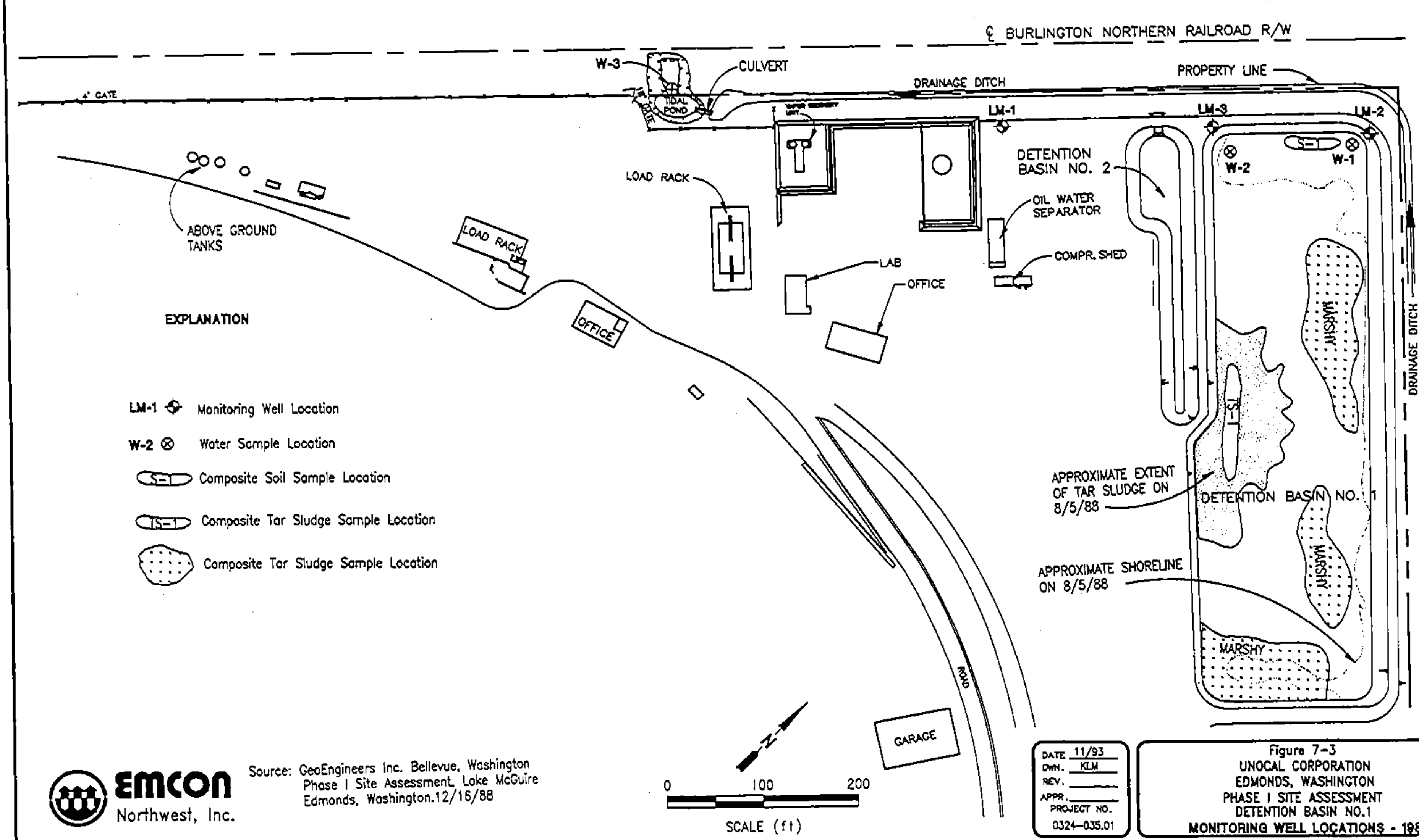
A number of historical aerial photographs were reviewed to document site changes over time. These photographs aided the personnel interviews conducted to determine the daily operations of the terminal as it related to the Detention Basin No. 1 area. A number of spills or unplanned releases of petroleum products which had impacted Detention Basin No. 1 occurred from 1954 to the late 1970s. The incidents ranged from an unknown quantity of an off-specification emulsified asphalt in the mid-1960s to an 80,000-gallon diesel fuel spill from an overfilled diesel tank in the late 1970s.

Laboratory analyses included EP Toxicity metals, polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds, semivolatile organic compounds, TPH, and BTEX. The sampling for "worst case" conditions in soil and tar did not encounter EP Toxicity levels that exceeded 1988 regulatory cleanup guidelines. The TPH concentrations of the lake sediments and tar exceeded 100,000 mg/kg, toluene was detected in the μg/kg range, ethylbenzene ranged from non-detect to 3.9 mg/kg, and total xylenes varied from 2 to over 1,000 mg/kg, depending on the test methods. No other volatile organic compounds or semivolatile organic compounds were detected in soil although the method detection limits were elevated.

No volatile or semivolatile organic compounds were detected in water samples analyzed from Detention Basin No. 1 and the outlet to the tidal pond. TPH ranged from 560 to 930 μg/L.

The report recommended that:

- Groundwater near Detention Basin No. 1 be investigated including the installation of four monitoring wells



EMCON Northwest, Inc.

Source: GeoEngineers Inc. Bellevue, Washington
Phase I Site Assessment, Lake McGuire
Edmonds, Washington.12/16/88

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PROJECT NO. 0324-035.01

Figure 7-3
UNOCAL CORPORATION
EDMONDS, WASHINGTON
PHASE I SITE ASSESSMENT
DETENTION BASIN NO.1
MONITORING WELL LOCATIONS - 1988

1= 100 11-22-93 0324\035\01C20

- UNOCAL consider the option of disposing of the tar in the basin by blending it with asphalt during site paving

7.4 Phase 2 Site Assessment, Detention Basin No. 1 – 1989

The purpose of the Phase 2 Site Assessment for Detention Basin No. 1, conducted during April 1989, was to determine the possibility of contamination of groundwater by petroleum products (GeoEngineers, 1989a). The Phase 2 study included:

- Drilling exploratory borings along the northwestern margin of the original limits of Detention Basin No. 1 and obtaining soil samples at 5-foot intervals for soil classification and field detection of possible contamination (see Figure 7-4 for sample locations)

- Collecting four soil samples and analyzing them for TPH

- Developing the well screens and obtaining groundwater samples from the three new monitoring wells and existing wells MW-1 and MW-2

- Analyzing the groundwater samples for TPH, BTEX, and semivolatile organic compounds

- Determining groundwater elevations and hydrocarbon vapor concentrations in each of the five monitoring wells

TPH in soil ranged from 65 to 360 mg/kg, and TPH in groundwater varied from 0.84 to 1.8 mg/L. In groundwater samples, benzene varied from non-detected to 110 μg/L, toluene was not detected, ethylbenzene ranged from non-detected to 40 μg/L, and total xylenes varied from not detected to 53 μg/L. Wells MW-2 and LM-1 had highest levels of BTEX. Groundwater varied from 2 to 5 feet in depth; flow was estimated to be to the north-northwest.

The report recommended that future remedial actions include:

- Removal of the tar from Detention Basin No. 1

- Asphalt production from tar removed from Detention Basin No. 1

- Removal and treatment of water from Detention Basin No. 1

- Landfarming of sediment and soil from Detention Basin No. 1

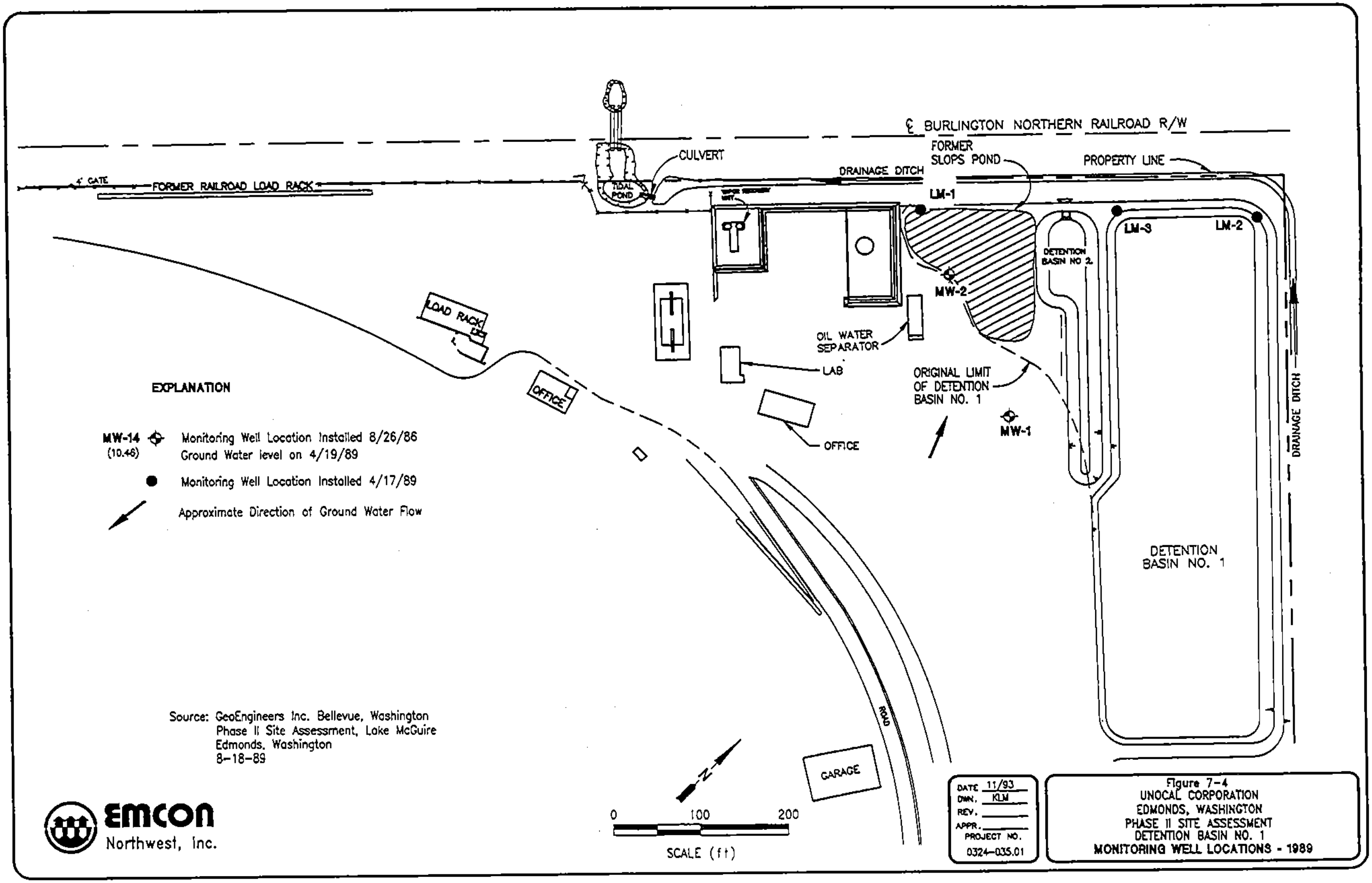

Figure 7-4
UNOCAL CORPORATION
EDMONDS, WASHINGTON
PHASE II SITE ASSESSMENT
DETENTION BASIN NO. 1
MONITORING WELL LOCATIONS - 1989

1= 100 11-22-93 0324\035\01C19

7.5 Site Contamination Assessment, Waste Soil Stockpile Area – 1989

A Site Contamination Assessment of the Waste Soil Stockpile Area was conducted in April 1989 (GeoEngineers, 1989b). UNOCAL Service Station No. 5353 in Seattle, Washington (soil was transported to the terminal in 1980) and UNOCAL Service Station No. 6211 in Des Moines, Washington (soil was transported to the terminal in 1987) were the principal sources of soil in the stockpile area. The purpose of the report was to evaluate the waste soil stockpile area for subsurface contamination from petroleum-related products. The study included:

- Drilling five hand-auger borings in the waste soil stockpile area and obtaining soil samples at various depths for laboratory analysis of TPH and BTEX (see Figure 7-5 for sample locations)

- Drilling a single monitoring well immediately northeast of the stockpile area and obtaining two soil samples for TPH and BTEX analyses

- Determining the groundwater elevation and hydrocarbon vapor concentration in the monitoring well and obtaining a groundwater sample for TPH and BTEX analysis

TPH in the soil stockpile varied from 510 to 6,300 mg/kg. TPH immediately below or adjacent to the stockpile ranged from not detected to 100 mg/kg. BTEX constituents were generally not detected. The highest soil benzene concentration was 110 μg/kg. TPH and BTEX were not detected in the groundwater sample. The depth to groundwater was about 4 feet at the time of the investigation.

The report recommended that UNOCAL perform additional remediation of the stockpile using landfarming. It was suggested that landfarming of the stockpiles could be accomplished concurrent with landfarming of the Detention Basin No. 1 sediment and soil.

7.6 Site Characterization, Marine Diesel Spill – 1990

A site characterization of a marine diesel spill was conducted in 1990 (GeoEngineers, 1990). On March 5, 1990, approximately 350 gallons of marine diesel fuel spilled when a sump overflowed in the southwest corner of the lower yard. UNOCAL reported the incident to Ecology and recovered most of the spilled product on the day of the spill. A site characterization was performed in the area of the spill to investigate the extent of petroleum impacted soil and to evaluate the need for remediation. The characterization included:

- Documenting the vertical and horizontal extent of the spill

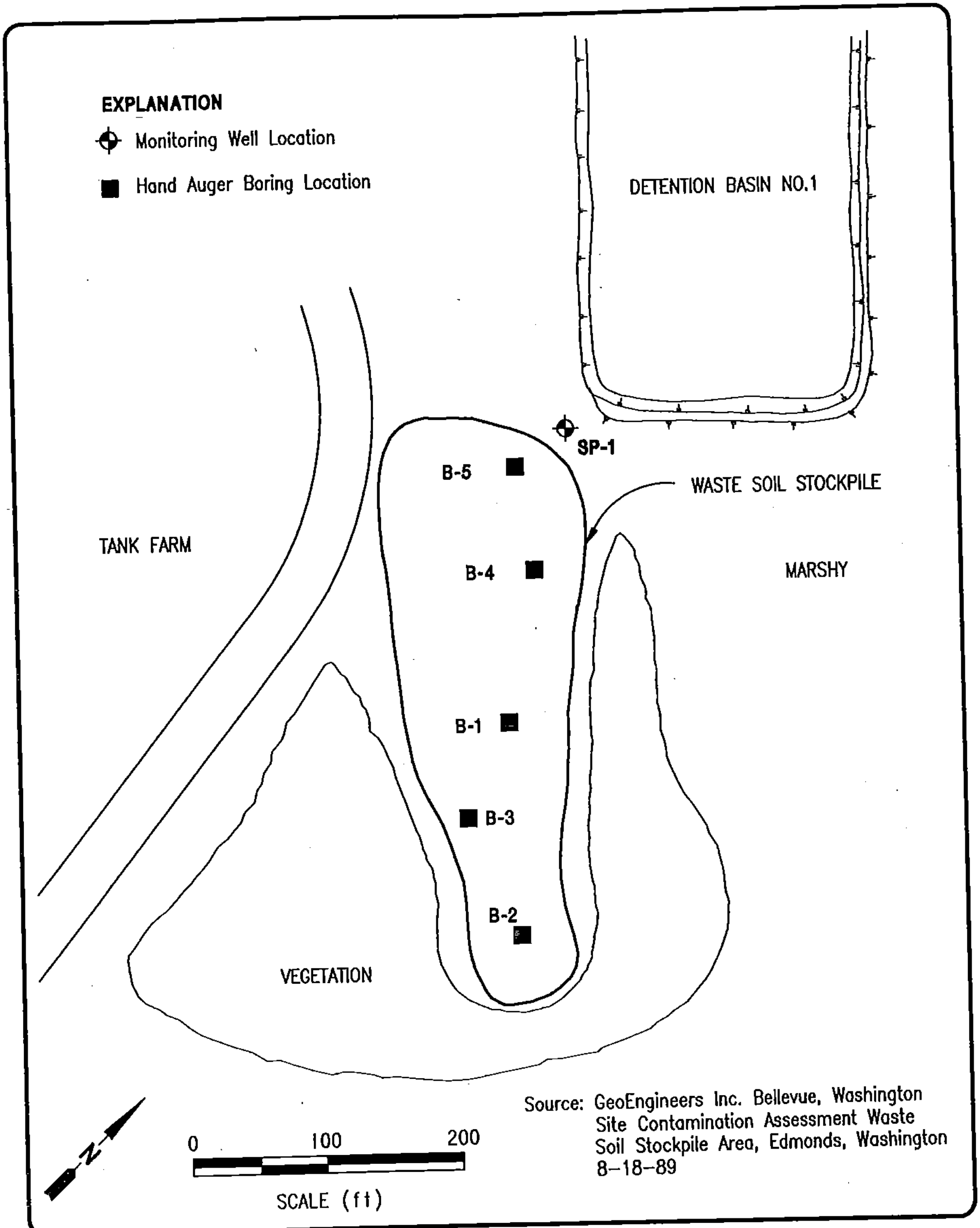

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Figure 7-5
UNOCAL CORPORATION
EDMONDS, WASHINGTON
BULK FUEL TERMINAL
SAMPLE AND MONITORING WELL LOCATIONS
WASTE SOIL STOCKPILE AREA - 1989

1= 100 11-23-93 0324\035\01C27

- Obtaining soil samples within the spill area for chemical analysis (see Figure 7-6 for sample locations)

Field observations were used to locate soil samples for chemical analysis. Ten soil samples were analyzed for TPH. TPH ranged from 9 to 14,400 mg/kg. The highest concentrations were found beneath the aboveground pipe racks. Soil contamination was up to 2 to 3 feet below the ground surface beneath the spill area. It was estimated that 100 cubic yards of soil were contaminated by the diesel spill. No free product was found.

Subsurface soil contamination was found beneath the aboveground pipe rack to a depth of at least 2.5 feet. It was suggested that the soil contamination in the vicinity of the pipe rack could be related to other sources of contamination within the lower yard.

It was recommended that remediation of the spill area be delayed until other remedial actions occurred at the facility.

7.7 Site Contamination Assessment, Lower Yard - 1990

A Site Contamination Assessment of the lower yard was conducted in September 1990 (GeoEngineers, 1991). The purpose of the assessment was to determine the extent of soil contamination due to past releases of petroleum products in the lower yard. The scope of the study included:

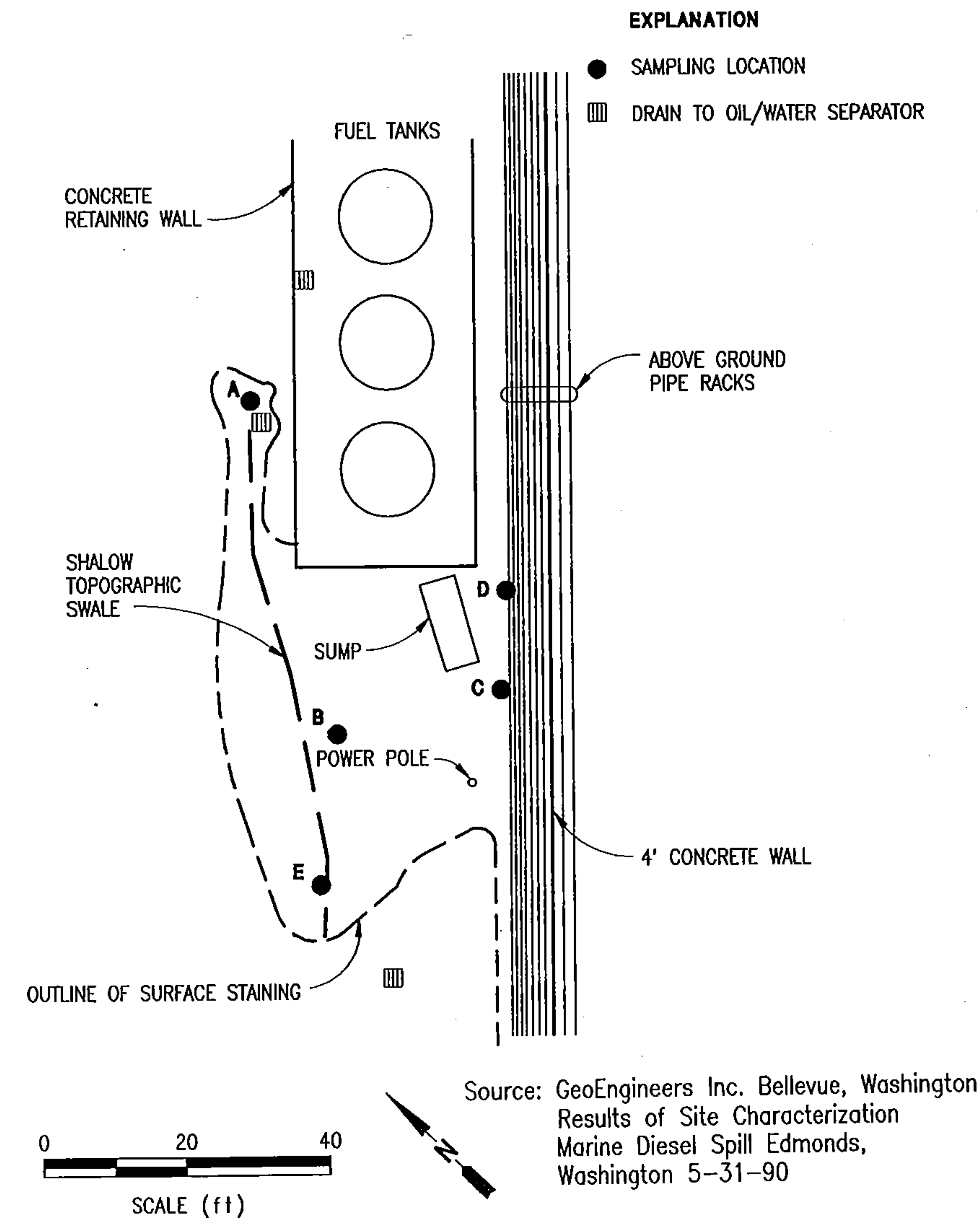
- Excavating and collecting soil samples from 25 test pits and analyzing for BTEX and TPH (see Figures 7-7 and 7-8 for sample locations)

- Field screening soil samples from the test pits

- Analyzing three soil samples from selected test pits for volatile hydrocarbons, semivolatile hydrocarbons, and TCLP metals

- Reporting and evaluating the results of an ongoing land farming operation and two bio-treatability tests

One sample each was collected for laboratory analysis from 23 of the 25 test pits, generally between depths of 6 and 8 feet below ground surface. Two samples were collected for laboratory analysis from two test pits. All test pit samples were analyzed for BTEX and TPH by USEPA Methods 8015M and 418.1. Benzene varied from not detected to 3 mg/kg, toluene ranged from not detected to 17 mg/kg, ethylbenzene varied from not detected to 43 mg/kg, and total xylenes ranged from not detected to 310 mg/kg. TPH by Method 418.1 varied from 12 to 16,000 mg/kg, TPH as gasoline (TPH-G) by Method 8015M ranged from not detected to 2,800 mg/kg, and TPH as diesel (TPH-D)



Source: GeoEngineers Inc. Bellevue, Washington
Results of Site Characterization
Marine Diesel Spill Edmonds,
Washington 5-31-90

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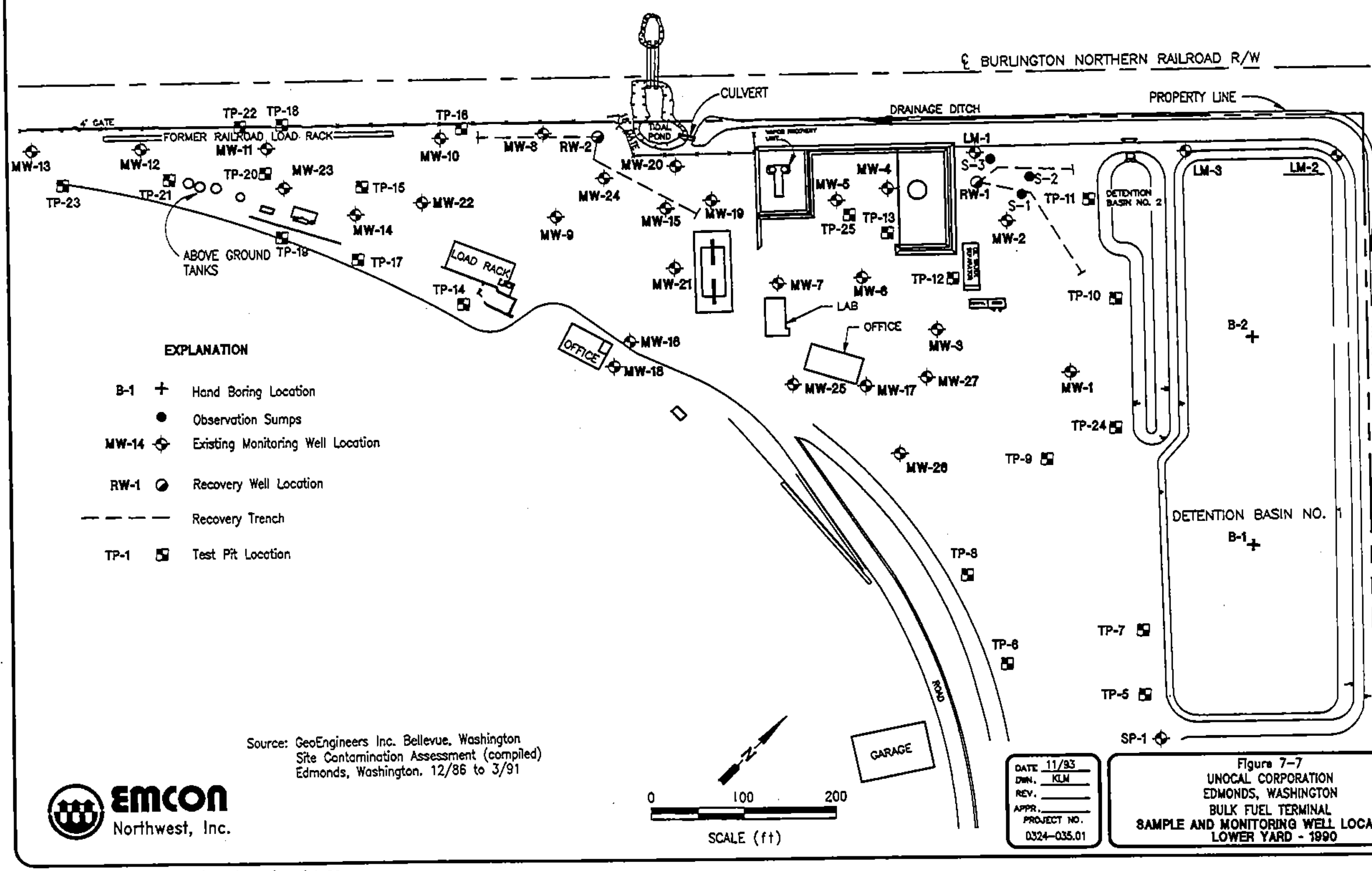
0324-035.01

Figure 7-6
UNOCAL CORPORATION
EDMONDS, WASHINGTON
MARINE DIESEL SPILL, 1990
SAMPLE LOCATIONS

1= 20 11-11-93 0324\035\01C26



EXPLANATION

B-1	+	Hand Boring Location
	●	Observation Sumps
MW-14	⌖	Existing Monitoring Well Location
RW-1	◐	Recovery Well Location
— — —		Recovery Trench
TP-1	▣	Test Pit Location

Source: GeoEngineers Inc. Bellevue, Washington
Site Contamination Assessment (compiled)
Edmonds, Washington. 12/86 to 3/91

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Figure 7-7
UNOCAL CORPORATION
EDMONDS, WASHINGTON
BULK FUEL TERMINAL
SAMPLE AND MONITORING WELL LOCATIONS, LOWER YARD - 1990

1=100 2-7-94 G:\DWG\0324\035\01C24

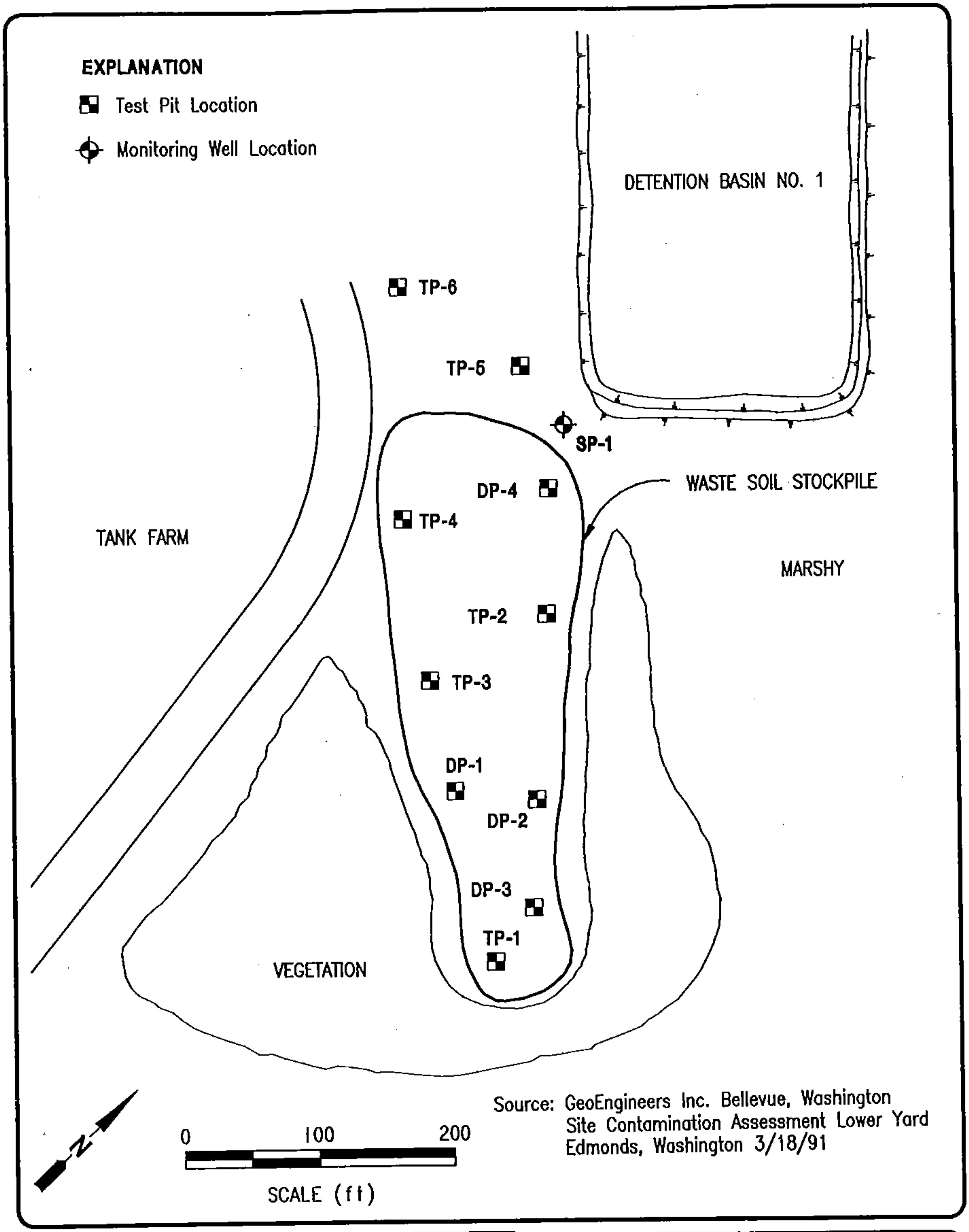

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Figure 7-8
UNOCAL CORPORATION
EDMONDS, WASHINGTON
BULK FUEL TERMINAL
SAMPLE AND MONITORING WELL LOCATIONS, LOWER YARD - 1990

1= 100 11-22-93 0324\035\01C25

varied from not detected to 23,000 mg/kg. No spatial trends were noted in the investigation, although the highest TPH levels were found in samples from the former refinery area, former asphalt plant, and former railroad loading rack.

All TCLP results were below regulatory thresholds designating waste soil as hazardous.

On-site landfarming efforts reduced TPH levels of gasoline- and diesel-contaminated soil from 2,600 mg/kg to less than 200 mg/kg within four months. TPH levels of Detention Basin No. 1 soil and soil from the former railroad loading rack areas decreased significantly during the two- to three-month biotreatability tests.

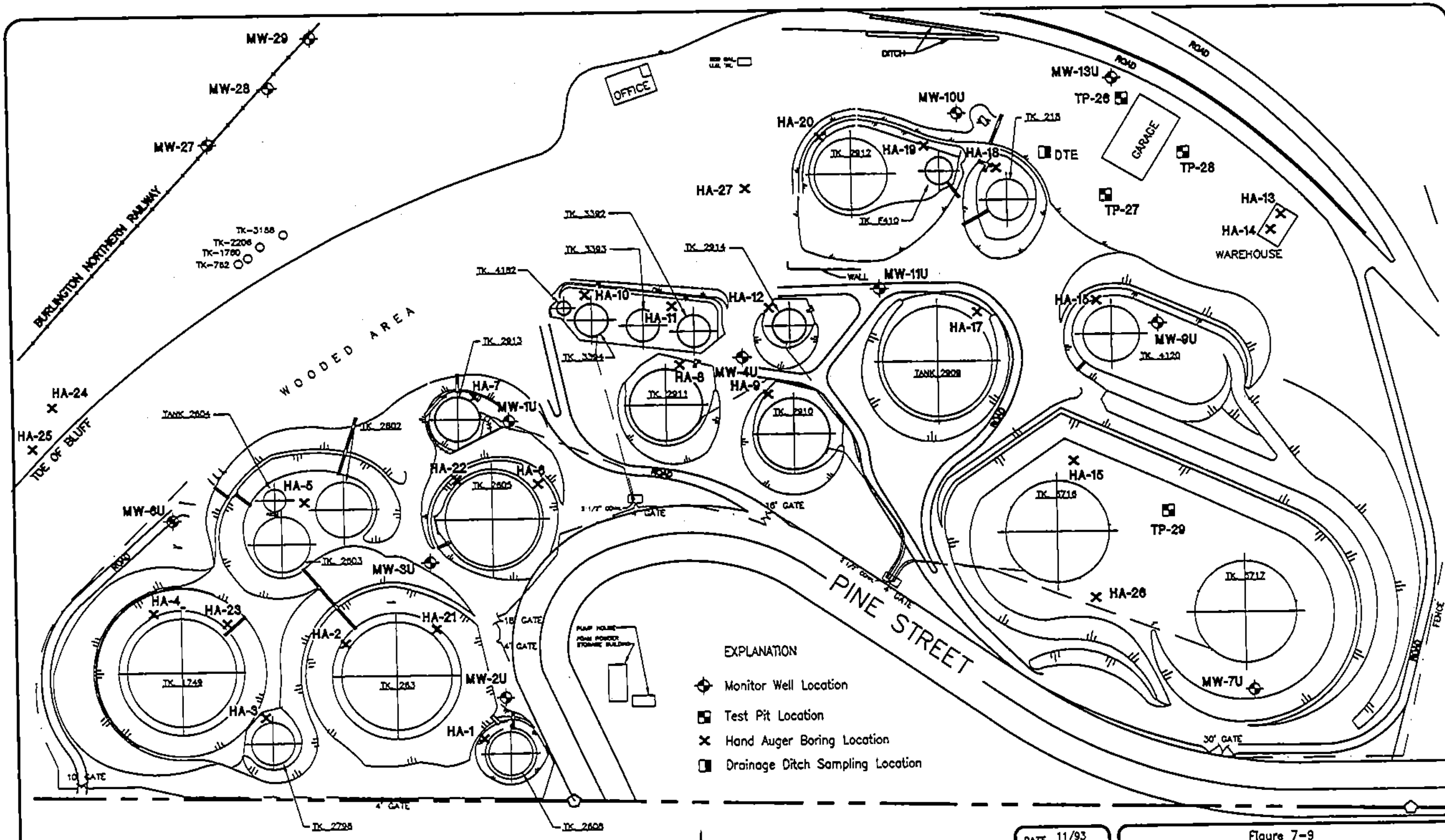
The report recommended that:

- Monitoring wells be installed downgradient of TP-16 and TP-18 and crossgradient of well TP-23 to delineate the extent of petroleum-impacted soil and groundwater
- Landfarming operations be continued to complete the cleanup of imported contaminated soils
- A pilot scale test be conducted to further evaluate landfarming remediation under field conditions

7.8 Supplemental Subsurface Contamination Assessment, Upper Yard – 1991

A supplemental Subsurface Contamination Assessment was performed in 1991 (GeoEngineers, 1993). The purposes were to explore the subsurface conditions in the eastern portion of the upper yard and the BNRR property north of the lower yard, and to evaluate possible soil and groundwater contamination at those locations. The scope included:

- Excavating four test pits, three adjacent to underground storage tanks at the transport garage, and one near Tanks 3716 and 3717, and obtaining soil samples for field screening from each test pit (see Figure 7-9).
- Drilling five borings with a drill rig in the eastern portion of the upper yard and obtaining soil samples for field screening at 5-foot intervals from each boring.
- Installing a 2-inch-diameter monitoring well in each upper yard boring, developing and purging each monitoring well, and measuring the combustible vapor concentration in each well headspace.



EMCON Northwest, Inc.

Source: GeoEngineers, Inc. Bellevue, Washington
Supplemental Subsurface Contamination Assessment
Upper Yard, Edmonds, Washington.09/05/91

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PROJECT NO. 0324-035.01

Figure 7-9
UNOCAL CORPORATION
EDMONDS, WASHINGTON
BULK FUEL TERMINAL
SAMPLE AND MONITORING WELL LOCATIONS,
UPPER YARD - 1991

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- Drilling 15 hand auger borings spaced around the upper yard near the warehouse and in the far western portion of the lower yard and collecting two soil samples from each boring for field screening.

- Drilling three borings with a drill rig off site on BNRR property, installing a monitoring well in each boring, and obtaining soil samples at 5-foot intervals for field screening.

- Field screening each soil sample and selecting at least two soil samples from each boring and one soil sample from each test pit for chemical analysis.

- Analyzing 45 soil samples for TPH by modified USEPA Method 8015, 20 select soil samples for TPH by USEPA Method 418.1, 4 select soil samples for total lead by USEPA Method 3050/7421, and 20 select soil samples for BTEX by USEPA Method 8020.

- Collecting one groundwater sample from each of the eight new monitoring wells and from monitoring wells MW-1U, MW-2, and MW-4U; analyzing each water sample for BTEX by USEPA Method 8020 and for TPH by modified USEPA Method 8015; and analyzing one water sample from wells MW-11U and MW-13U for TPH by USEPA Method 418.1.

- Surveying the ground surface and top of casing elevations of each monitoring well referenced to an existing benchmark.

BTEX compounds were detected in only two of the twenty soil samples analyzed. Benzene was not detected in any soil sample, and toluene, ethylbenzene, and total xylenes detections ranged from 0.085 to 3.3 mg/kg. Eight soil samples were above the detection limits in the TPH-G analyses, eleven soil samples were above the detection limits in the TPH-D analyses, and fourteen soil samples were above the detection limits in the Method 418.1 TPH analyses. TPH-G detections varied from 7 to 2,700 mg/kg, detected values of TPH-D ranged from 90 to 19,000 mg/kg, and detected values of TPH by Method 418.1 varied from not detected to 30,000 mg/kg. Typically, soil samples from two depths were analyzed from each boring or test pit, and TPH levels decreased with depth. The highest TPH levels were found near Tanks 263, 1749, 2606, 2911, 2913, and 4120. None of the soil samples collected on BNRR property were above the TPH detection limits.

Groundwater was encountered in all but one drilled borings and all but three hand augered borings. In the lower yard, groundwater was encountered at a depth of about 7 feet. Groundwater flow was stated to be to the north towards the detention pond or towards the wetlands to the east. In the upper yard, two saturated zones were encountered: a perched zone less than 10 feet deep, and a deeper zone that varied in depth from 12 to 75 feet. Groundwater flow was stated to be complex, and no groundwater contour maps were presented.

Benzene was detected in one water sample at 0.5 μg/L, toluene was detected in one water sample at 0.9 μg/L, and ethylbenzene was detected in one water sample at 0.7 μg/L. Total xylenes were detected in two water samples, at 0.8 and 1.4 μg/L. None of the water samples were above the detection limits in the TPH-G and TPH-D analyses. Both water samples analyzed for TPH by Method 418.1 were above the detection limit, at 2.2 and 2.3 mg/L.

The report recommended that:

- Further upper yard investigations be performed after tank removal
- Several test trenches be excavated to investigate the soil for lenses of contamination

7.9 Harbor Square Site Assessment - 1991

A Phase 1 and Phase 2 site assessment of the Harbor Square property in Edmonds, Washington was performed for the Port of Edmonds (Port) in 1991 (Landau, 1992). The investigation was done to assess the nature and extent of potential contamination at a portion of the Port's Harbor Square property. The site assessment was conducted in two phases. In Phase 1, historic documents and personal interviews were assessed, and preliminary site investigations (including site reconnaissance and focused soil explorations) were conducted. In Phase 2, more comprehensive site investigations were performed to assess site environmental conditions.

7.9.1 Phase 1 Investigation

The Phase 1 investigation included:

- Review and summary of the site history
- Review of agency files and records
- Site reconnaissance and limited soil sampling

Landau's record search revealed two sources of contamination. One source identified in Ecology files was documented in a Phase 1 investigation performed by Burlington Northern Railroad in April 1991. The report described a leaking 2,000-gallon underground diesel tank (which was removed in September 1990) located approximately 700 feet north of the Harbor Square (Dayton Street Depot) area, on Burlington Northern

Railroad property. TPH concentrations in surrounding soil ranged from nondetected to 64,000 mg/kg. Evidence of a diesel release was reported to have been found in shallow groundwater. Information on the other source of site contamination came from a former Edmonds Fire Department employee. According to this employee, who had worked with the fire department since about 1970, there were some incidental diesel spills from locomotives along the railroad tracks west of the site.

Four soil borings (Figure 7-10) were drilled to investigate (1) reports of a "black ooze" seep in the pavement (HS-1), (2) the former railroad spur (HS-2 and HS-3), and (3) buried railroad ties (HS-4). One to two soil samples were collected from each boring and submitted to a laboratory for the analysis of TPH. One sample from HS-2 was also analyzed for volatile and semivolatile organic compounds, pesticides, PCBs, and metals.

The groundwater table was reported to be at a depth of about 3 feet. TPH by Method 418.1 varied from 2,000 to 4,400 mg/kg, and TPH by Method 8015M ranged from nondetected to 7,900 mg/kg. Elevated TPH results were found in samples from HS-2 and HS-4. The Phase I report stated that the two most likely sources for the elevated TPH levels were the former UNOCAL Oil (Dayton Street) Depot and the railroad spur on the west side of the site.

7.9.2 Phase 2 Investigation

The purpose of the Phase 2 investigation to collect sufficient data to determine the extent of contamination, to assess the risk associated with migrating contaminants, and to investigate a reported seepage of tarry material from the parking lot pavement east of Building 4.

The investigation included:

- Drilling and sampling five soil borings
- Installing five monitoring wells
- Collecting and testing soil and groundwater samples
- Measuring groundwater elevations

The five soil borings and five monitoring wells (Figure 7-10) were located to investigate (1) reports of a "tar-like" material seeping from the pavement (HS-5 and MW-3), (2) the former oil storage warehouse (HS-6), (3) the former oil storage tanks (HS-7), (4) the railroad spur or Phase I areas of concern (HS-8, MW-2, and MW-5), (5) background conditions (HS-9 and MW-1), and (6) an area downgradient of the site. One to two soil samples were collected from each boring/monitoring well and submitted to a laboratory for the analysis of TPH. One soil sample from HS-5 was also analyzed for volatile and

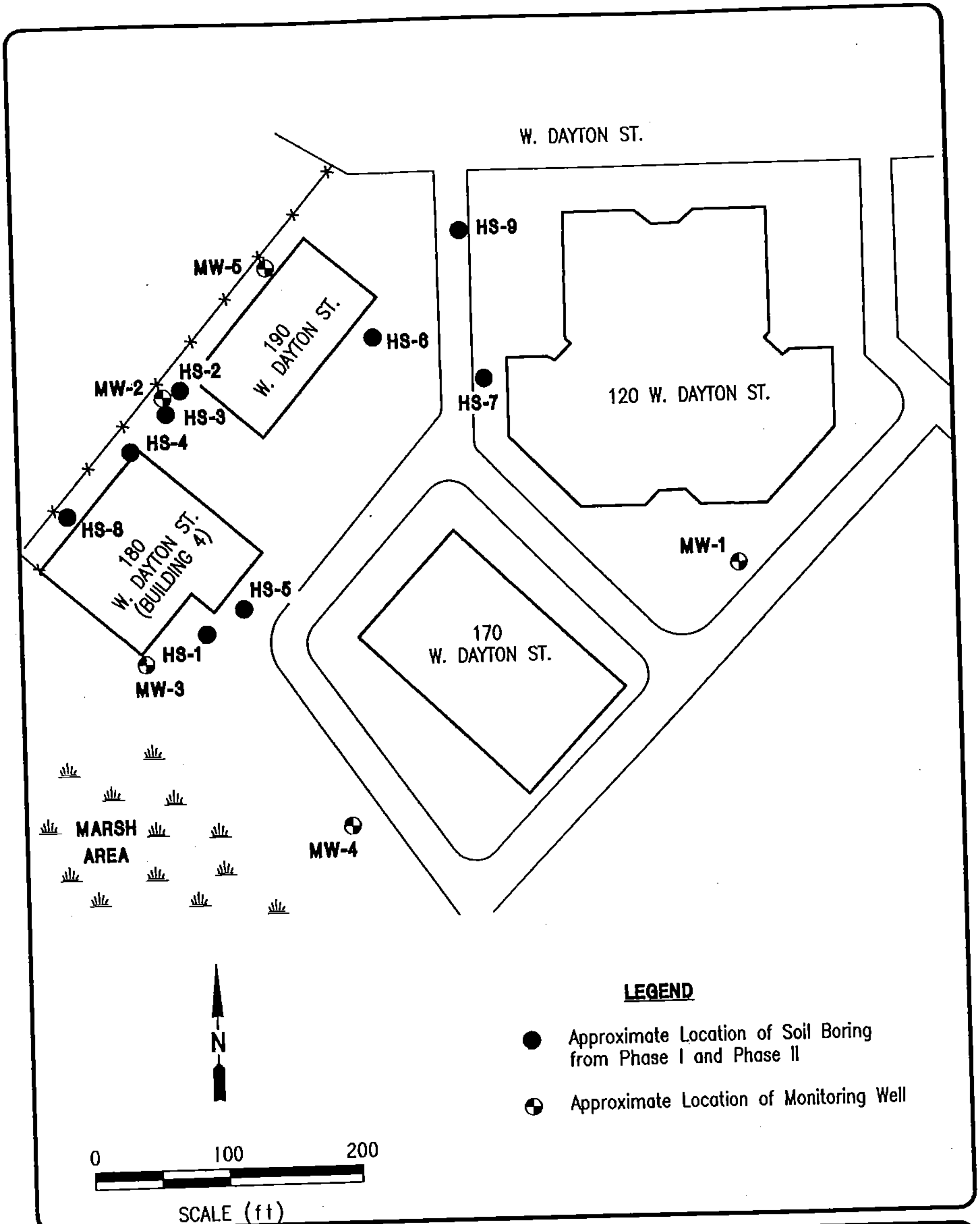

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Figure 7-10
UNOCAL CORPORATION
EDMONDS, WASHINGTON
BULK FUEL TERMINAL
HARBOR SQUARE SITE ASSESSMENT

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semivolatile organic compounds, pesticides, PCBs, and metals. Groundwater samples were analyzed for TPH and volatile organic compounds.

In soil samples, TPH by Method 418.1 varied from 14 to 110,000 mg/kg, and TPH by Method 8015M ranged from nondetected to 51,000 mg/kg. Elevated TPH results were found in soil samples from HS-5 and MW-2. PAHs in a soil sample from HS-5 ranged from 2.9 to 680 mg/kg. It was reported that up to 4 feet of soil was encountered at HS-5 that was saturated with a viscous, tar-like substance. All groundwater TPH results were below detection limits, and no volatile organic compound was detected in a significant concentration.

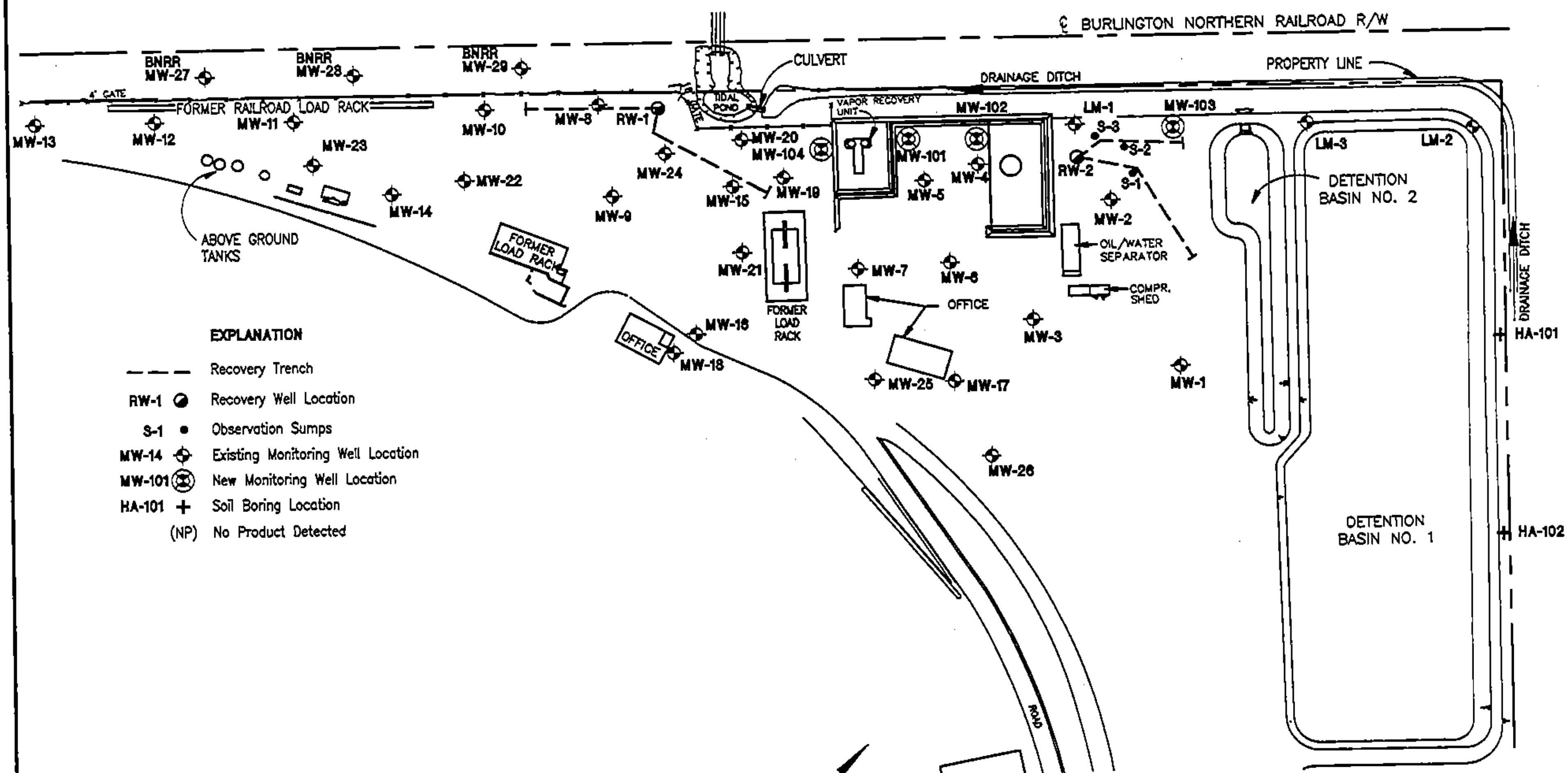
Based on the results of the Phase 1 and 2 investigations, it was recommended that the Port:

- In accordance with MTCA reporting requirements, notify Ecology of site conditions within 90 days of the first known detection of constituents of concern at the site
- Contact the former operators of the railroad and oil depot facilities to determine past site uses and practices
- Continue periodic groundwater measurements
- Monitor groundwater quality
- Assess the risk for potential human and possible on-site biological receptors from exposure to identified on-site contamination
- Develop a remedial action plan

7.10 Preliminary Remedial Investigation - 1992

A preliminary remedial investigation was performed in December 1992 and January 1993 that focused on evaluating the areal extent of existing free product plumes and evaluating water quality along the west-central property boundary (EMCON, 1994). In the investigation, soil samples were collected from six borings (Figure 7-11), monitoring wells were installed and sampled in four of the soil borings, temporary well points were installed and sampled in two of the soil borings, and groundwater and surface water levels were measured.

Depth to groundwater ranged from 6.6 to 9.6 feet in the four monitoring wells. Surface water elevations were higher than groundwater elevations in nearby monitoring wells. No free product was observed during drilling of the soil borings, in the monitoring wells, or in the well points. In soil, TPH-G varied from not detected to 2.7 mg/kg, TPH-D



EXPLANATION

— — —	Recovery Trench
RW-1	Recovery Well Location
S-1	Observation Sumps
MW-14	Existing Monitoring Well Location
MW-101	New Monitoring Well Location
HA-101	Soil Boring Location
(NP)	No Product Detected

EMCON Northwest, Inc.

Source: Union Oil Company of California Los Angeles, California Site Area Study General Arrangement Edmonds Terminal Edmonds, Washington. 10/12/92

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Figure 7-11
UNOCAL CORPORATION
EDMONDS, WASHINGTON
BULK FUEL TERMINAL
SOIL BORING & MONITORING WELL LOCATIONS
LOWER YARD - 1992

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ranged from not detected to 2,670 mg/kg, and TPH-O varied from not detected to 2,250 mg/kg. Benzene was not detected in any soil sample, and toluene, ethylbenzene, and total xylenes were detected in only one soil sample at concentrations of 3.7, 5.1, and 33.6 mg/kg, respectively. Lead was detected in two soil samples, at 16 and 17 mg/kg.

In the six groundwater samples, TPH-G ranged from not detected to 15 mg/L, TPH-D varied from non-detected to 4.96 mg/L, and TPH-O ranged from non-detected to 1.27 mg/L. In the six groundwater samples, benzene was detected in three samples (0.001 to 0.585 mg/L), toluene was detected in three samples (0.001 to 0.188 mg/L), ethylbenzene was detected in three samples (0.004 to 0.355 mg/L), and total xylenes were detected in four samples (0.006 to 2.9 mg/L). Total lead was detected in two water samples, at 0.002 and 0.052 mg/L.

7.11 Data Quality Evaluations

The existing environmental data at the Terminal have been reviewed to determine the quality of the data. Appendix E details the review of all on-site data except that generated in the 1991 upper yard assessment (Section 7.8). GeoEngineers (1993) reviewed the data for the 1991 upper yard assessment.

All data generated at the Terminal provide useful qualitative indicators of sample contaminants. However, since some sample surrogate and spike compound recoveries were low, individual sample results may be biased low. Analytical results should therefore be used only to provide relative comparisons of contaminant concentrations. The Harbor Square site assessment data is judged to be acceptable for quantitative use, as qualified in Appendix E.

8 ENVIRONMENTAL CLEANUPS

8.1 Underground Storage Tank Cleanups

No underground storage tank (UST) cleanups have been performed to date at the Terminal. A 1,200-gallon fiberglass UST was removed on June 15, 1990, by J.V.E. Mechanical, Inc. A site assessment was not conducted during the tank removal activities. All excavated soils were used as backfill material, and additional clean fill was imported to bring the excavation to finish grade. A description of the underground storage tank is presented in Section 3.1.12.

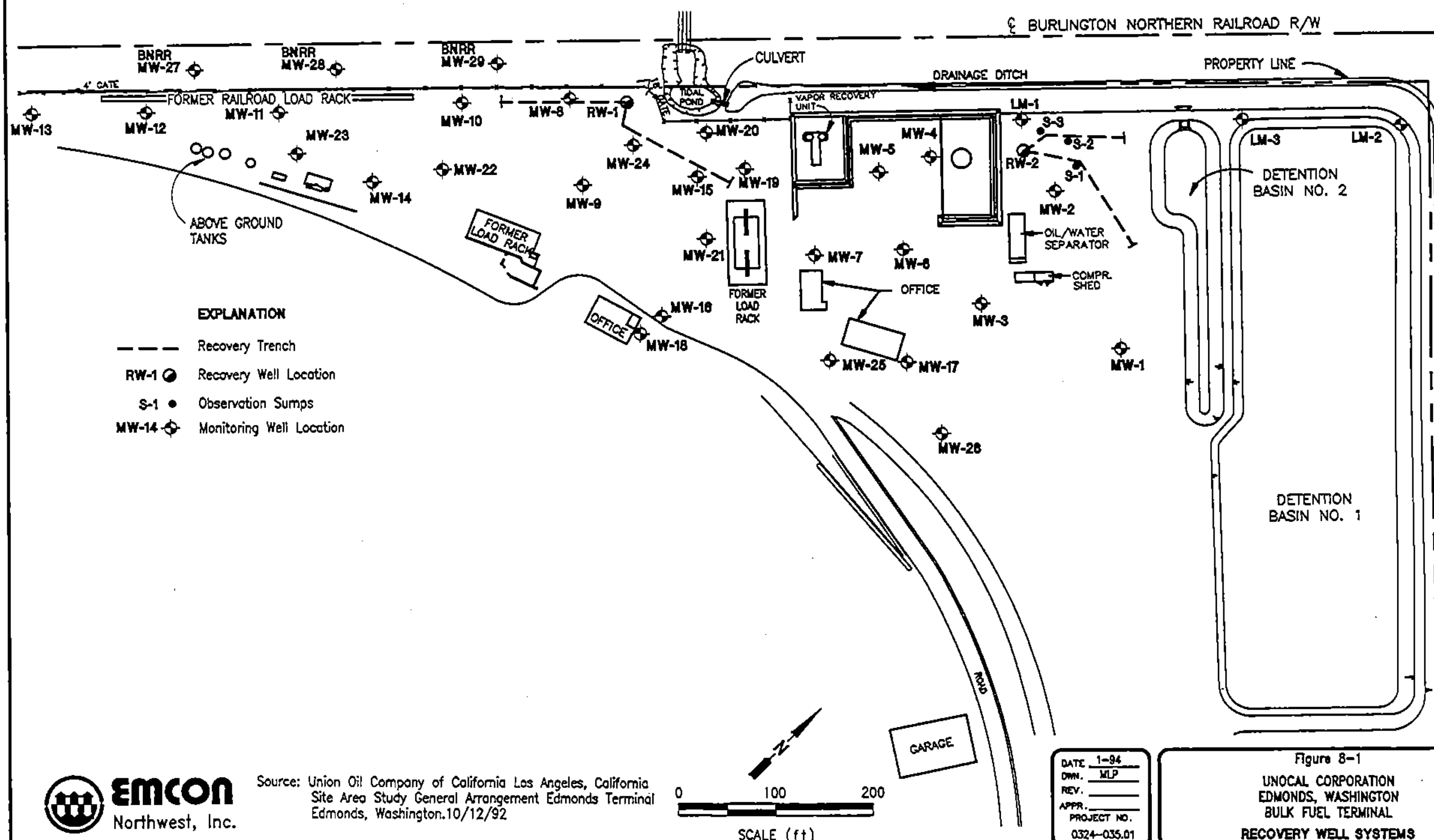
8.2 Product Recovery Project

During a Phase 1 Site Assessment in 1986, phase-separated petroleum hydrocarbons were discovered in eight groundwater monitoring wells during the assessment activities (GeoEngineers, 1986). Between July 27, and August 5, 1987, two product recovery systems were installed. They consisted of recovery sumps and trenches with perforated drains (Figure 8-1).

Recovery system RW-1 is located to the south and east of the tidal basin, along the central portion of the western property limit. Two trench legs containing 4-inch-diameter perforated drains extend in a northeasterly and southerly direction from a 48-inch-diameter inverted culvert which serves as a recovery well. A skimming pump, located within the recovery well, would pump water and recovered petroleum product through an overhead line to an aboveground storage tank (Tank F410). An estimated 20,000 gallons of recoverable petroleum product was reported to be in the vicinity of the tidal basin (GeoEngineers, 1986).

Recovery system RW-1 was activated on May 20, 1988. The system was operated during the warmer months, April through October, when the risk of freezing temperatures was low. The system was operated when the facility was manned, approximately eight hours per day, Monday through Friday.

Recovery system RW-2 is located to the north and west of the facility oil/water separators. The recovery system is similar in design to RW-1 and consists of an inverted 48-inch-diameter culvert well with two trench legs containing 4-inch-diameter drain pipe.



EXPLANATION

— — —	Recovery Trench
RW-1 ◕	Recovery Well Location
S-1 •	Observation Sumps
MW-14 ⊕	Monitoring Well Location

EMCON Northwest, Inc.

Source: Union Oil Company of California Los Angeles, California Site Area Study General Arrangement Edmonds Terminal Edmonds, Washington.10/12/92

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Figure 8-1

UNOCAL CORPORATION
EDMONDS, WASHINGTON
BULK FUEL TERMINAL

RECOVERY WELL SYSTEMS

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Recovery system RW-2 has not been activated since its construction in July 1987 due to insufficient petroleum product recovery at the well. GeoEngineers, Inc., estimated approximately 1,000 gallons of recoverable petroleum product was detected in the former RW-2 area (GeoEngineers, 1986).

Four progress reports were prepared which summarized product recovery activities at the Terminal. The first (GeoEngineers, 1987) described the installation of the two recovery systems. Slight to moderate product seepage was observed during excavation of RW-1 and the south trench leg. In the south leg, the highest amount of product was observed around MW-8. Higher amounts of product seepage were observed in the east trench leg. Small amounts of product were found during excavation of RW-2 and the connecting trenches. Excavated soil was used as backfill and was also placed near the entrance to the Terminal. Wells containing product were not reported.

The second progress report (GeoEngineers, 1988) described product recovery activities between August 1987, and September 1988. The recovery pump in RW-1 was activated on May 20, 1988. It was reported that about 2,900 gallons of product were recovered during the first day of pumping, and that intermittent pumping through September 24, 1988, recovered another 1,900 gallons. Wells containing product were not reported.

The third progress report (GeoEngineers, 1989) described the recovery activities that occurred between September 1988, and August 1989. Recovery well RW-2 was not activated during this period due to a lack of product in the well. Recovery well RW-1 was operated intermittently during the period and not much during freezing weather. About 1,700 gallons of product was recovered during the period, most of it in April 1989. Modifications were made to the product skimmer in RW-1 to allow the optimal pumping level to be more effectively maintained. Product was reportedly found in MW-2, MW-5, MW-10, MW-15, MW-17, MW-20, MW-21, and MW-24.

The fourth progress report (GeoEngineers, 1991) discussed product recovery activities during the period of August 1989, and September 1990. RW-2 was not activated due to the small amount of product in the well. RW-1 was not operated during the winter months and early spring to prevent the system from freezing and for repairs. About 1,000 gallons of product were recovered during the period, most of it in March 1990. Product was reportedly found in MW-5, MW-10, MW-11, MW-12, MW-15, MW-17, MW-20, and MW-21. Product recovery testing was performed in MW-5, MW-10, MW-11, and MW-17, and it was determined that periodic manual pumping of the wells would recover product.

As of September 30, 1990, GeoEngineers, Inc., reported a total of approximately 7,500 gallons of petroleum product recovered by RW-1. Recovered product estimates for the 1991 and 1992 operating season are not available. The recovered volume estimated by GeoEngineers, Inc., is considered an optimistic estimate of the actual free product removed from the subsurface by the recovery well system. The overhead line and Tank F410 pumped and received waste water/product from several locations across the facility during the recovery system operating period. Recovered product volume estimates were obtained by gauging Tank F410 on a periodic basis. The gauged volume may have included product recovered during dock and truck loading rack operations and from the oil/water separators.

On December 14, 1992, EMCON redeveloped monitoring wells MW-2, MW-5, MW-10, and MW-21 and installed a Welex Environmental, Inc., Hydro-Skimmer unit in each well for passive recovery of phase-separated petroleum hydrocarbons. The Hydro-Skimmer units incorporate a float assembly with a screened casing and hydrophobic filter to allow only product to enter the unit. Following several weeks of monitoring, approximately 2 gallons of product were recovered from the four monitoring wells. Based on tests conducted by Welex Environmental, Inc., it was determined that the product in monitoring wells MW-5 and MW-21 was too thick and viscous to pass through the hydrophobic filter on the Hydro-Skimmer units. These units were removed from MW-5 and MW-21, cleaned, and are being stored on site. The remaining units in MW-2 and MW-10 were monitored and drained biweekly through September 1993.

In addition to the passive skimming, UNOCAL personnel hand-bailed all wells containing detectable, phase-separated, petroleum hydrocarbons on a biweekly to monthly basis through September 1993. After removing the skimming units, phase-separated hydrocarbons in MW-5 and MW-21 were hand-bailed on a biweekly to monthly basis. Currently, the recovery system is being evaluated for potential modification. Monthly depth-to-water measurements continue to be collected from all lower yard monitoring wells.

As required by the Agreed Order, a report was prepared that more fully describes the product recovery system. This report (EMCON, 1994a) also includes an evaluation of free product thicknesses beneath the Terminal and anticipated recovery volumes, tidal influences, and anticipated system modifications.

8.3 Other Cleanups

8.3.1 Soil Bioremediation Activities

In 1980 and 1987, petroleum contaminated soils were transported to the Terminal for bioremediation. Approximately 2,000 cubic yards of soil is stockpiled in the eastern portion of the lower yard, near the entrance to the facility. The primary sources of the stockpiled soil were UNOCAL Service Station 5353 in Seattle and UNOCAL Service Station 6211 in Des Moines. A site contamination assessment, conducted in August 1989, is discussed in Section 7.5.

8.4 Miscellaneous

8.4.1 Asbestos

In September 1983, Ballard Construction Company in Seattle, Washington, was contracted to remove and dispose of 3,264 linear feet of asbestos-containing pipe insulation during the relocation of the facility slops line. In August 1989, during a scheduled boiler maintenance event, the boiler and related piping were inspected for asbestos-containing materials; none were found.

8.4.2 PCBs

UNOCAL has no record that PCBs were used or stored on site; however, they potentially were contained in transformer oil. Twenty-three electrical transformers are located at the Terminal. In October 1984, 20 of the transformers were sampled and analyzed for PCBs. All of the oil samples were within the range of a non-PCB-designated transformer (i.e., less than 50 ppm PCBs) and the transformers were labeled with non-PCB tags. One of the three transformers not sampled belongs to the Snohomish County P.U.D. The P.U.D. reported to UNOCAL that their transformer had been tested and was also within the range of a non-PCB-designated transformer. No other records of electrical transformer inspections or service are available to determine the status of the remaining two unsampled transformers. It was UNOCAL's policy not to change or dispose of transformer fluids on site.

Based on interviews with UNOCAL and P.U.D. personnel, the potential for PCB spillage to the ground is remote. The P.U.D. representative, a 36-year employee, stated that it has never been the P.U.D.'s policy or practice to change transformer oil on a customer's property; the transformer is always removed to a county site for this service. In addition, neither UNOCAL nor the P.U.D. representative recalled lightening strikes to the Terminal. The P.U.D. employee stated that the likelihood for transformer oil to explode out and onto the ground from a lightening strike, or to be released to the ground during maintenance, is very remote.

9 CONCEPTUAL SITE MODEL

9.1 Preliminary Conceptual Site Model

Historic operations and previous studies conducted at the site have been reviewed to develop a conceptual understanding of the Terminal. The conceptual understanding of the site is primarily based on operational history. A summary of potential sources, potential release mechanisms, and potential routes of exposure is presented in Table 9-1 and Figure 9-1 provides a preliminary conceptual site model. This model will be revised as necessary as new information becomes available.

Since limited analytical data are available for the Terminal, a representative schematic cross-section of surface and subsurface conditions cannot be prepared at this time, but will be prepared as part of the remedial investigation.

Table 9-1

Summary of Potential Contaminant Sources and Transport
UNOCAL Bulk Fuel Terminal
Edmonds, Washington

Potential Source	Potential Constituents	Actual/Potential Release Mechanism	Potential Routes of Migration
Dock Operations	Petroleum hydrocarbons, PAHs, VOCs, metals	Spill to surface water	Surface water
Railcar Unloading Areas	Petroleum hydrocarbons, PAHs, VOCs, metals	Spill to soil	Soil, groundwater, surface water, upland sediments
Upper Yards Tanks	Petroleum hydrocarbons, PAHs, VOCs, metals	Spill to soil	Soil, groundwater, surface water, upland sediments
Lower Yards Tanks	Petroleum hydrocarbons, PAHs, VOCs, metals	Spill to soil	Soil, groundwater, surface water, upland sediments
Detention Basin No. 1	Petroleum hydrocarbons, PAHs, VOCs, metals	Spill to surface water, soil	Soil, groundwater, surface water, upland sediments
Piping Systems	Petroleum hydrocarbons, PAHs, VOCs, metals	Spill to soil, surface water	Soil, groundwater, surface water, upland sediments
Asphalt Plant	Petroleum hydrocarbons, PAHs, VOCs, metals	Spill to soil	Soil, groundwater, surface water, upland sediments
Asphalt Warehouse	Petroleum hydrocarbons, PAHs, VOCs, metals	Spill to soil	Soil, groundwater
Maintenance Operations	Petroleum hydrocarbons, PAHs, VOCs, metals	Spill to soil	Soil, groundwater, surface water, upland sediments
Truck Loading Racks	Petroleum hydrocarbons, PAHs, VOCs, metals	Spill to soil	Soil, groundwater, surface water, upland sediments
Storm Drains and Septic Systems	Petroleum hydrocarbons, PAHs, VOCs, metals	Release to soil, surface water	Soil, groundwater, surface water, upland sediments
Underground Tanks	Petroleum hydrocarbons, PAHs, VOCs, metals	Spill to soil, groundwater	Soil, groundwater

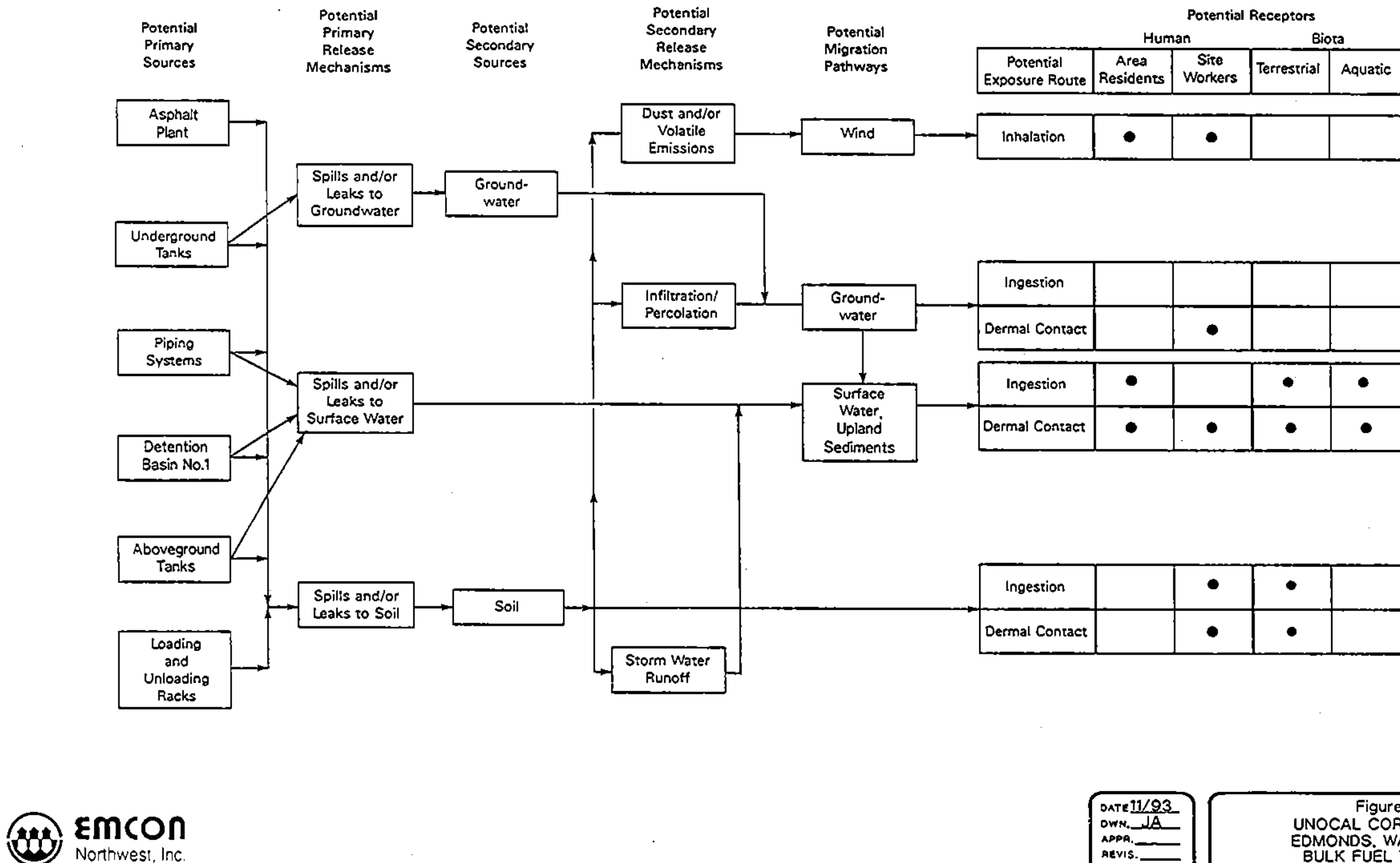

Figure 9-1
UNOCAL CORPORATION
EDMONDS, WASHINGTON
BULK FUEL TERMINAL
CONCEPTUAL SITE MODEL

10 FACILITY ENVIRONMENTAL MANAGEMENT PROGRAM

The Terminal's environmental program included an inspection/testing program and facility plans. A description of these programs is provided in this section.

10.1 Inspection/Testing Program

10.1.1 Tank Inspection and Cleaning

Tank cleaning and internal inspections were performed to review the structural integrity of the tank and to perform the necessary repairs and maintenance. External inspection of the tanks and surrounding areas was performed by UNOCAL personnel:

- All visible tanks, pipelines, flanges, and pumps were examined on a routine basis for indication of leaks, drips, sweating, and other defects.

- Storage tank inspections included gauge hatch cover, manhole covers, gaskets, roof seals, and pontoon compartments.

- All pump sleeves were inspected and lubricated.

- Detailed inspections were performed, including foam chamber inspections of the tanks.

In addition to external inspections, cathodic protection systems were also inspected periodically.

Underground storage tanks with corrosion protection were inspected for tank tightness every five years using the Heath Petro-tite service. Underground tanks that did not have corrosion protection were tested every two years.

10.1.2 Pipe Inspection/Testing

All aboveground pipes, valves, and supports were inspected daily during the normal course of operations. The pipelines were pressure-tested annually and protected from corrosion by periodic painting.

10.2 SPCC Plan

An October 1989 spill prevention and countermeasure control (SPCC) plan describes spill prevention measures instituted at the facility. The SPCC plan was prepared to satisfy the requirements of USEPA regulations (40 CFR Part 112) at that time and includes:

- General facility information including the type of facility, address, and number of aboveground and underground storage tanks
- A record of spill events
- Secondary containment, protection, operating procedures, and inspections of bulk storage tanks
- Intra-facility transfer operations including out-of-service lines and pipe supports
- Loading/unloading procedures for tank trucks
- Facility drainage descriptions and procedures
- Personnel training and spill prevention procedures

The SPCC Plan lists emergency response procedures and telephone numbers including those of plant supervisors, oil clean-up companies, government agencies, local agencies, and other UNOCAL personnel. The U.S. Coast Guard National Response Center number is also listed.

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[1] A list of data sources reviewed for the preparation of this report is provided in Appendix F.

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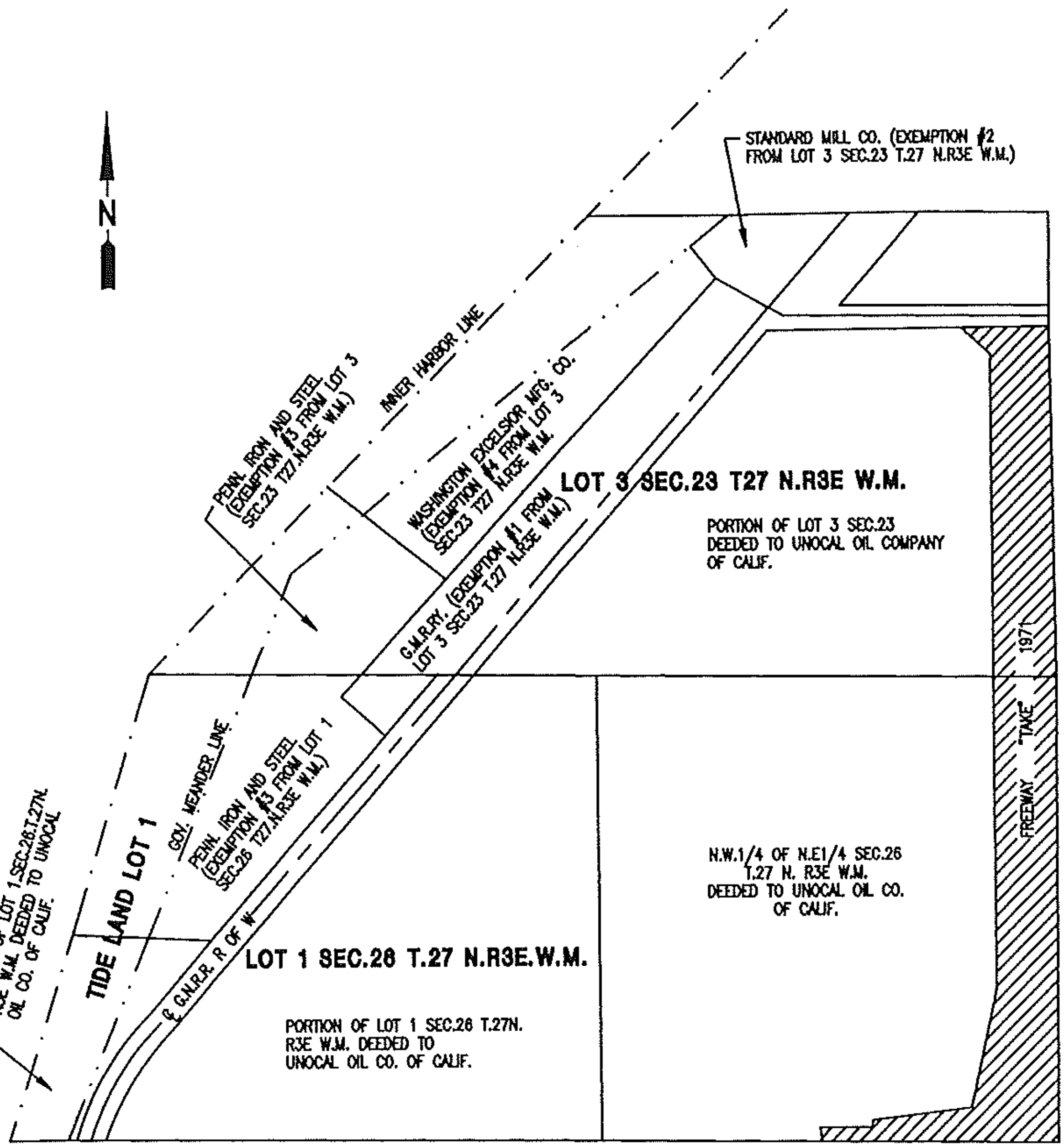
LIMITATIONS

The services described in this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, nor the use of segregated portions of this report.

APPENDIX A

PROPERTY OWNERSHIP AND LEASE HISTORY SUMMARY



Source: Snohomish County Surveyor Records,
Volume 2, Page 215. 2/17/21

EMCON Northwest, Inc.

DATE 11/93
DWN. KLM
REV.
APPR.
PROJECT NO.
0324-035.01

UNOCAL CORPORATION
EDMONDS, WASHINGTON
BULK FUEL TERMINAL
ORIGINAL PURCHASE PLOT MAP

1= 50011-11-93 0324\035\01C11

LESOURD & PATTEN, P.S.

ATTORNEYS AT LAW

MEMORANDUM

TO: Unocal Management

FROM: Lawrence E. Hard

DATE: January 11, 1993

RE: Property Ownership Records/Edmonds Terminal

INTRODUCTION

We have reviewed Unocal files maintained in our office and at the Edmonds terminal facility. We have had communications with Stewart Title Company to review property documents which have been recorded. This report is a summary of that information. We believe there may be documents solely in the possession of the Company in Los Angeles, or elsewhere, which might clarify certain aspects of property ownership such as the nature and extent of leasehold interests or other uses of the real estate. We will supplement this analysis once we are made aware of such information.

OWNERSHIP HISTORY

Unocal now owns a total of 53.5 acres of real property within the city limits of Edmonds, Washington. Originally, the Company owned approximately 125 acres which it acquired in 1920 for $30,000. The largest portion of that property is located

2400 COLUMBIA CENTER · 701 FIFTH AVENUE · SEATTLE, WASHINGTON 98104-7095
TELEPHONE: (206) 624-1040 · FACSIMILE: (206) 223-1099

south of Dayton Street and west of what is now State Route 104. A smaller portion of the original purchase is a parcel located north of Dayton Street.

For ease of reference, the title insurance company has categorized this original purchase into three areas which it refers to as "Parcels A, B and C". Parcel B is the land north of Dayton Street. Parcels A and C are uplands and tidelands property south of Dayton Street and extending out to the inner harbor line.

There is no record of any Union Oil activity on Parcel B for the period 1920 to 1944, when that parcel was sold by the Company to two individuals. There is no record of any Union Oil use of Parcel C, although that property was continguous to the railroad right-of-way to the east and Puget Sound to the west. It is possible that activities were conducted on that property for the 37 years that it was owned by the Company. This parcel was sold to the Port of Edmonds in 1957, and has since been developed as a major public marine facility with waterfront retail and commercial activities. There is reason to believe that dredge materials from Parcel C were later placed by the Port of Edmonds at the north end of Parcel A as fill material. This was done with the knowledge and consent of Union Oil.

Most of Union Oil's operations, in terms of assets employed and personnel involved, were located in the southerly portion of Parcel A where Unocal constructed and maintained a large petroleum storage facility, asphalt plant, and distribution center. Soon after the Company originally acquired the property, in 1923 it obtained an easement from the Great Northern Railway Company to construct and maintain a trestle for the supporting pipes over the railroad right-of-way. This easement was intended to allow Union Oil to link its tidelands facility and the pier with the storage tanks. That lease is still in existence, and is terminable by the railroad on 30 days' notice.

In 1957, the same year that the Company sold Parcel C to the Port, Union Oil began leasing harbor area from the State of Washington contiguous to the southern portion of Parcel A. The original leases with the State of Washington for the harbor area were renewed every ten years until 1987 when the lease was renewed for 20 years. An easement across a portion of the harbor area was granted in 1978 in favor of the Department of Transportation.

By the late 1940s, Union Oil actively conducted limited product distribution operations at the north end of Parcel A. For example, in 1948, it leased a portion of that property to General American Transportation Corporation. This facility is generally referred to as the "Dayton Street Depot". There was leasing activity in that area in the early 1960s (e.g., 1963 lease to Earl Joplin and a 1964 lease to Roy Allen. A 1963 lease to American Tar may have been in that area).

In 1978, a large portion of the northerly half of Parcel A, including the "Dayton Street Depot" area, was sold to the Port of Edmonds. The Port has since leased that land to private developers who have created a commercial office and retail complex known as "Harbor Square".

In 1981, a large parcel located between the Harbor Square project and the Unocal terminal at the southerly half of Parcel A was given to the City of Edmonds for use as a wildlife preserve and open space. That parcel is known as the "Union Oil Marsh". In 1980, as part of a comprehensive development plan for the company, and before Union Oil deeded the Union Oil Marsh to the City, the Company annexed all of its property (Parcel A) into the City of Edmonds and subdivided that land into four parcels (Parcels I, II, III and IV). The Union Oil Marsh is Parcel IV.

The remaining property, Parcels I, II and III, consists of almost five acres of tidelands (Parcel I), located west of the railroad right-of-way, and over 48 acres of uplands property (Parcels II and III). The tidelands (Parcel I) has been leased to the City of Edmonds for a substantial period of time. The earliest recorded lease was in 1982, with a modification in 1986 to expand the area being leased. There is evidence that the City had begun leasing a portion of the tidelands as early as 1969 for development as a park.

About one-third of the uplands property (Parcels II and III) is located on a plateau separated from the balance of the property by a steep bluff. This plateau is referred to as the "Upper Yard", and contains all of the aboveground storage tanks. The rest of the property, located at the foot of the bluff, is known as the "Lower Yard".

The Upper and Lower Yards constitute the property now generally known as the Edmonds terminal. In 1971, a strip along the eastern edge of the property was condemned by the State of

Washington for construction of State Route 104, a major arterial which also serves as the main access to the ferry terminal located in downtown Edmonds. As a result of this highway project, a large storm sewer crosses the Lower Yard, documented in an easement recorded in 1971.

In the early 1980s, there were easements granted to the City of Edmonds for water lines intended to more adequately service the public marina and other facilities along the Edmonds waterfront. In 1984, in a widely-publicized gesture of goodwill, Unocal leased a small portion of the Lower Yard, near the entrance to the terminal, to a nonprofit organization for development and use as a salmon hatchery. The lease is for 20 years, with two ten-year options to renew, although it may be terminated by Unocal with one-year's written notice. A little later (1985) an easement across a portion of the Lower Yard was granted to provide electrical power to the hatchery.

LEH:ja

APPENDIX B

AERIAL PHOTOGRAPHS

Table B-1

Aerial Photographs Obtained and Reviewed

Date	Scale		Description
1947	1"=200'	General Area:	Asphalt plant not yet constructed
		Lake Form:	Kidney shaped; not fully developed
		Surface Water:	None
		Vegetation:	Trees surrounding "lake"; short grasses in dry areas
6/9/55	1"=200'	General Area:	Two small buildings are located south of the lake. Eight above-ground refinery tanks, associated piping and an oil/water separator are located north of the lake.
		Lake Form:	L-shaped
		Surface Water:	Water occupies an estimated 20-foot-wide channel along the northern, western, and eastern margins of the dike enclosure. The central portion of the lake is dry. A creek channel surrounds the outer dike perimeter.
		Vegetation:	Short grasses in dry areas.
6/29/65	1"=1,670'	General Area:	Large building adjacent to and south of lake; additional storage tank added in eastern portion of upper yard; southern portion of boat harbor constructed.
		Lake Form:	Unchanged
		Surface Water:	Unchanged
		Vegetation:	Short grasses in dry areas.
1967	1"=1,670'	General Area:	Unchanged
		Lake Form:	Unchanged
		Surface Water:	Essentially unchanged; there is no water along the lake's southern margins.
		Vegetation:	Unchanged

Table B-1

Aerial Photographs Obtained and Reviewed

Date	Scale		Description
6/16/69	1"=1,670'	General Area:	Northern end of boat harbor in place; development at Dayton Street Depot at northend of property.
		Lake Form:	Unchanged
		Surface Water:	Water from marsh flowing to and around lake to tidal basin outlet.
		Vegetation:	Unchanged
2/26/70	1"=200'	General Area:	Unchanged
		Lake Form:	An earth dike has been constructed that cuts off the southwest end of the lake to form a slops pond.
		Surface Water:	The slops pond is full of water. Lake McGuire is nearly full of water.
		Vegetation:	Locally dense with short grasses and shrubs in dry area.
8/30/72	1"=1,670'	General Area:	State Route 104 under construction.
		Lake Form:	Unchanged
		Surface Water:	The slops pond is full of water. Water occupies an estimated 20-foot-wide channel along the lake's western, northern, and eastern margins.
		Vegetation:	Unchanged
7/13/73	1"=400'	General Area:	SR 104 complete.
		Lake Form:	Unchanged
		Surface Water:	Unchanged
		Vegetation:	Unchanged

Table B-1

Aerial Photographs Obtained and Reviewed

Date	Scale		Description
6/11/74	1"=1,670'	General Area:	There is evidence of construction south of the lake. Trucks are in the process of filling the slops pond. The earth dikes that form Lake McGuire have been graded at their crests to allow trucks to drive along them.
		Lake Form:	Unchanged
		Surface Water:	Lake McGuire is full of water.
		Vegetation:	None visible
4/2/76	1"=1,670'	General Area:	The slops pond has been filled and graded. A narrow skimmer pond has been constructed parallel to the southern side of Lake McGuire.
		Lake Form:	Unchanged
		Surface Water:	Water occupies a 10- to 15-foot-wide channel on all sides except the southern margin of the lake. Water fills the skimmer pond.
		Vegetation:	Short grasses in dry areas.
7/13/77	1"=400'	General Area:	Building in south end of lower yard next to pipeline trestle is gone.
		Lake Form:	Unchanged
		Surface Water:	Unchanged
		Vegetation:	Unchanged
5/20/78	1"=1,670'	General Area:	Unchanged
		Lake Form:	Unchanged
		Surface Water:	Very little water in lake.
		Vegetation:	Unchanged

Table B-1

Aerial Photographs Obtained and Reviewed

Date	Scale		Description
7/19/79	1"=1,670'	General Area:	Unchanged
		Lake Form:	Unchanged, local areas if white sand can be seen along the southern margin.
		Surface Water:	Unchanged
		Vegetation:	Dry lake bed is partially vegetated with short grasses. Trees are scattered along the tops of the northern dikes.
8/25/80	1"=200'	General Area:	Most refinery structures, pipes and tanks have been removed, a graded parking lot remains.
		Lake Form:	Unchanged
		Surface Water:	Unchanged
		Vegetation:	Unchanged
2/27/81	1"=400'	General Area:	Unchanged
		Lake Form:	Unchanged
		Surface Water:	Unchanged
		Vegetation:	Unchanged
6/16/82	1"=1,670'	General Area:	Unchanged
		Lake Form:	Unchanged
		Surface Water:	Unchanged
		Vegetation:	Local areas of dense brush.
7/30/83	1"=400'	General Area:	Harbor Square development at Dayton Street Depot (4 buildings); the roofing asphalt storage building has been demolished, a graded lot remains; asphalt plant footprint gone;
		Lake Form:	Unchanged
		Surface Water:	Unchanged
		Vegetation:	Unchanged

Table B-1

Aerial Photographs Obtained and Reviewed

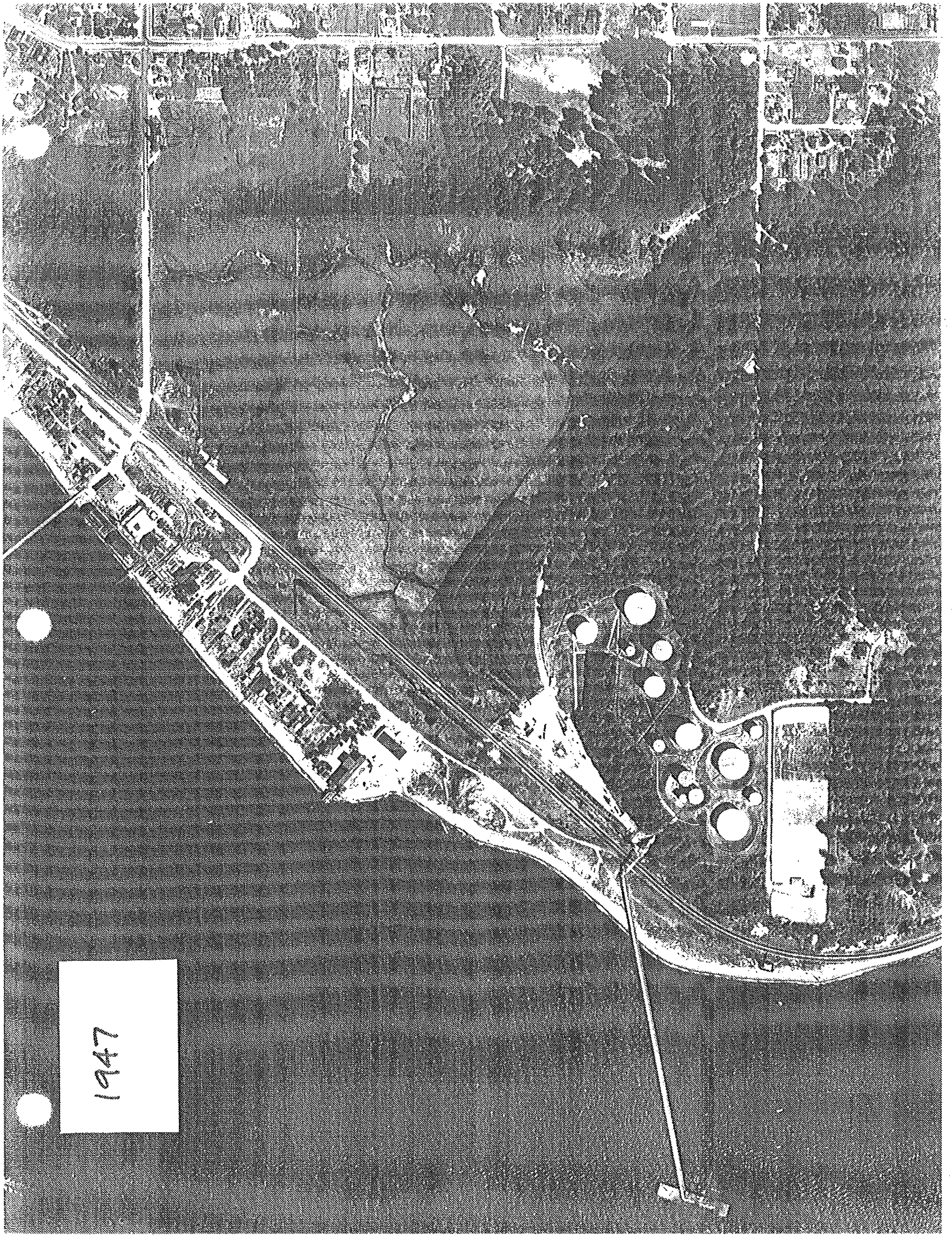
Date	Scale		Description
7/8/84	1"=400'	General Area:	Seven buildings at Harbor Square; two new buildings in middle of lower yard near truck loading rack.
		Lake Form:	Unchanged
		Surface Water:	Unchanged
		Vegetation:	Unchanged
6/28/85	1"=1,670'	General Area:	Harbor Square complete; "developed" marsh area south and adjacent to Harbor Square.
		Lake Form:	Unchanged
		Surface Water:	Unchanged
		Vegetation:	Trees and locally dense brush are along the top of the western, northern, and eastern dikes.
6/10/86	1"=400'	General Area:	Unchanged
		Lake Form:	Unchanged
		Surface Water:	Unchanged
		Vegetation:	Unchanged
6/19/87	1"=1,670'	General Area:	Unchanged
		Lake Form:	Unchanged; dark areas on the dry lake bed along the southwestern margin are tar.
		Surface Water:	Unchanged
		Vegetation:	Locally dense
7/16/88	1"=400'	General Area:	Unchanged
		Lake Form:	Unchanged
		Surface Water:	Unchanged
		Vegetation:	Unchanged

Table B-1

Aerial Photographs Obtained and Reviewed

Date	Scale		Description
7/23/89	1"=400'	General Area:	Tanks adjacent to old asphalt plant removed.
		Lake Form:	Unchanged
		Surface Water:	Unchanged
		Vegetation:	Unchanged
9/21/90	1"=400'	General Area:	Area adjacent to and south of lake appears to be tilled.
		Lake Form:	Unchanged
		Surface Water:	Unchanged
		Vegetation:	Locally dense with short grasses and shrubs in dry areas.
7/2/91	1"=1,670'	General Area:	Unchanged
		Lake Form:	Unchanged
		Surface Water:	Unchanged
		Vegetation:	Unchanged
8/10/92	1"=400'	General Area:	Unchanged
		Lake Form:	Unchanged
		Surface Water:	Unchanged
		Vegetation:	Short grasses in area next to lake tilled in 1990.

NOTE: Portions of this table have been excerpted from GeoEngineers (1988b)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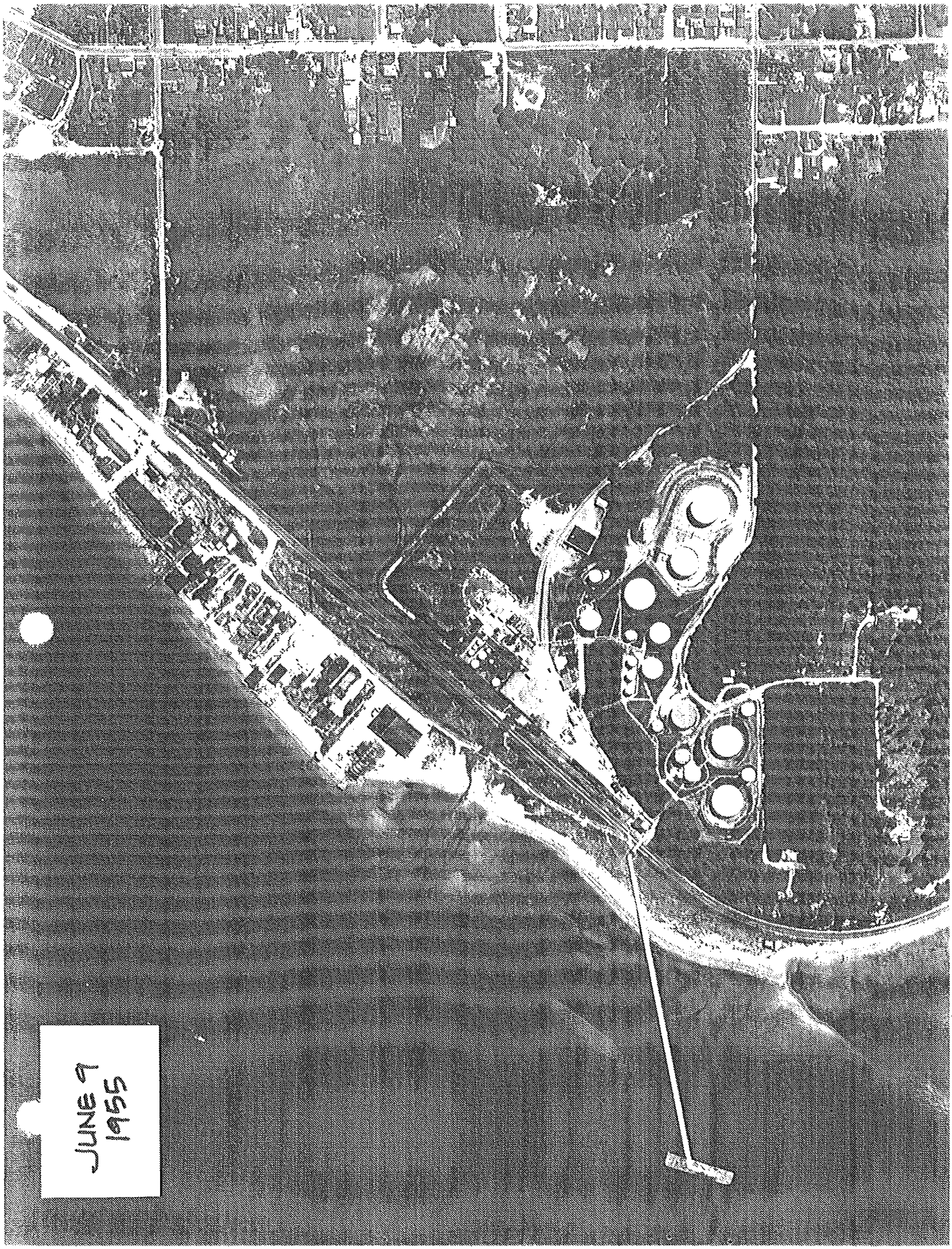
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6-29-65
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1965


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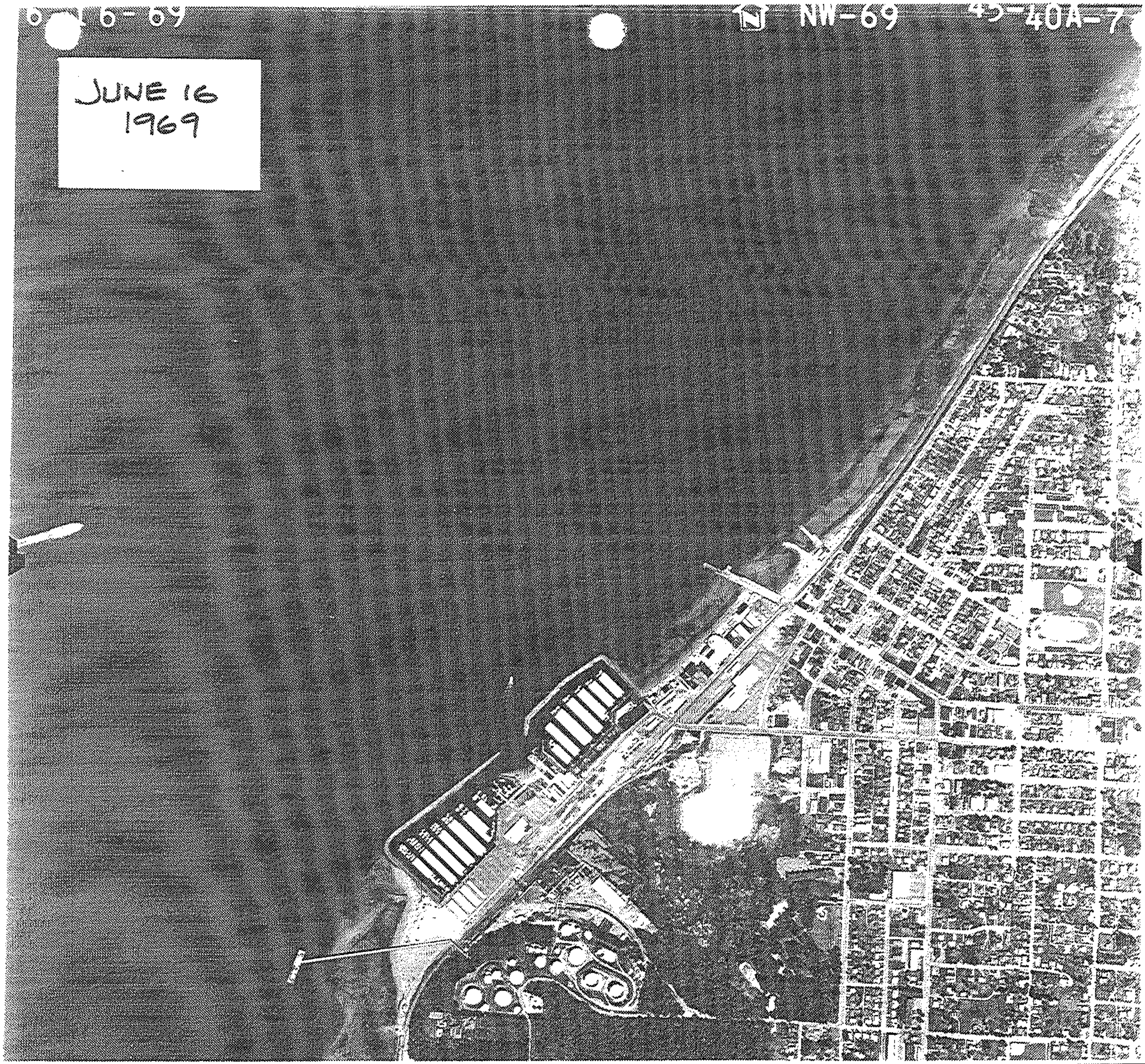
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45-40A-7
JUNE 16
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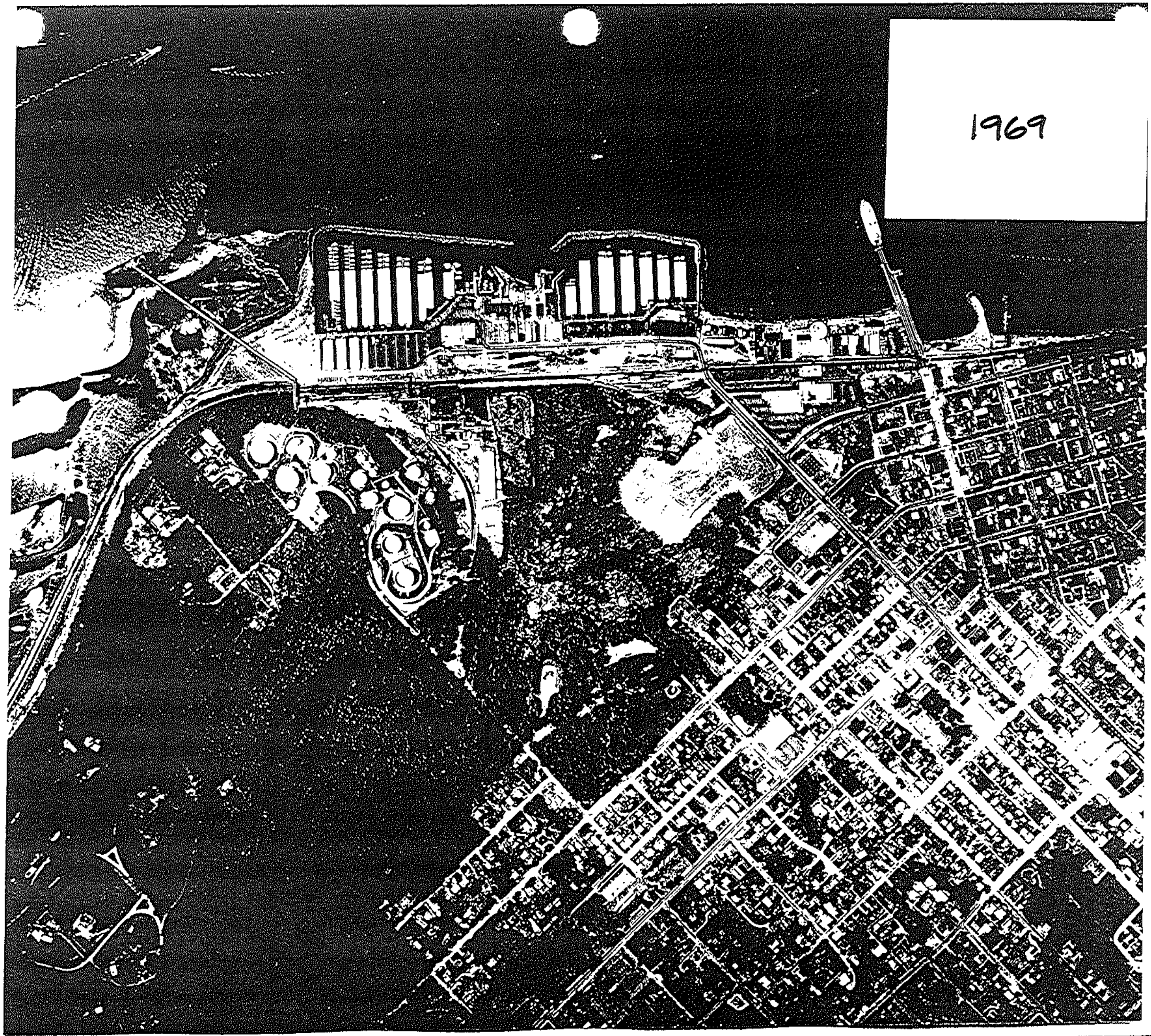
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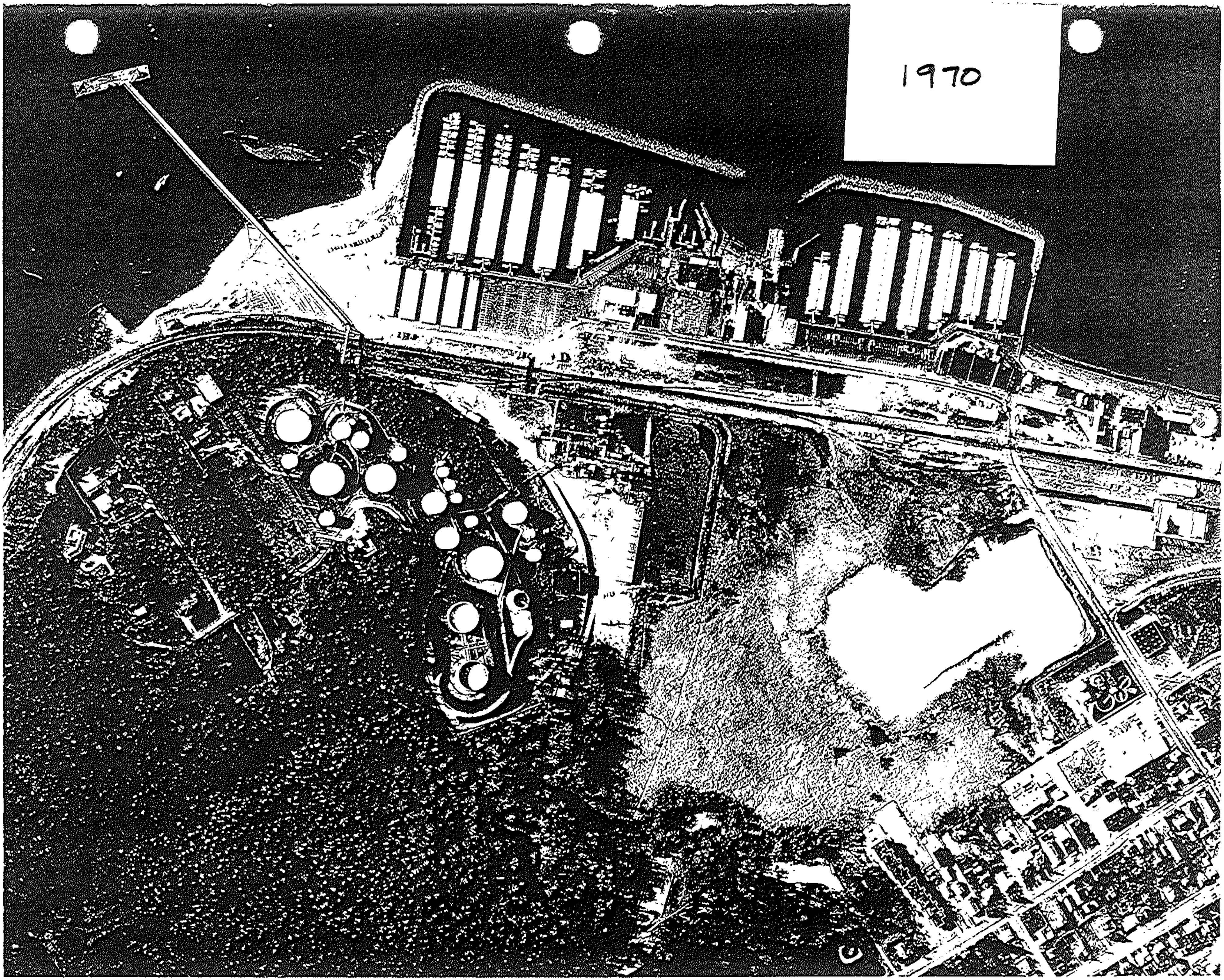
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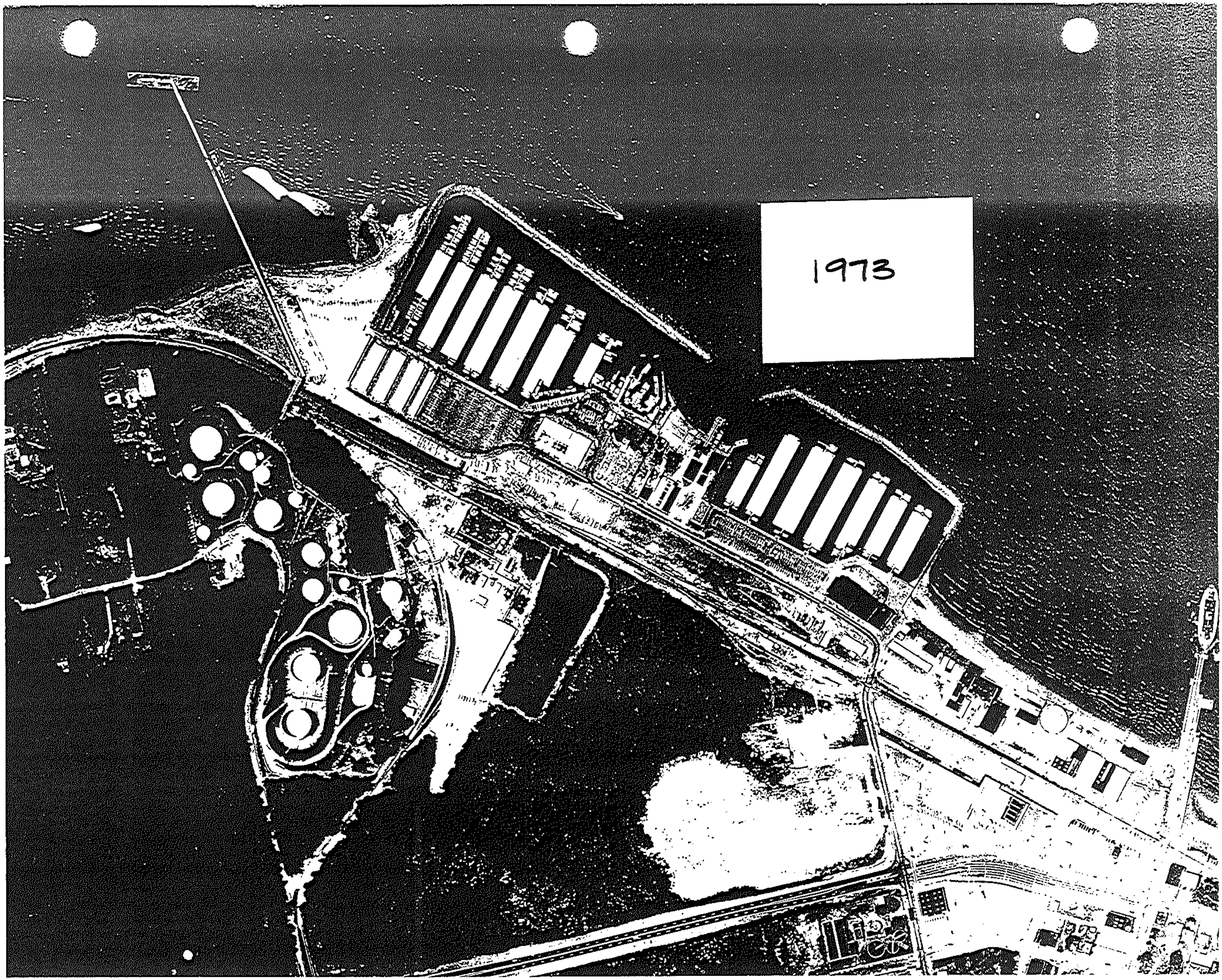
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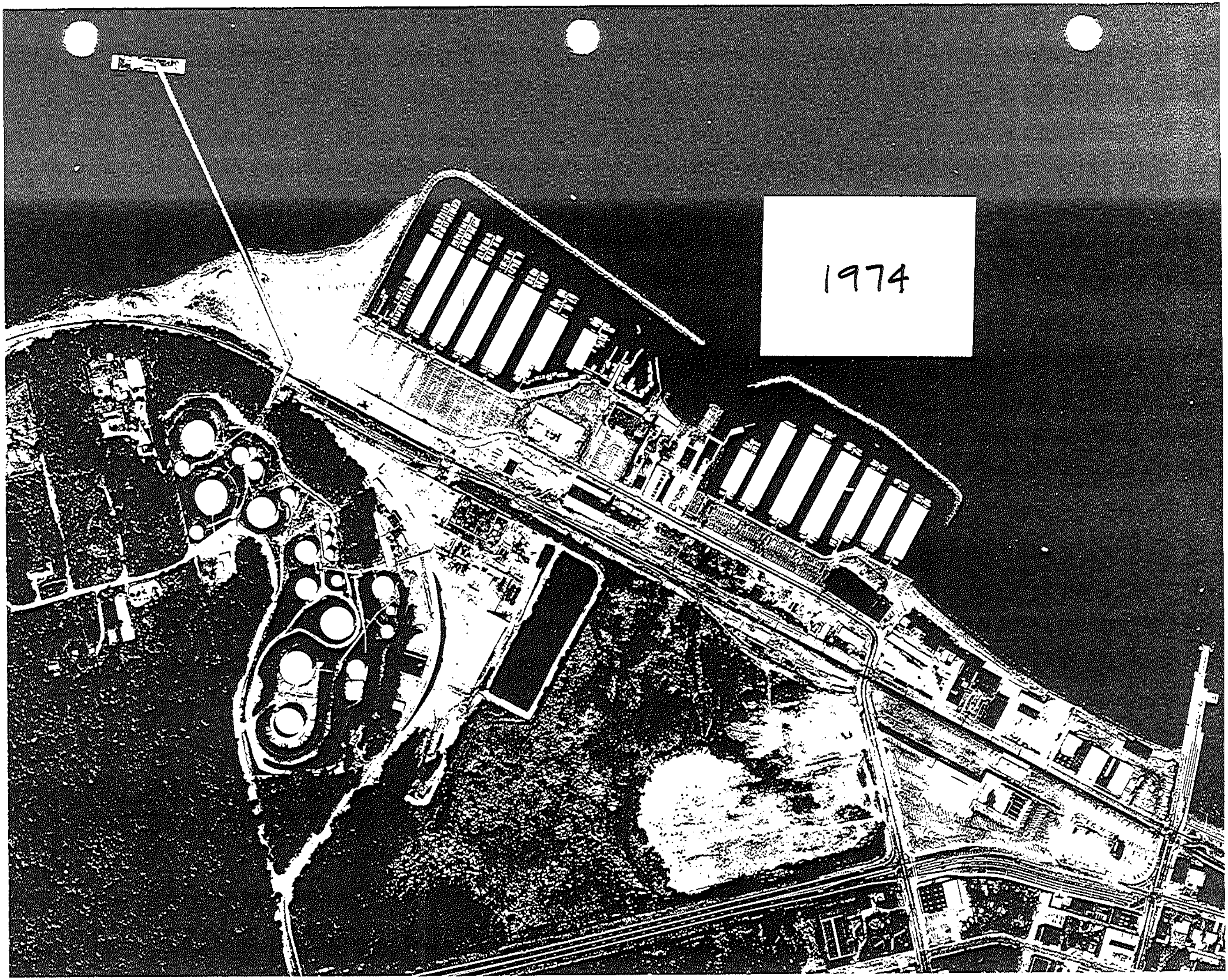
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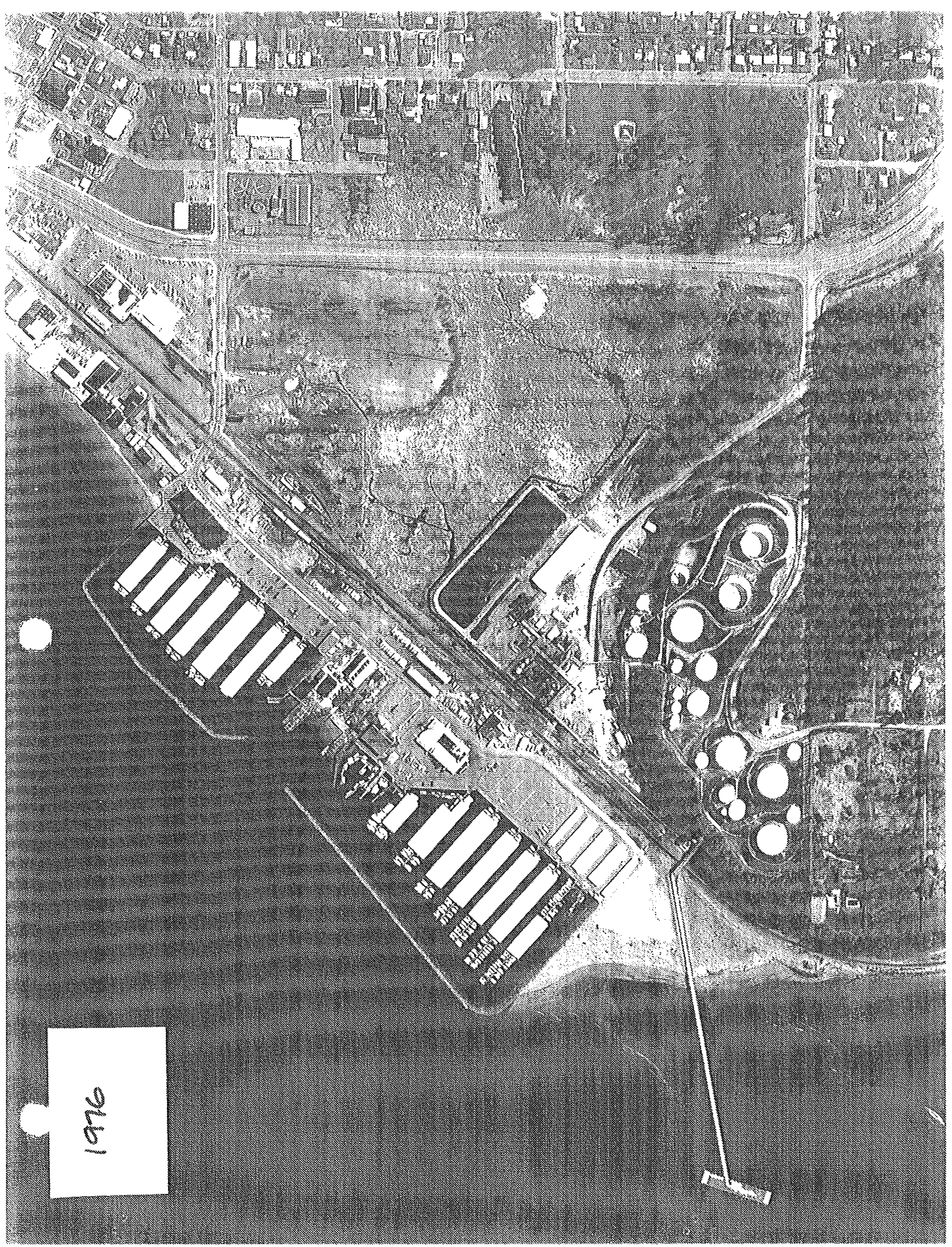
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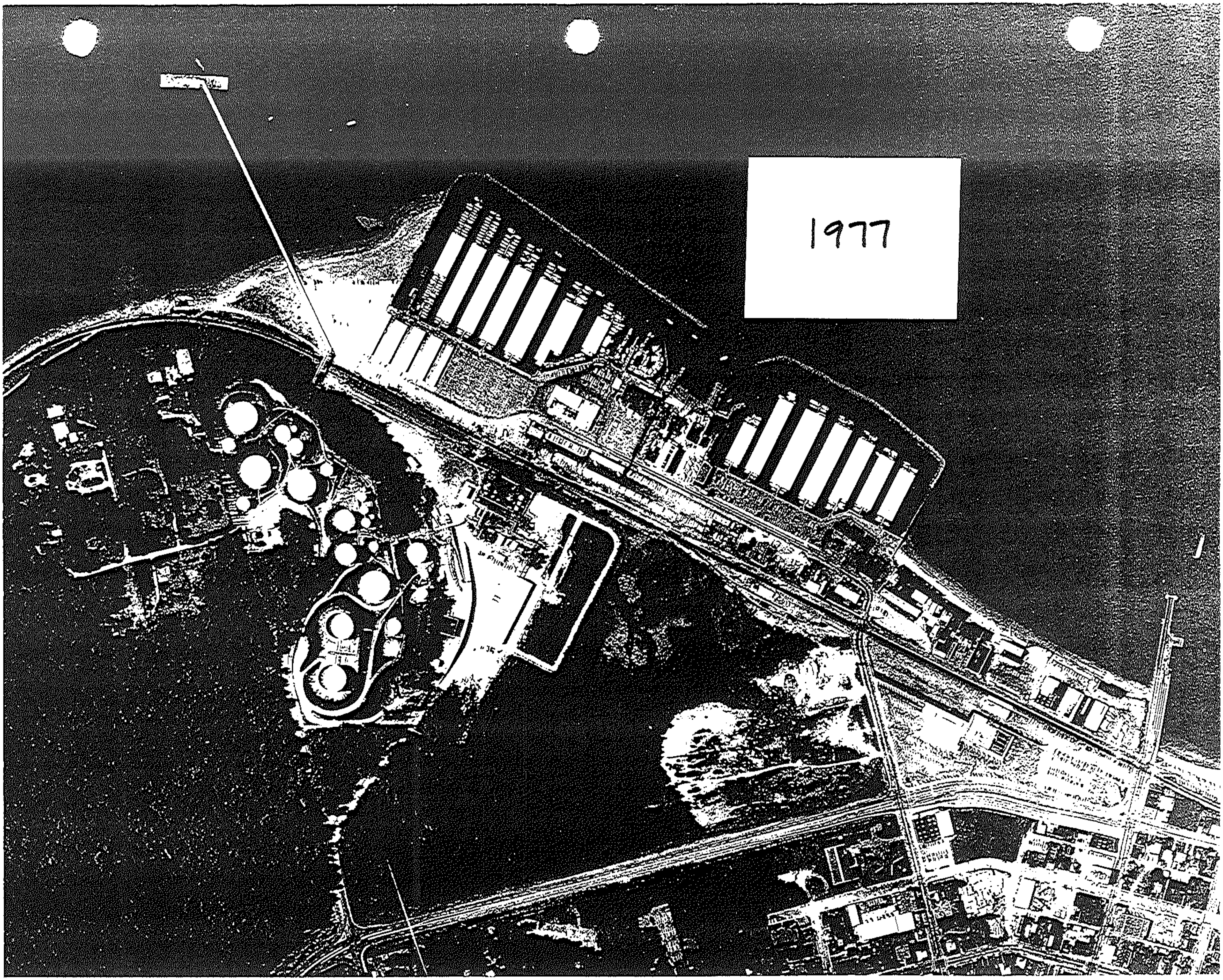
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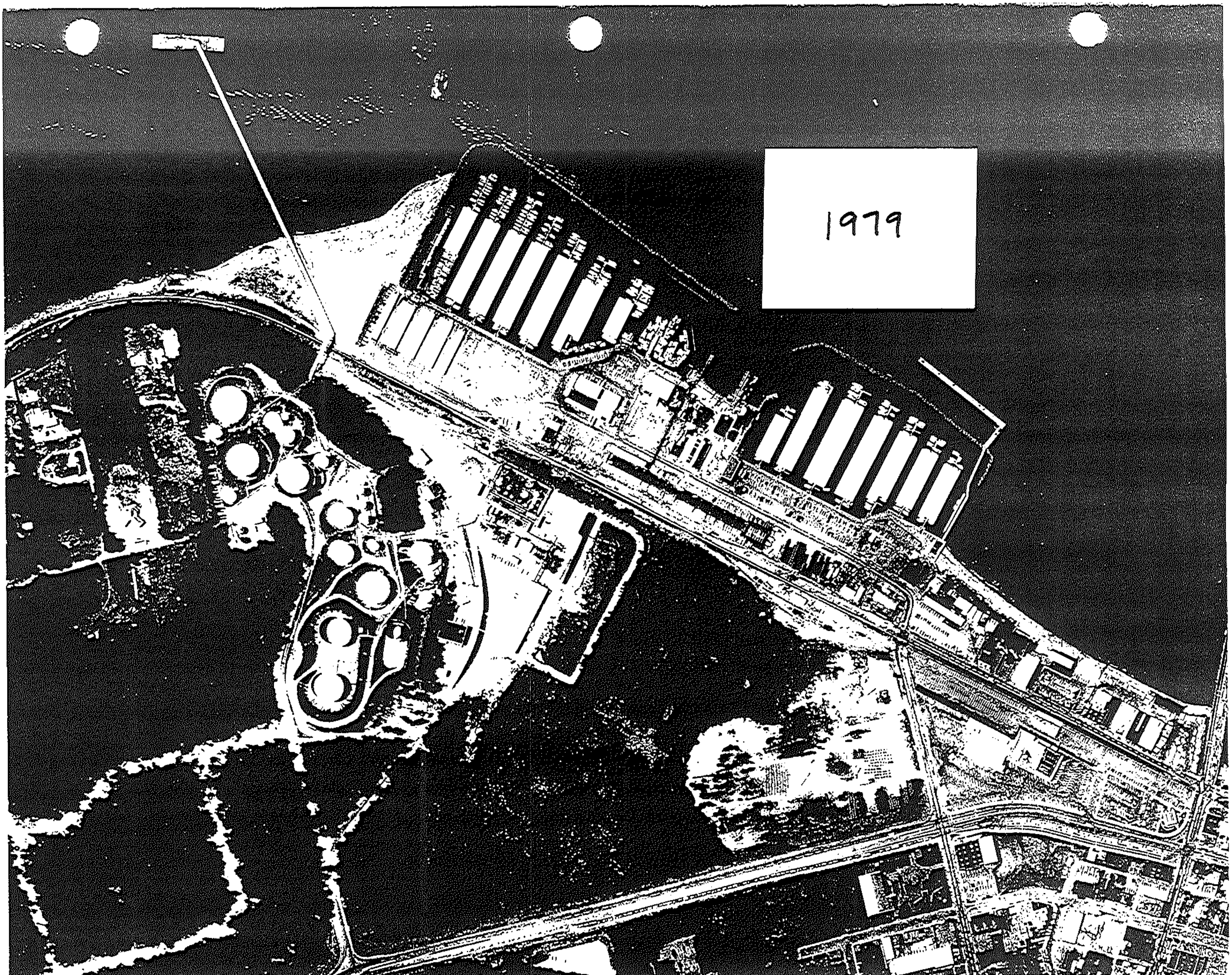
NW
5-20-78
MAY 20
1978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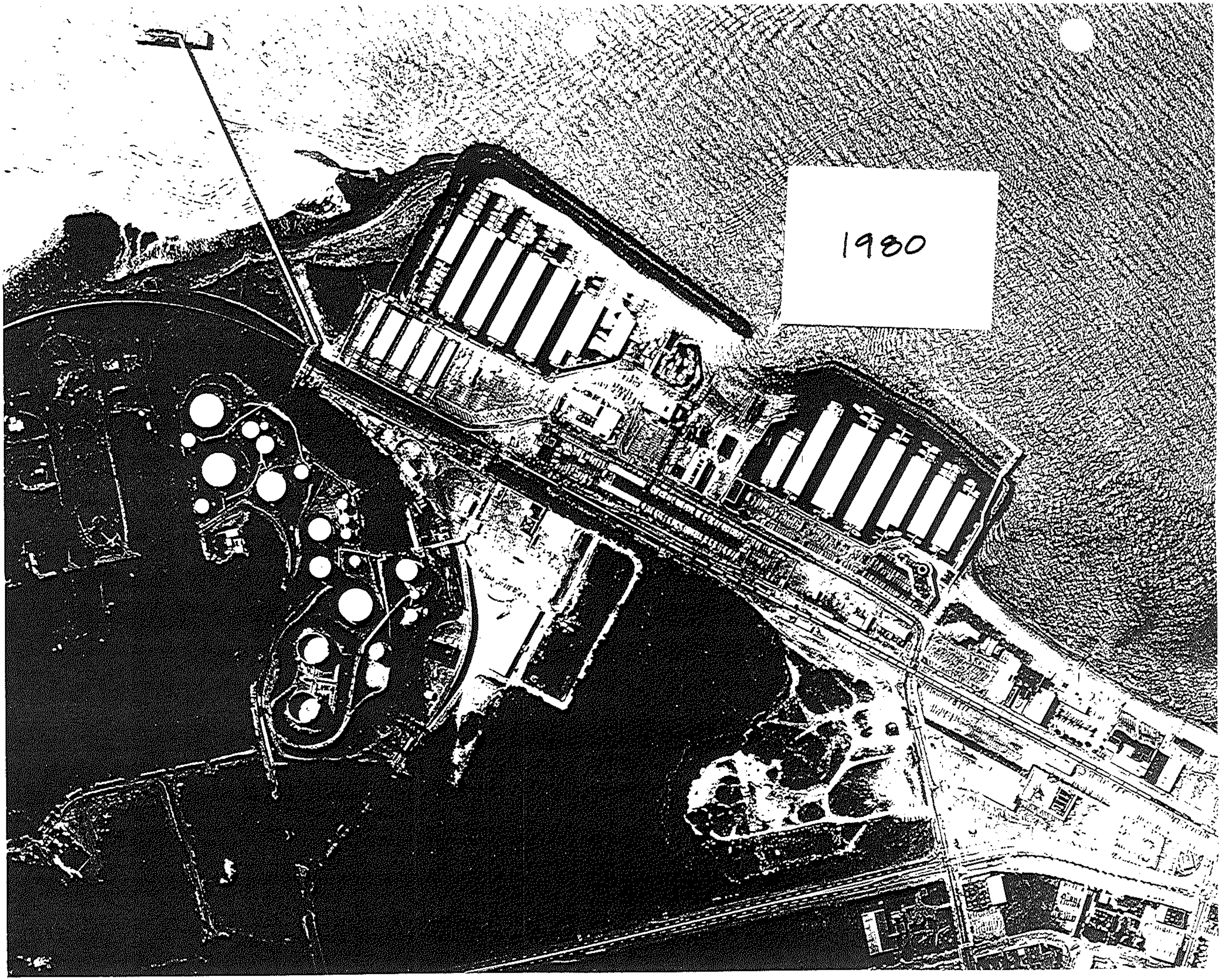
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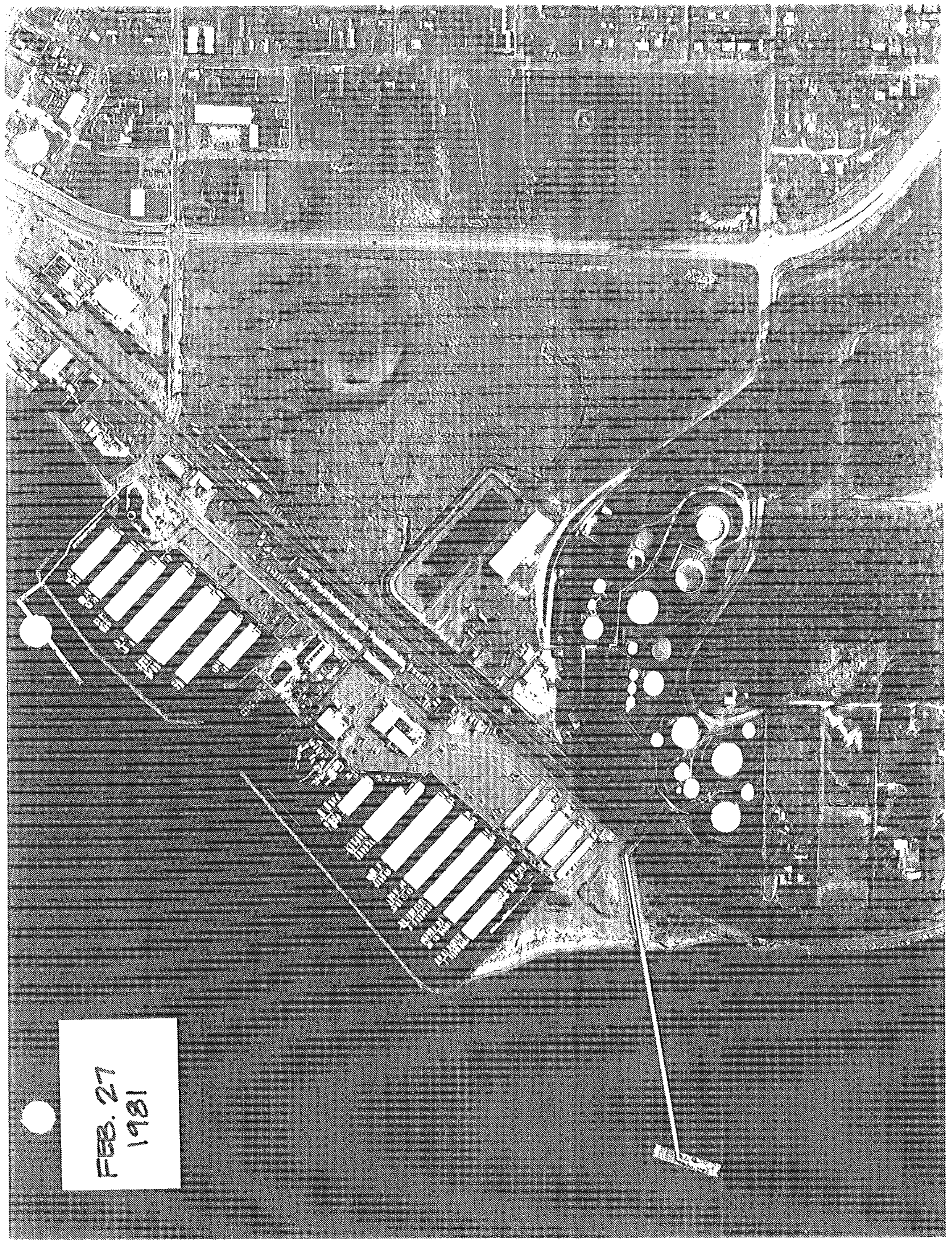
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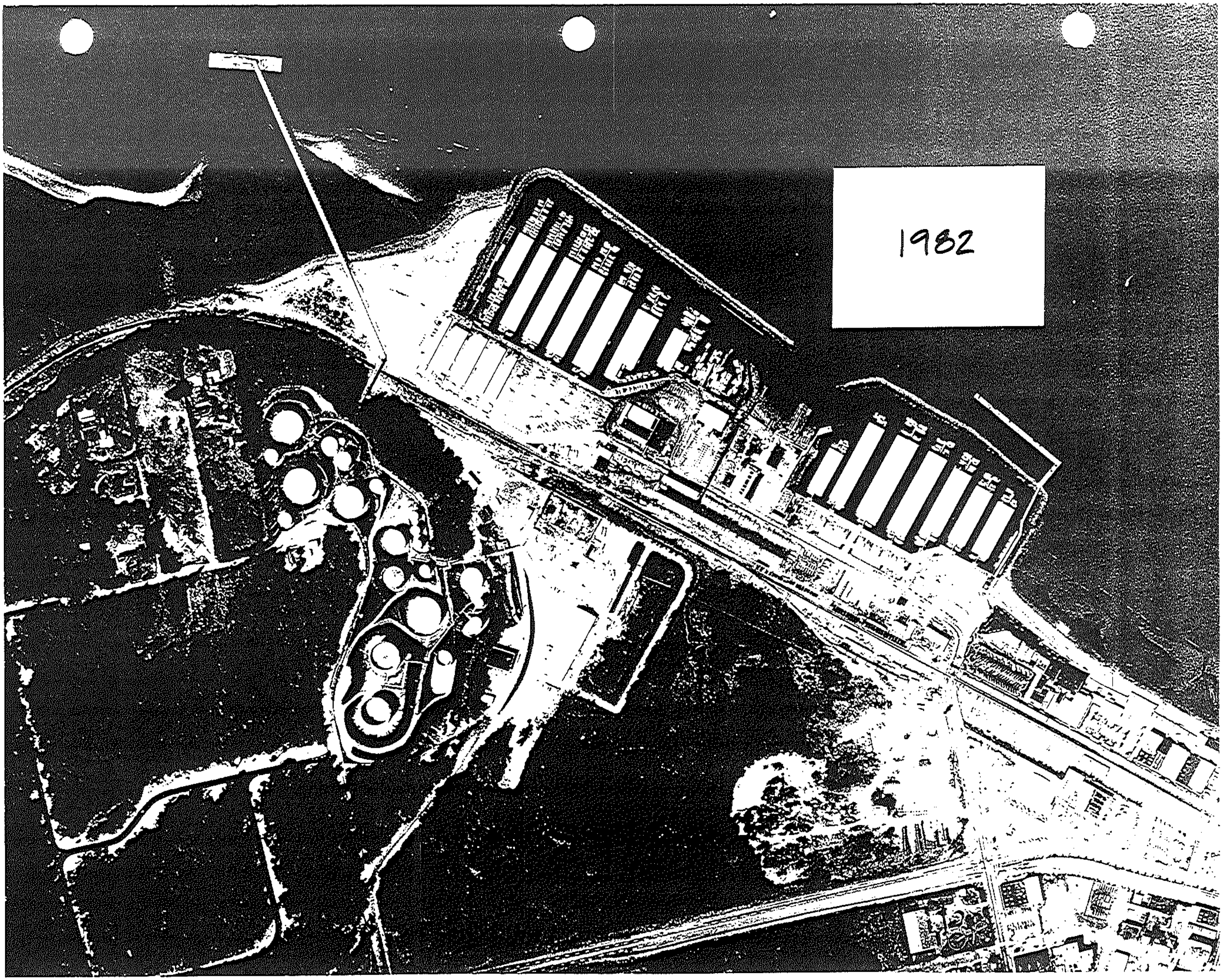
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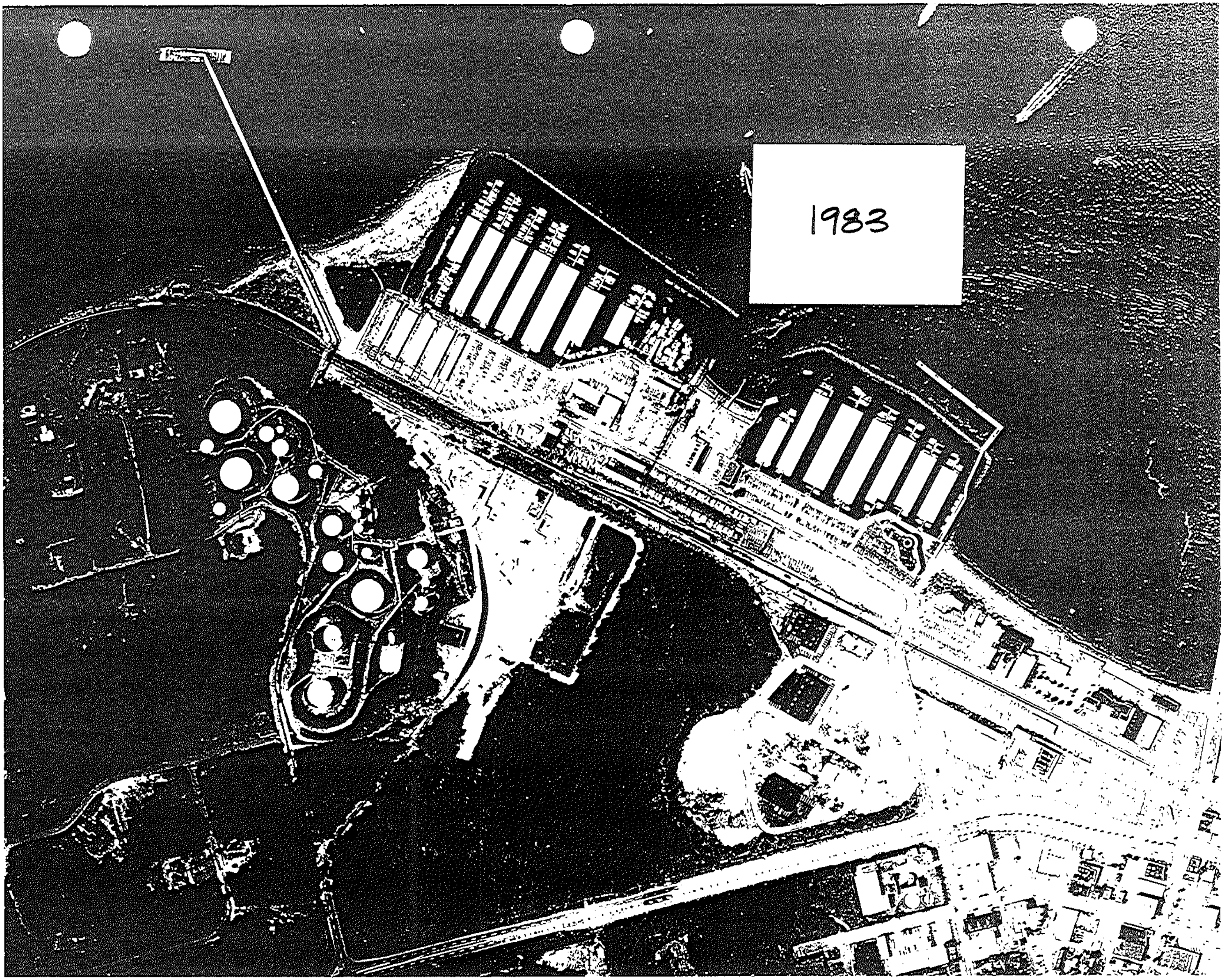
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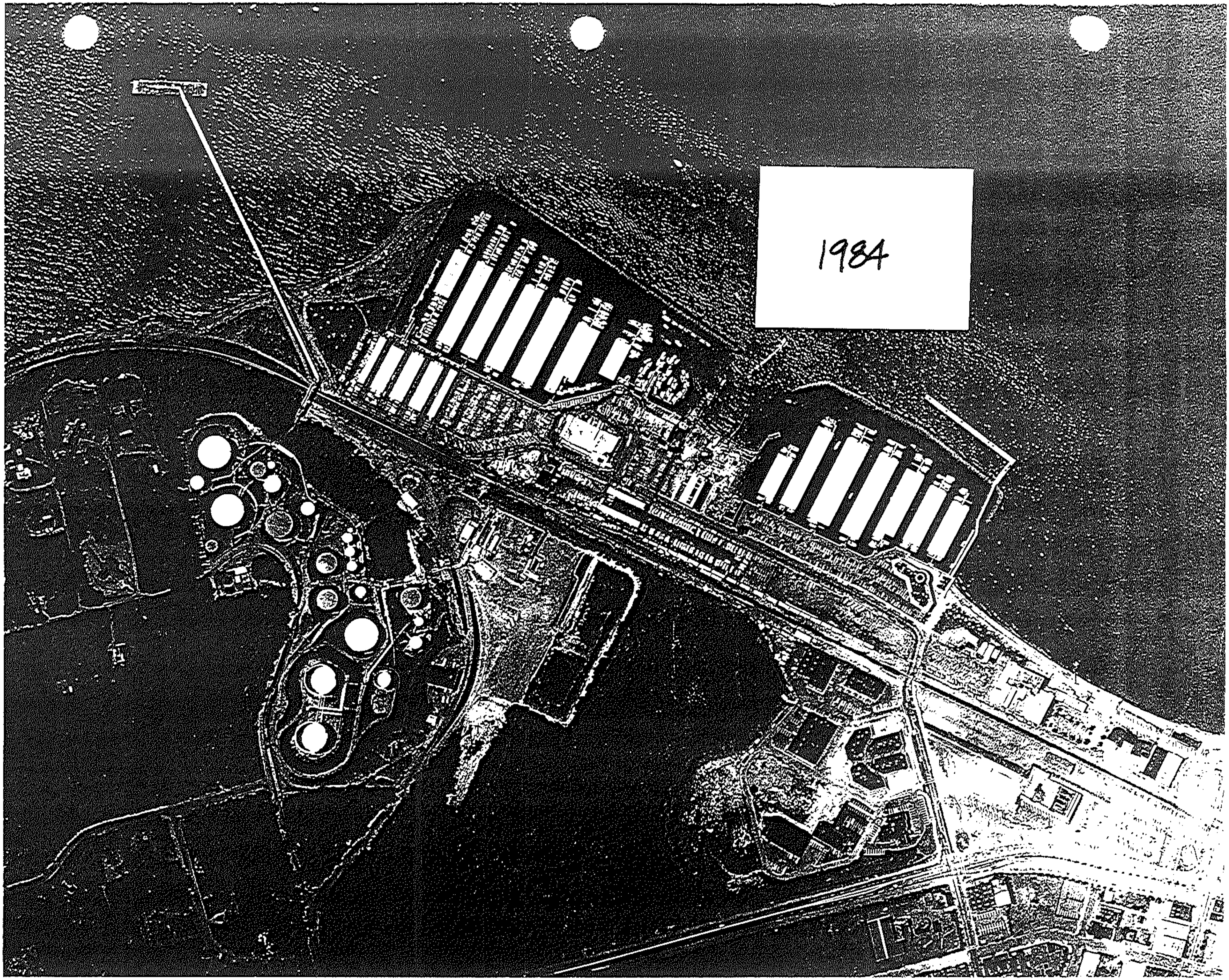
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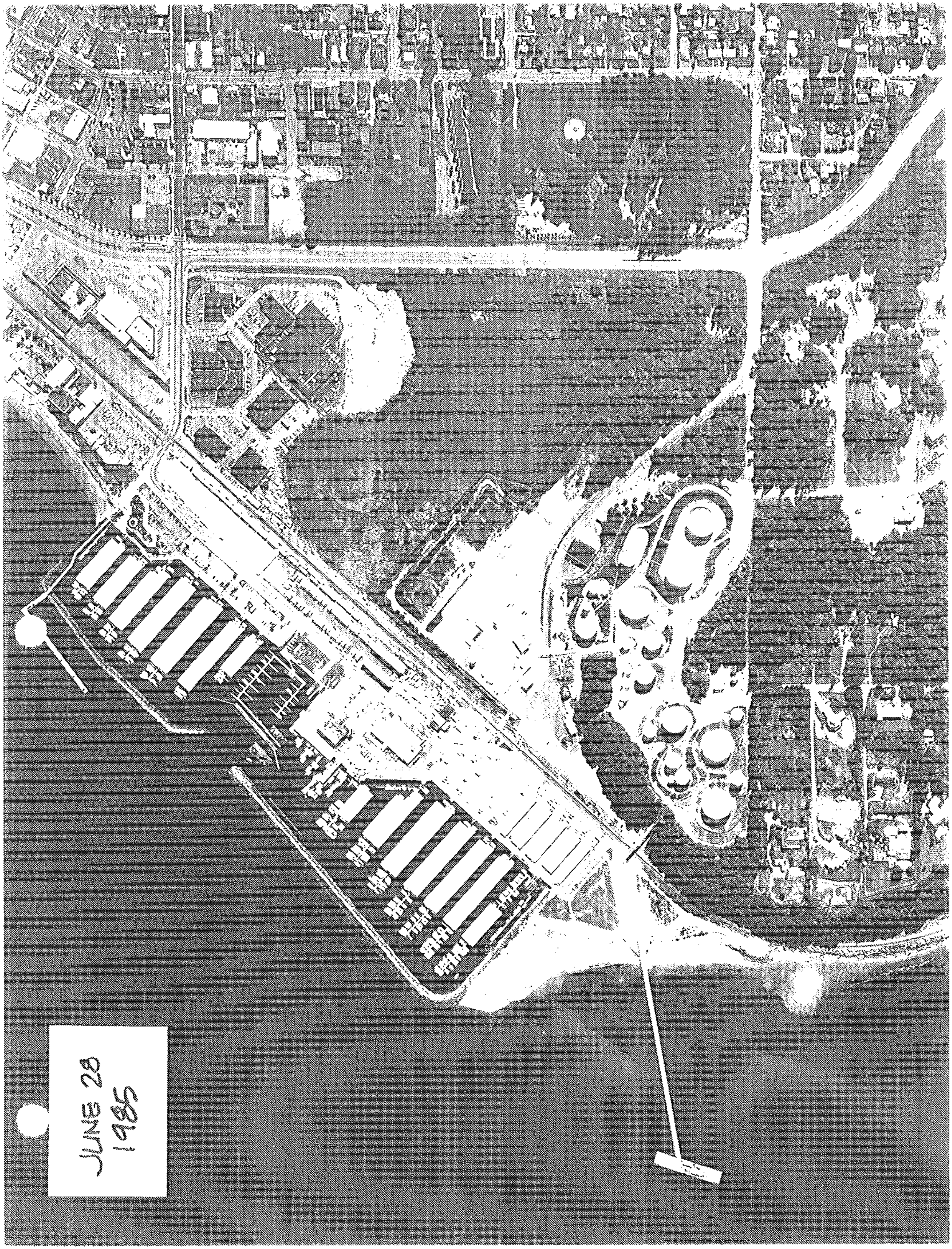
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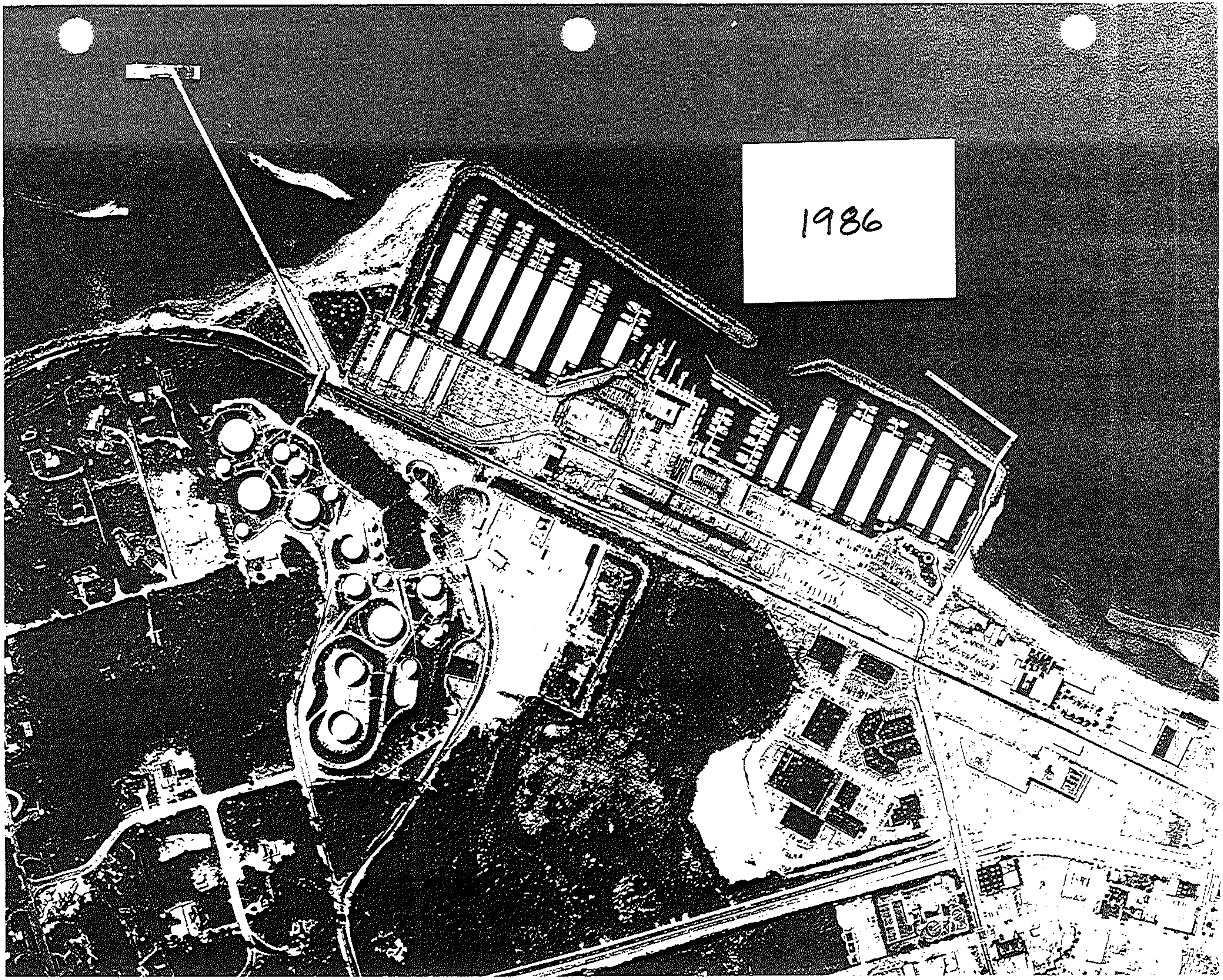
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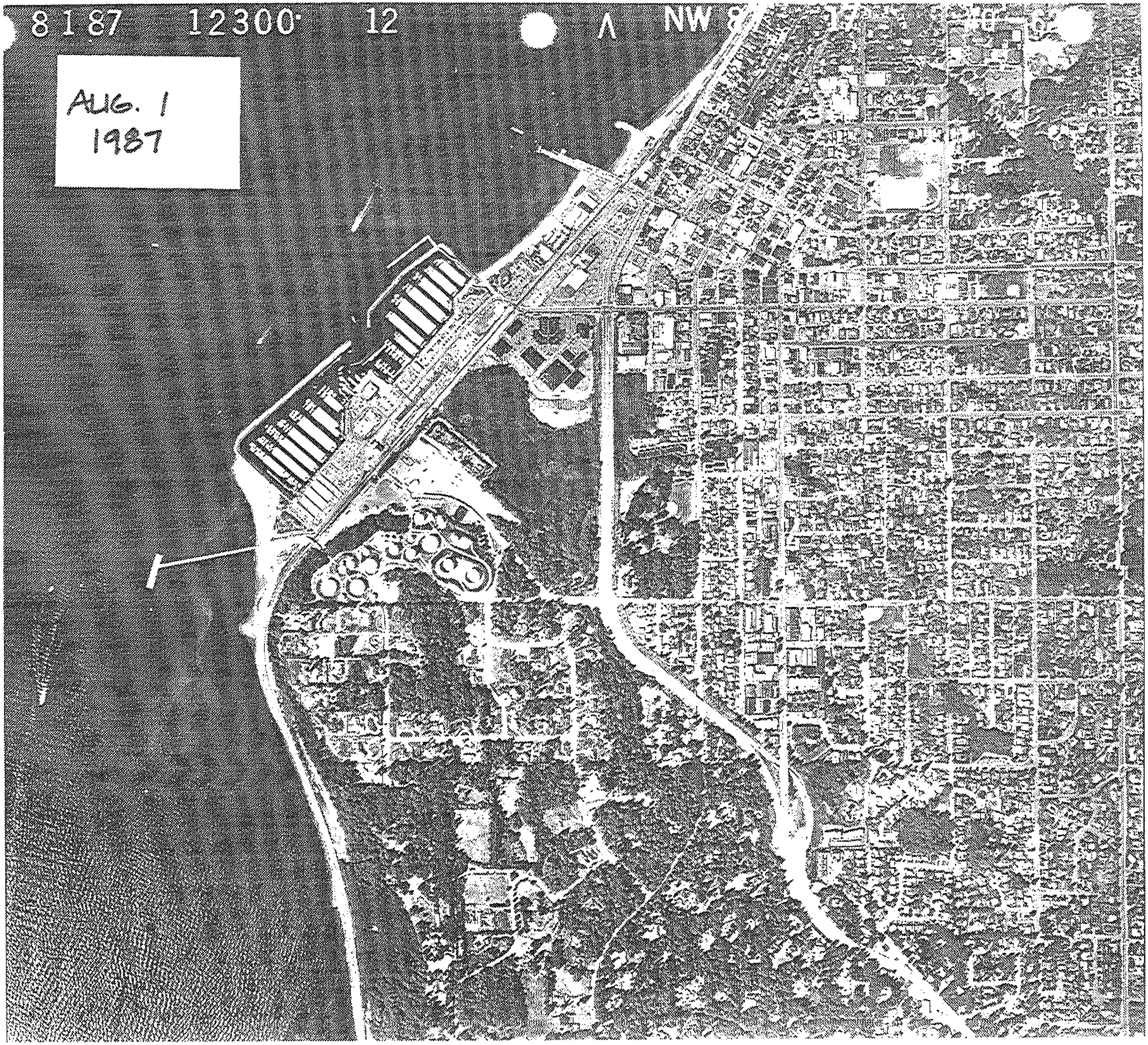
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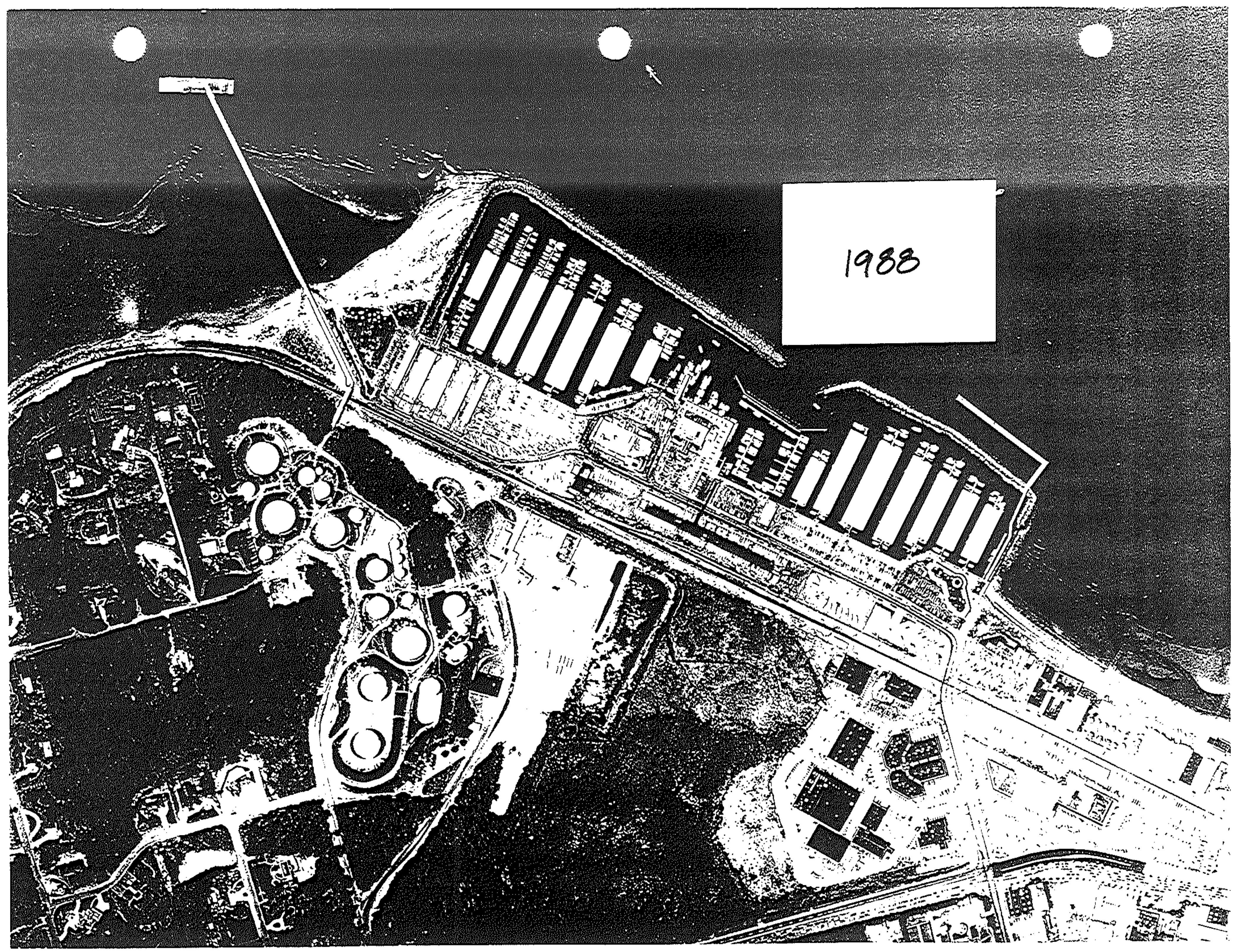
NW
AUG. 1
1987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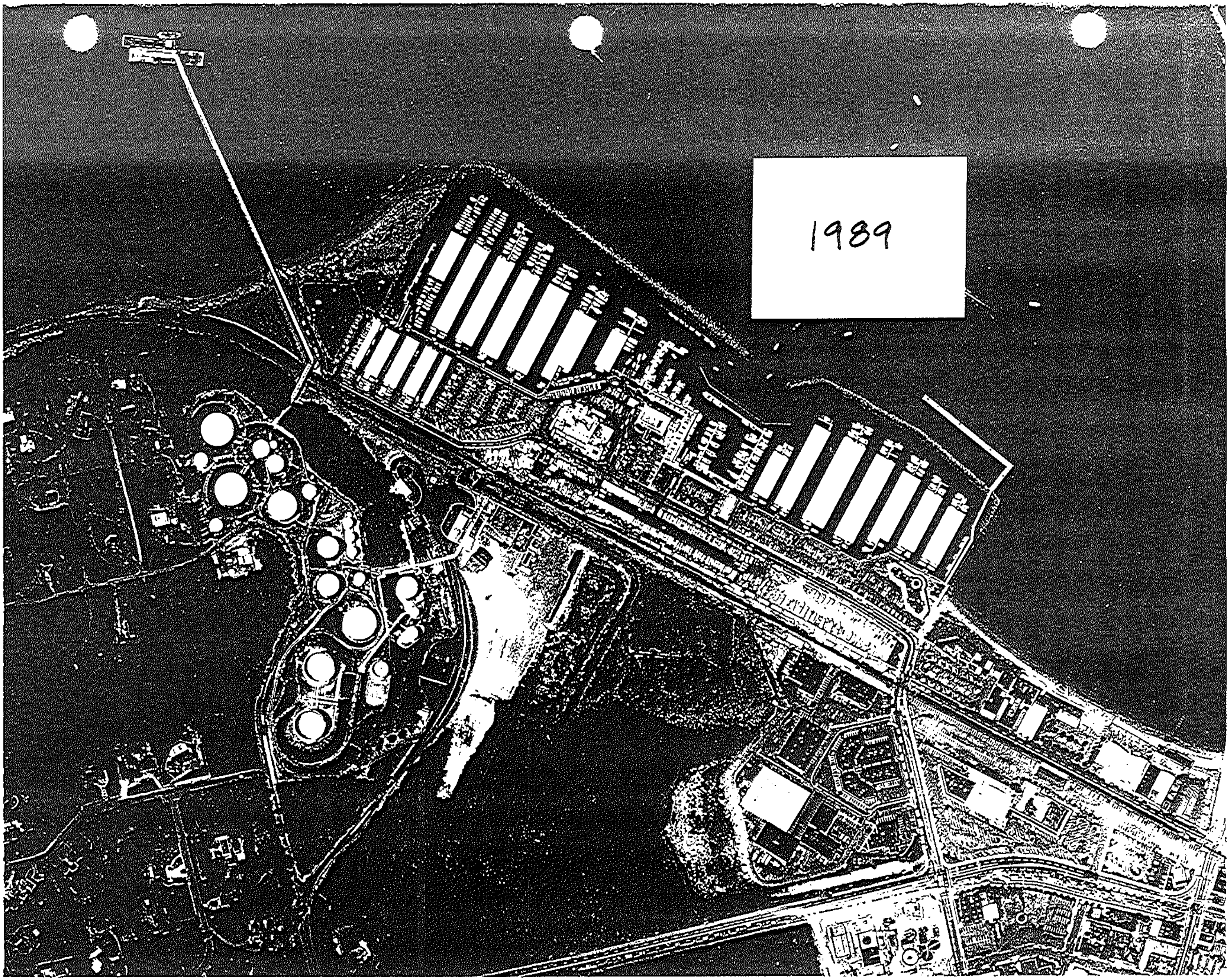
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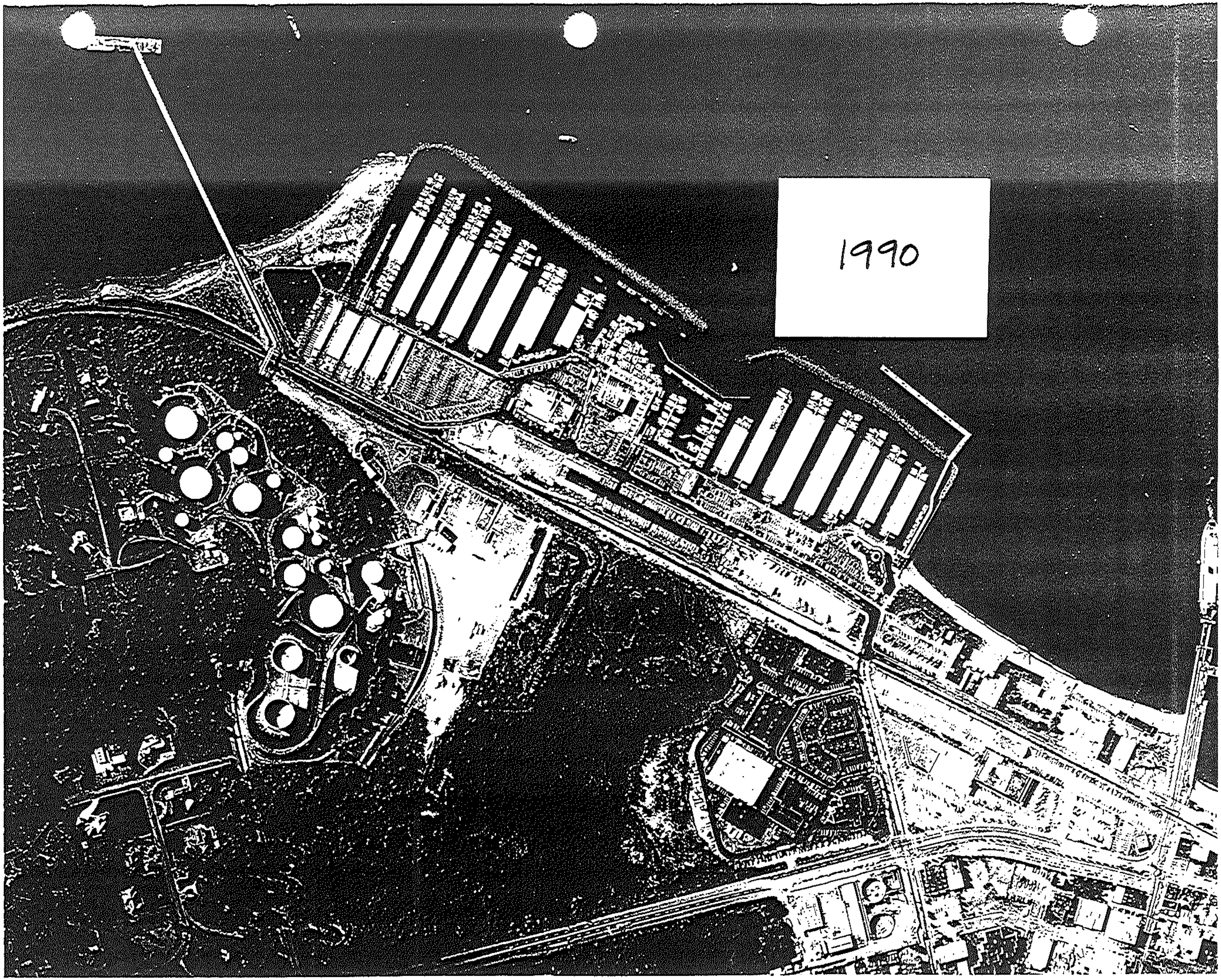
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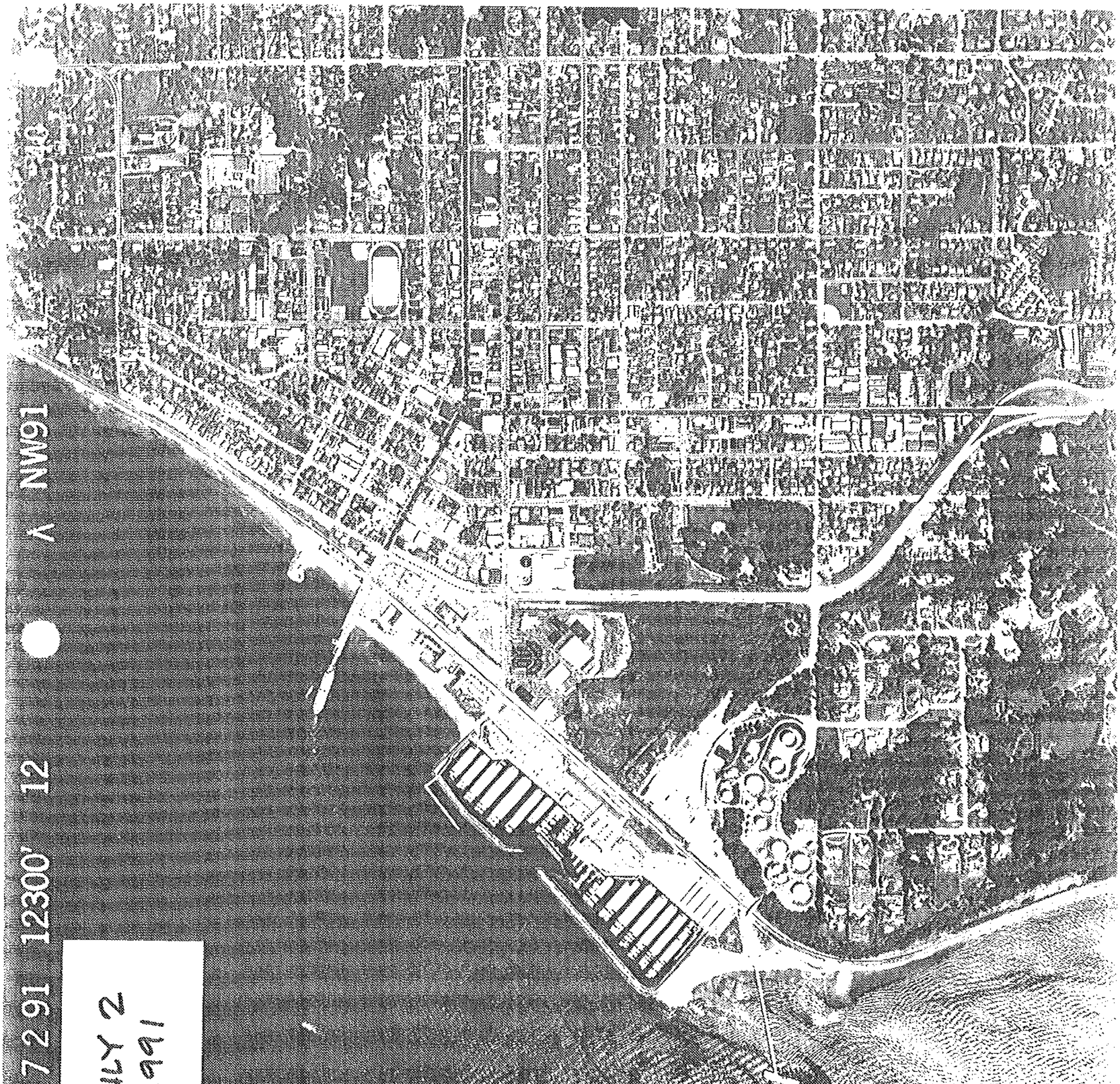
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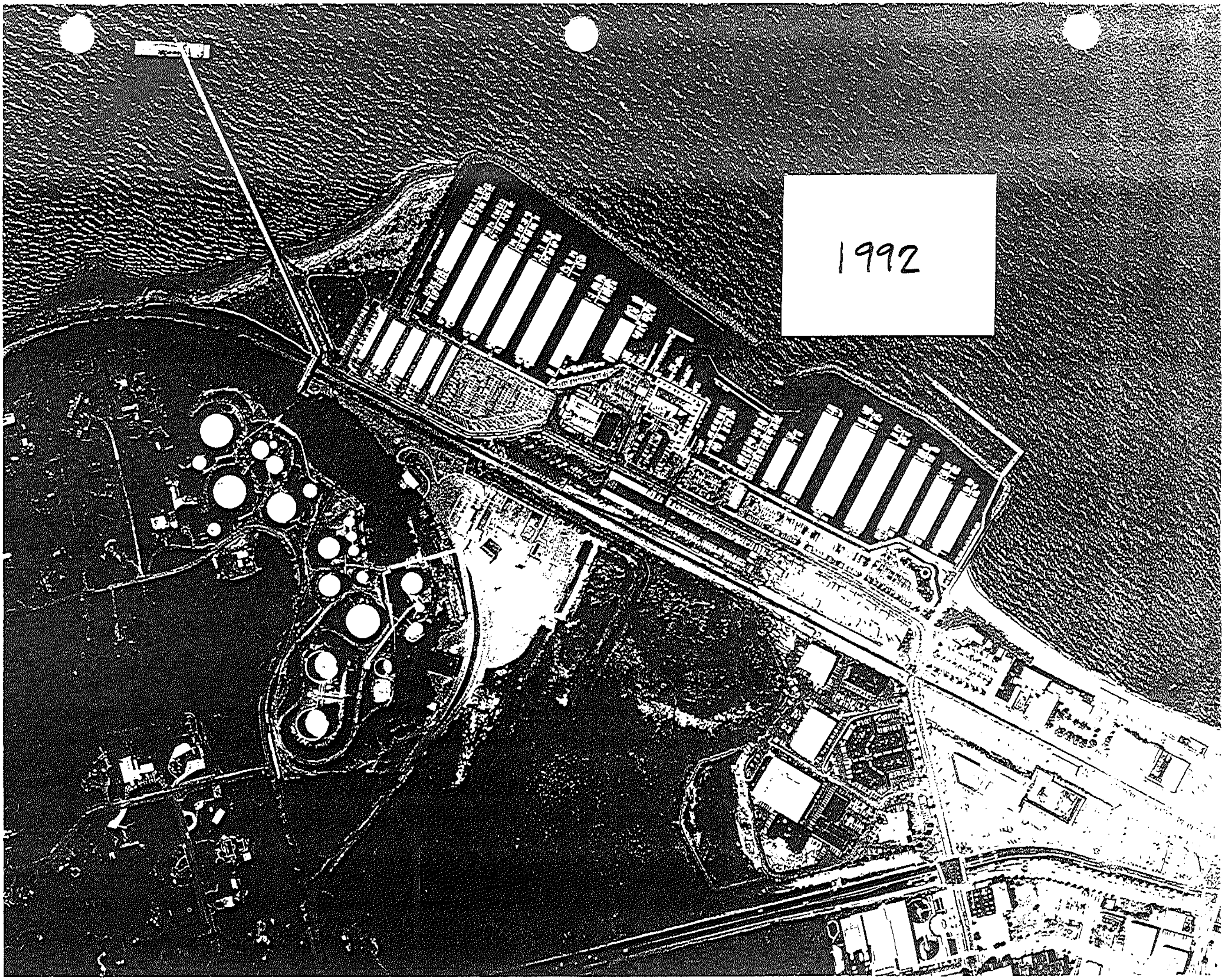
1991


1992

APPENDIX C

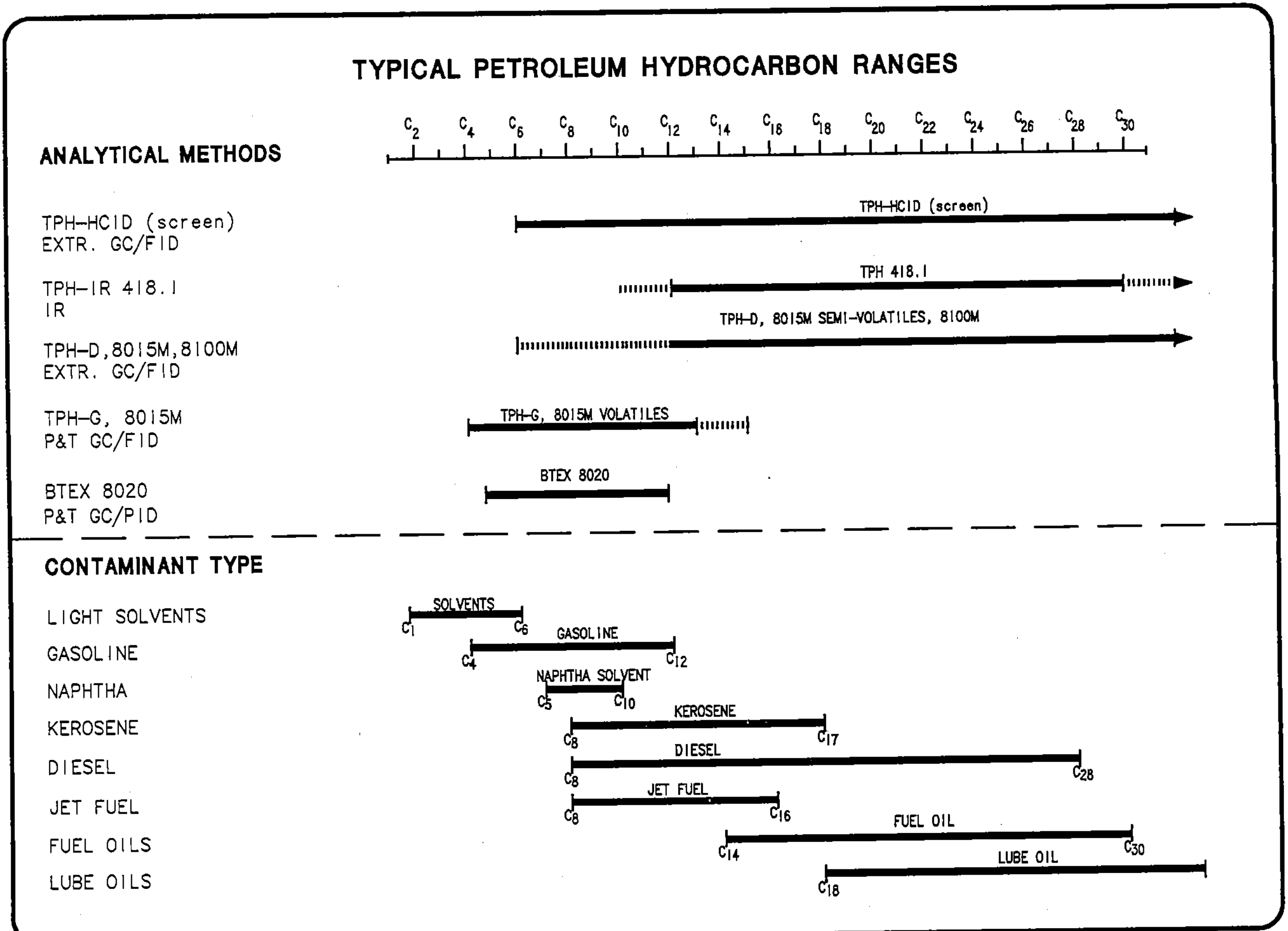
MATERIAL SAFETY DATA SHEETS SUMMARY

Specific Gravity of Hydrocarbon Products
UNOCAL Bulk Fuel Terminal
Edmonds, Washington

Product	Specific Gravity
Aviation Gasoline	0.70
Aviation Gasoline	0.70 - 0.72
Aviation Gasoline	0.70 - 0.72
87 Unleaded Gasoline	0.74
88 Leaded Gasoline	0.74
89 Unleaded Gasoline	0.75
92 Unleaded Gasoline	0.75
R-212 (F) Additive	0.75
Mineral Spirits	0.799
Diesel Fuel	0.80
Heating Oil #1	0.80[a]
Diesel #1	0.80[a]
Jet A Fuel	0.82
R-212 (D) Additive	0.82
Diesel #2	0.85
R-212 Additive	0.856
Marine Diesel Oil	0.89
R-224 Additive	0.915
Fuel Oil #5	0.93
Fuel Oil #6	0.94
Residual Fuel Oil 1.5%	0.94
Bunker Fuel	1.00[a]
Industrial Fuel Oil	1.11
Slurry Oil	1.11

NOTE: Values obtained from Material Safety Data Sheets. Unless otherwise noted, values were measured at a temperature of 20°C and a pressure of 760 mm Hg.

[a] Temperature and pressure of measurement not listed.



1=1 02-07-94 G:\DWG\0324\035\01C45

UNOCAL 76

ACCOUNT NO. 88810123

UNOCAL REFINING & MARKETING DIVISION
MATERIAL SAFETY DATA COORDINATOR
ROOM 1113-A
911 WILSHIRE BLVD.
P.O. BOX 7600
LOS ANGELES, CALIFORNIA 90051
(213) 977-7589

JUL 06,1991

EDMONDS TERMINAL
UNOCAL
ATTN.: JIM CLARK
P.O. BOX C-2004
EDMONDS, WA. 98020

SUBJECT: MATERIAL SAFETY DATA SHEETS

DEAR SIR:

IN COMPLIANCE WITH WORKER "RIGHT-TO-KNOW" LAWS AND THE OSHA HAZARD COMMUNICATION STANDARD, THE REFINING & MARKETING DIVISION OF THE UNION OIL COMPANY OF CALIFORNIA IS PROVIDING ITS CUSTOMERS WITH MATERIAL SAFETY DATA SHEETS FOR EACH PRODUCT PURCHASED. A DATA SHEET WILL BE AUTOMATICALLY MAILED WHEN A FIRST TIME SALES ORDER FOR A PRODUCT IS RECEIVED. MATERIAL SAFETY DATA SHEETS WITH SARA CHEMICALS, WILL BE MAILED OUT ANNUALLY TO ALL CUSTOMERS WHO PURCHASE THOSE PRODUCTS. ALSO, WHEN A MATERIAL SAFETY DATA SHEET IS REVISED, CUSTOMERS WHO HAVE PURCHASED THE PRODUCT IN THE PREVIOUS TWELVE MONTHS WILL AUTOMATICALLY RECEIVE AN UPDATED COPY.

DEVELOPMENT OF THE MATERIAL SAFETY DATA SHEET AND DISSEMINATION TO CUSTOMERS IS A PRINCIPLE MEANS OF ACHIEVING EFFECTIVE HAZARD COMMUNICATION IF YOU, THE CUSTOMER, USE IT IN YOUR EMPLOYEE SAFETY TRAINING PROGRAM. PLEASE REVIEW THE INFORMATION ON THESE SHEETS WITH YOUR EMPLOYEES WHO MAY COME INTO CONTACT WITH THE PRODUCTS. IF YOU REPACKAGE THE PRODUCT, USE IT AS AN INGREDIENT IN YOUR OWN PRODUCTS, OR MAKE WHOLESALE OR BULK SALES OF THE PRODUCT, WE RECOMMEND THAT YOU PASS THIS INFORMATION ON TO YOUR CUSTOMERS.

THE INFORMATION ON THE MATERIAL SAFETY DATA SHEETS SHOULD BE USED FOR HEALTH AND SAFETY TRAINING ONLY, NOT FOR SPECIFICATION PURPOSES. IF ADDITIONAL SPECIFICATION OR PRODUCT APPLICATION INFORMATION IS DESIRED, PLEASE CONTACT THE NEAREST UNOCAL SALES OFFICE. IF YOU WISH TO HAVE FUTURE MSDS MAILINGS SENT TO A DIFFERENT ADDRESS, PLEASE CONTACT US AT THE ABOVE ADDRESS.

OUR SALES RECORDS INDICATE THAT YOU HAVE PURCHASED THE PRODUCTS LISTED BELOW. THIS MAY NOT BE A COMPLETE LIST. ADDITIONAL MAILINGS WILL FOLLOW.

PRODUCT CODE	PRODUCT NAME
00300	UNOCAL 76 LEADED REGULAR
04032	UNION STEAVAL B
075501163	UNOCAL STARTING FLUID
03726	UNOCAL UNIMIX TWO-CYCLE OIL
05975	UNOCAL INDUSTRIAL FUEL OIL
03650XX40	UNION GUARDOL MOTOR OIL 40
05980	UNOCAL SLURRY OIL
03950	UNOCAL MULTIPURPOSE ATF
00470	UNOCAL 76 UNLEADED 89
04631	UNION TURBINE OIL XD 32
00901	UNOCAL HIGH PERFORMANCE 92
05163	UNOCAL MP GEAR LUBE LS 80/90
00301	UNOCAL 76 LEADED REGULAR GASOLINE
04532	UNOCAL R-212(A) GASOLINE ADDITIVE
0755018	UNOCAL DISC BRAKE FLUID DOT3
03935	UNOCAL ATF DEXRON (R) II (UNDYED)
00406	UNOCAL UNLEADED PLUS 87 M/H GRADE
04570	UNOCAL R-212(D) GASOLINE ADDITIVE

ACCOUNT NO. 88810123

PRODUCT CODE	PRODUCT NAME
01501	UNOCAL HEATING OIL #1
05161	UNION MP GEAR LUBE LS 75W
01502	UNOCAL HEATING OIL #2
05454	UNOCAL UNOBA EP GREASE 1
01010	UNOCAL 76 AVIATION GASOLINE 80/87
05165	UNOCAL MP GEAR LUBE LS 85W/140
00401	UNOCAL 76 PERFORMANCE PLUS 89
04534	UNOCAL R-212(F) GASOLINE ADDITIVE
01125	UNION 76 AVIATION FUEL JET A
05372	UNOCAL A GREASE 2
03310XX14	UNOCAL SUPER MOTOR OIL 10W/40
05906	UNOCAL NO. 6 LS FUEL OIL 1% MAX
03320XX30	UNOCAL PREMIUM MOTOR OIL 30
01601	UNION DIESEL #1
05455	UNOCAL UNOBA EP GREASE 2
01030	UNOCAL 76 AVIATION GASOLINE 100/130
05322	UNOCAL MP AUTOMOTIVE GREASE NO. 2
01650	UNION AUTOMOTIVE DIESEL
05590	UNOCAL CABLE LUBE
03650XX54	UNOCAL GUARDOL MOTOR OIL 15W/40
05946	UNOCAL NO. 6 HS FUEL OIL OVER 1%
03659XX30	UNOCAL HEAVY DUTY MOTOR OIL 30
05956	UNOCAL NO. 6 RESIDUAL FUEL OIL 1.5%
03330XX30	UNION CUSTOM MOTOR OIL 30
05916	UNOCAL NO. 6 FUEL OIL 480
01602	UNOCAL DIESEL #2
05467	UNOCAL UNOBA MOLY HD GREASE NO. 2
03650XX50	UNOCAL GUARDOL MOTOR OIL 50
05945	UNOCAL NO. 5 FUEL OIL
03951	PRIVATE BRAND MP TRANSMISSION FLUID
06940	UNOCAL ANTI-FREEZE AND COOLANT

M. S. D. S. SHEETS

1. **GASOLINE**

Product Code	Vendor	Product Name
00901	Unocal	High Performance 92 Unleaded Gasoline
00406	Unocal	Unleaded Plus 87 M/H Grade Unleaded Gasoline
00401	Unocal	76 Unleaded Gasoline
00401	Unocal	76 Performance Plus 89
00300	Unocal	76 Leaded Regular Gasoline
00301	Unocal	76 Leaded Regular Gasoline
21010	Unocal	76 Aviation Gasoline 80/87
21230	Unocal	76 Aviation Gasoline 100/130
21140	Chevron	R-224 Gasoline Additive
21145	Chevron	R-224W Gasoline Additive
0470 03	UNOCAL	76 UNLEADED PLUS GASOLINE RM/L 89

NOTED
JAN 24 1991
CLARK

M. S. D. S. SHEETS

1. GASOLINE

Product Code	Vendor	Product Name
00901	Unocal	Super 76 Unleaded Gasoline
00401	Unocal	76 Unleaded Gasoline
00301	Unocal	76 Leaded Gasoline
01010	Unocal	76 Aviation Gas 80/87
01030	Unocal	76 Aviation Gas 100/130
04570	Unocal	R-212-D Gasoline Additive

RSC

ATTACHED IS THE COMPLETED MSDS LIST FOR 1988.

NOTED
MAY 26 1988
J. S. CLARK

Lib/Jim
MSDS

NOTED
MAY 26 1988
J. S. CLARK

MID DISTILLATES FUELS

Product Code	Vendor	Product Name
01125	Unocal	76 Aviation Fuel Jet A
01602	Unocal	Diesel #2

3. FUEL OILS/RESIDUAL FUELS

05975	Unocal	IFO 1750
05910	Unocal	Bunker Fuel Oil
05906-5946	Unocal	Residual Fuel Oil
UN. 1863	BPMAP	Jet-A - Jet A-1
NA 1993	BPMAP	Marine Diesel Oil
NA 1993	BPMAP	Marine Gas Oil
NA 1993	BPMAP	Residual Fuel Oil

4. SOLVENTS

02060	Unocal	Solvent/Thinner #5

5. GREASES

Product Code	Vendor	Product Name
05372	Unocal	A - Grease
5454-5455	Unocal	Unoba EP Grease
5590	Unocal	Cable Lube
5322	Unocal	MP Automotive Grease
5467	Unocal	Moly H.D. Grease

6. <u>ENGINE OILS</u>

Product Code	Vendor	Product Name
03650xx 40	Unocal	Guardol 40
03650xx 50	Unocal	Guardol 50
03650xx 54	Unocal	Guardol 15W x 40
03310xx 14	Unocal	Super 10-40
03332xx 30	Unocal	Premium 30
03659xx 30	Unocal	Heavy Duty 30
03330xx 30	Unocal	Custom 30

7. <u>TRANSMISSION OILS</u>

	Unocal	ATF Dexron
	Unocal	ATF Type I

8. <u>INDUSTRIAL OILS</u>

04031 xx B	Unocal	Steaval B
4631 - 4636	Unocal	Turbine Oil 150
		Unax AW 46

9. <u>GEAR OILS</u>

05165	Unocal	MP Gear Lube IS 85V/140
05161	Unocal	MP Gear Lube

10. GARAGE - MISC PRODUCTS

PRODUCT CODE	VENDOR	PRODUCT NAME
81867	Curtis Ind.	Quik Eas
81871	Curtis Ind.	Power Grip
81867	Chemifax	Showers N. Stuff
83997	Curtis Ind.	Silicone Lubricant TM 736
85171	Curtis Ind.	Lubricant TM 2544
86425	Curtis Ind.	Decal gasket removal
94812	Curtis Ind.	Brake Clean
44812	Curtis Ind.	Silicone Caulk
111702	EXSL Chemical	Martin # 950
15130-003	Johnson Wax	J Shop 500
15140-003	Johnson Wax	J Shop 600
1269	ZEP Mfg.	A-ONE
0432	ZEP Mfg.	ZEPTEEN
0925	ZEP Mfg.	ZEP Reach
21948	Bowman Dist	Battery Term Protector
219051	Bowman Dist	Belt Dressing
19022	" "	Caulking Strip - White
19023	" "	Caulking Strip - Black
19452	" "	Chain & Cable Lube
19459	" "	Cutting Oil
19429	" "	Dip and Seal
19437	" "	Dry Graphite Lube
21945	" "	Electric Motor Contact Cleaner
19474	" "	Easy Anti Seize
19475	" "	Gasget, Decal, Paint Remover
19404	Bowman Dist	Open Gear & 5th Wheel Lube

21418	"	"	Heavy Load Red Grease
21412-1	"	"	Lock De-Icer
21440	"	"	Cleaning Solvent
21446	"	"	Low volatile red RTV silicone
21498	"	"	Maxi Blue easy gasket maker
21500	"	"	Sealant Adhesive
21961	"	"	Hi Temp Anti Seize Thread compound
19462	"	"	Teflon Dry Lube
21964	"	"	Valve Solvent Penetrating Fluid
21948	Bowman Dist		Battery Terminal Protector
21976	"	"	Weatherstrip Adhesive
21950	"	"	Spray Adhesive
21978	"	"	Weatherstrip Adhesive Black
21990	"	"	F.S.A. Adhesive
21971	"	"	Safety Silicone Lubricant

PRODUCT CODE	VENDOR	PRODUCT NAME
78134	Mechanics Choice	Battery Cleaner/ Leak Detector
78146	Mechanics Choice	Battery Cleaner & Protector
78113	Mechanics Choice	Brake Cleaner
78107	Mechanics Choice	Gear & Chain Lube
78158	Mechanics Choice	Dry Graphite
78137	Mechanics Choice	Red Grease
78130	Mechanics Choice	Gasget & Decal Remover
78110	Mechanics Choice	Loosen-It
78140	Mechanics Choice	Non-Flammable Loosen-It
78105	Mechanics Choice	Lube Plate
78145	Mechanics Choice	Dry Moly
78102	Mechanics Choice	Super Silicone
78000	Mechanics Choice	Super Grease Gone
78139	Mechanics Choice	Thread Shred
78150	Mechanics Choice	5th Wheel Lube
78157	Mechanics Choice	Zinc Galvenizing Coating
7910	L-Tech	Solid Steel Welding Rod
7912	L-Tech	Solid Steel Welding Wire
7923	L-Tech	Coxyfuel Brazing Rod
7782-44-7	Union Carbide	Oxygen
74-86-2	Union Carbide	Acetylene
128-38-9	Union Carbide	Carbon Dioxide

PRODUCT CODE	VENDOR	PRODUCT NAME
0145	ZEP	ZEP 45
0251	ZEP	ZEP Reserve
0282	ZEP	ZEP Powerhouse
0291	ZEP	ZEP Power Solvent
0415	ZEP	ZEP Big Orange
400AL Resin	Amaron	Amerlock 400
400AL Cure	Amaron	Amerlock 400AL Cure
450GL Resin	Amaron	Amercoat 450GL Resin
65	Amaron	Amercoat 65 Thinner
N/A	State Chemical	State TKO

PRODUCT CODE	VENDOR	PRODUCT NAME
7449-37-1	Union Carbide	Argon
79-98-6	Union Carbide	Propane
07750-1163	Unocal	Starting Fluid
07550-2912	Unocal	Disc Brake Fluid
6631	Safety Kleen Corp	Immersion Cleaner & Carburator & Cold Parts Cleaner 60%
W/A	State Chemical	State 4 way

11. TERMINAL

PRODUCT CODE	VENDOR	PRODUCT NAME
BOILER		
118	Mogul	5308
150	Mogul	5424
129	Mogul	5300
095	Mogul	5010
REAGENTS		
5620	Unocal	Reagent 1
300487	Unocal	Reagent 2
	Unocal	Reagent 3
5631	Unocal	Reagent 4
NPPA 704-M	Unocal	Reagent 5
60-10-0	Unocal	Reagent 6
MISC.		
	Amoco	Amoco 547-D
	Ansul	Foray
	Ansul	Purple K
450S1000	Napko	Unibrown Paint
450S2000	Napko	Falomino-Paint
7439-97-6	Troy Chemical	Mercury
6001-A	Armite Laboratory	Lead-Plate M0250
21427	Bowman Dist	Silicone
21942	Bowman Dist	Battery Cleaner
21945	Bowman Dist	Electric Motor & Contact Cleaner
07662	Dow Chemical	Ambitrol CN
0694	Unocal	Anti-Freeze Coolant
FC 203 CE	3 M	3% AFFF Foam Concentrate

BOILER TEST CHEMICAL REAGENTS

PRODUCT CODE	VENDOR	PRODUCT NAME
Hydrochloric Acid	Mogul	SULFITE P
N/A	Mogul	SULFITE Q
1318 Butyl Cellosolve	Mogul	ALKALINITY C
1319 N/A	Mogul	ALKALINITY D
1320 Sulfuric Acid	Mogul	ALKALINITY E
1321 Acetic Acid	Mogul	CHLORIDE F
1322 N/A	Mogul	CHLORIDE G
1387 Sodium Hydroxide	Mogul	SULFITE C
1393 Nitric Acid	Mogul	PHOSPHATE PA
1394 Sulfamic Acid	Mogul	PHOSPHATE PB
1395 Tin Compounds	Mogul	PHOSPHATE PC
CATALOG# 110	HACH	Ammonium Molybdate
CATALOG# 1061	HACH	PHOSPHATE 2 Reagent
R-0630	Taylor Tech	Chromate Indicator
R-0699	Taylor Tech	Iodide Iodate Reagent
R-0725	Taylor Tech	Acid Starch Powder
R-0736	Taylor Tech	Sulfuric Acid .5N
R-0807	Taylor Tech	Silver Nitrate

MOGUL COPRORATION - BOILER CHEMICAL

PRODUCT CODE	VENDOR	PRODUCT NAME
095 Sodium Hydroxide	Mogul	EG 5010
116 Sodium Bisulfite	Mogul	EG 5308
379 Morpholine	Mogul	EG 5331
129 Cyclohexylamine	Mogul	EG 5360
150 Polyacrylic Acid	Mogul	EG 5424

CHEMAX CORPORATION BOILER CHEMICAL

PRODUCT CODE	VENDOR	PRODUCT NAME
160 Boiler Water Scale Control		PRODUCT 160
174 Oxygen Scavenger		PRODUCT 174
273 Steam Line Treatment		PRODUCT 273
274 Steam Line Treatment		PRODUCT 274

EDMONDS TERMINAL

UNLEADED TEST REAGENTS

PRODUCT CODE	VENDOR	PRODUCT NAME
Trichloroethane	Unocal	Reagent 1
Trichloroethane	Aldrich Chem	Reagent 1
1,4-Dioxane	Grant Chem.	Reagent 1
Potassium Bromate	Unocal	Reagent 2
Hydrochloric Acid	Unocal	Reagent 3
Trichloroethylene	Unocal	Reagent 4
Sodium Sulfite Anhydrous	Unocal	Reagent 5
Diphenylthiocarbazone Hydrazide	Unocal	Reagent 5

9. GEAR OILS

PRODUCT CODE	VENDOR	PRODUCT NAME
05163	Unocal	MP Gear Lube LS 80W/90
05165	Unocal	MP Gear Lube LS 85W/140
05161	Unocal	MP Gear Lube LS 75W
05590	Unocal	Cable Lube

8. INDUSTRIAL OILS

PRODUCT CODE	VENDOR	PRODUCT NAME
04031	Unocal	Steaval B 110
04032	Unocal	Steaval B
4631	Unocal	Turbine Oil XD 32

7. TRANSMISSION OILS

PRODUCT CODE	VENDOR	PRODUCT NAME
03131	Unocal	ATF Type F
03335	Unocal	ATF Dexron (R) undyed
03150	Unocal	Multipurpose ATF
03951	Unocal	Private Brand MP Trans Fd

E. **ENGINE OILS**

Product Code	Vendor	Product Name
03650xx 40	Unocal	Guardol 40
03650xx 50	Unocal	Guardol 50
03650xx 54	Unocal	Guardol 15W x 40
03310xx 14	Unocal	Super 10-40
03320xx 22	Unocal	Premium 20W/20
03320xx 30	Unocal	Premium 30
03659xx 30	Unocal	Heavy Duty 30
03330xx 30	Unocal	Custom 30
03725	Unocal	Unimix Two Cycle Oil

4. SOLVENTS

PRODUCT CODE	VENDOR	PRODUCT NAME
02060	Unocal	Solvent/Thinner #5

M. S. D. S. SHEETS

1. GASOLINE

Product Code	Vendor	Product Name
00901	Unocal	High Performance 92 Unleaded Gasoline
00406	Unocal	Unleaded Plus 87 M/H Grade Unleaded Gasoline
00401	Unocal	76 Unleaded Gasoline
00401	Unocal	76 Performance Plus 89
00300	Unocal	76 Leaded Regular Gasoline
00301	Unocal	76 Leaded Regular Gasoline
01010	Unocal	76 Aviation Gasoline 80/87
01030	Unocal	76 Aviation Gasoline 100/130
01140	Chevron	F-224 Gasoline Additive
01145	Chevron	F-224A Gasoline Additive

2. MID DISTILLATES FUELS

Product Code	Vendor	Product Name
01125	Unocal	76 Aviation Fuel Jet A
01501	Unocal	Unocal Heating Oil #1
1630	Unocal	Unocal Automotive Diesel
01601	Unocal	Unocal Diesel #1
01502	Unocal	Unocal Heating Oil #2
01602	Unocal	Unocal Diesel #2
05000162	Amoco	Amoco 547-D Additive

I. FUEL OILS/RESIDUAL FUELS

PRODUCT CODE	VENDOR	PRODUCT NAME
05906	Unocal	NO. 6 LS Fuel Oil 1% Max
05910	Unocal	Bunker Fuel Oil
05916	Unocal	NO. 6 Fuel Oil 480
05945	Unocal	No. 5 Fuel Oil
05946	Unocal	No 6 HS F/O over 1%
05955	Unocal	No. 6 Resid F/O 1.5%
05975	Unocal	INdustrial Fuel Oil
05980	Unocal	Unocal Slurry Oil
UN 1863	BPNAP	Jet-A - Jet A-1
UN 1993	BPNAP	Marine Gas Oil
UN 1993	BPNAP	Marine Diesel Oil
UN 1270	BPNAP	Cutter Stock
UN 1270	BPNAP	Light Cycle Oil
UN 1993	BPNAP	Residual Fuel Oil

MISC VENDORS AND CHEMICALS

Product Code	Vendor	Product Name
No Id Number	Alaskan	Welding Rod
05000168 Kerosene	Amoco	Amoco 547-D
400AL Resin	Amaron	Amerlock 400AL Resin
400AL Cure	Amaron	Amerlock 400AL Cure
450GL Resin	Amaron	Amercoat 450GL Resin
65	Amercoat	65 Thinner
450GL Cure	Amaron	Amerlock 450GL Cure
No ID Number	Ansul	Foray
No ID Number	Ansul	Purple K
6001-A	Armite Laboratory	Lead-Plate M0250
07522 Glycools	Dow Chemical	Ambitrol CN
111762	EXSL Chemical	Martin 4 350
1219/0072	Gas Tech, Inc.	25 ppm H2s
15130-003	Johnson Wax	J Shop 500
15140-003	Johnson Wax	J Shop 600
	Liquid Carbinic	CO_2
NO ID NUMBER	J.H. McCabe	Water Cut Paste
459945	Mine Safety App. Co.	Methane
SnCl4 on Pumice	Mine Safety App. Co	Smoke Tubes
FC 203 Lihgt Water	3M COMPANY	3% AFFF Foam Concentrate
45091000	Napko	Unibrown Paint
45092000	Napko	Palomino-Paint
No ID Number	Nassau	Bare Filler Wire
No ID Number	Nassau	Silver-Tin Solder
VCI-1, 2-1, 2-2,	Nrm Instru	Zerust Vapor Capsule
No ID Number	Nor Western Dist	Leomite
Ethylene Glycol	Quantum Chemical	Norkool Concentrate

Product Code	Vendor	Product Name
S631	Safety Kleen Corp	Immersion Cleaner & Carburator & Cold Parts Cleaner 60%
N/A	State Chemical	State TKO
7439-97-6	Troy Chemical	Mercury
WM 3001	Westmar Company	Kar Kleen 100
WM 3021	Westmar Company	Kar Kleen 103
NO ID NUMBER	Westmar Company	Formula 300
NO ID NUMBER	Westmar Company	Tred Off Slm

Product Code	Vendor	Product Name
06340	Unocal	Anti-Freeze
0755016	Unocal	Disc Brake Fluid
07750-1163	Unocal	Starting Fluid

ZEP MANUFACTURING COMPANY

PRODUCT CODE	VENDOR	PRODUCT NAME
0114	Zep Mfg.	Zep Big Orange
0145	Zep Mfg.	Zep 45
0251	Zep Mfg.	Zepreserve
0292	Zep Mfg.	Zep Powerhouse
0291	Zep Mfg.	Zep Power Solv
0266	Zep Mfg.	ZEP Dyna 143
0408	Zep Mfg.	Zep Fast Basket Clear
0415	Zep Mfg.	Zep Big Orange
0432	ZEP Mfg.	Zepteen
0916	Zep Mfg.	Zep Handstand Lotion Soap
0925	ZEP Mfg.	Zep Reach
0957	Zep Mfg.	Zep F-10 Shaker
1265	ZEP Mfg.	A-ONE

MECHANICS CHOICE INC

PRODUCT CODE	VENDOR	PRODUCT NAME
78000	Mechanics Choice	Super Grease Gone
78102	Mechanics Choice	Super Silicone
78105	Mechanics Choice	Lube Plate
78107	Mechanics Choice	Gear & Chain Lube
78110	Mechanics Choice	Loosen-It
78113	Mechanics Choice	Brake Cleaner
78130	Mechanics Choice	Gasget & Decal Remover
78134	Mechanics Choice	Battery Cleaner/ Leak Detector
78137	Mechanics Choice	Red Grease
78139	Mechanics Choice	Thread Shred
78140	Mechanics Choice	Non-Flammable Loosen-It
78145	Mechanics Choice	Dry Moly
78146	Mechanics Choice	Battery Cleaner & Protector
78150	Mechanics Choice	5th Wheel Lube
78157	Mechanics Choice	Zinc Galvenizing Coating
78158	Mechanics Choice	Dry Graphite

FEL-PRO INCORPORATED

PRODUCT CODE	VENDOR	PRODUCT NAME
1915-85	Fel-Pro	Pro CS-A
2115-78	Fel-Pro	Pro-Lock Nut Type
2117-78	Fel-Pro	Pro-Lock Wicking Type
2118-78	Fel-Pro	Pro-Lock Retaining 1
2120-85	Fel-Pro	Pro Lock Hydraulic Sealant
2122-78	Fel-Pro	Pro-Lock Flange Sealant

CURTIS INDUSTRIES

PRODUCT CODE	VENDOR	PRODUCT NAME
81867	Curtis Ind.	Silicone Lubricant TM 736
81869	Curtis Ind.	Quik Eas
81871	Curtis Ind.	Power Grip
83997	Curtis Ind.	Brake Clean
84756	Curtis Ind.	Cold Galvanizing Compound TM 1626
85171	Curtis Ind.	Lubricant TM 2044
86425	Curtis Ind.	Decal/Gasket Removal
88726	Curtis Ind.	Curtis Red Oxide Primer
94812-16	Curtis Ind.	Duraflow RTV Silicone Caulk

PRODUCT CODE	VENDOR	PRODUCT NAME
21910	Bowman Dist	4 Way RMC Rust & Moisture Control
21942	Bowman Dist	Battery Cleaner
21945	Bowman Dist	Electric Motor Contact Cleaner
21948	Bowman Dist	Battery Term Protector
21950	Bowman Dist	Spray Adhesive
21961-62	Bowman Dist	Hi Temp Anti Seize Thread Compound
21964	Bowman Dist	Valve Solvent Penetrating Fluid
21971	Bowman Dist	Safety Silicone Lubricant
21976	Bowman Dist	Weatherstrip Adhesive
21978	Bowman Dist	Weatherstrip Adhesive Black
21990	Bowman Dist	F.S.A. Adhesive

TERMINAL MISC CHEMICALS

BOWMAN DISTRIBUTION

PRODUCT CODE	VENDOR	PRODUCT NAME
19022	Bowman Dist	Caulking Strip - White
19023	Bowman Dist	Caulking Strip - Black
19429	Bowman Dist	Dip and Seal
19437	Bowman Dist	Dry Graphite Lube
19452	Bowman Dist	Chain & Cable Lube
19459	Bowman Dist	Cutting Oil
19462	Bowman Dist	Teflon Dry Lube
19464	Bowman Dist	Open Gear & 5th Wheel Lube
19474	Bowman Dist	Easy Anti Seize
19475	Bowman Dist	Gasget, Decal, Paint Remover
19482	Bowman Dist	Blue Universal Hi Temp
19440	Bowman Dist	ATC Air Tool Conditioner Sealant Dressing
21412	Bowman Dist	Lock De-Icer
21418	Bowman Dist	Heavy Load Red Grease
21427	Bowman Dist	Silicone
21431	Bowman Dist	PB Blaster Penetrating Catalyst
21435	Bowman Dist	Silicone Rubber Adhesive Sealant, Clear
21440	Bowman Dist	Cleaning Solvent
21446	Bowmar Dist	Low volatile red RTV Silicone
21498	Bowman Dist	Maxi Blue easy gasket maker
21500	Bowman Dist	Sealant Adhesive
21905-1	Bowman Dist	Belt Dressing

Product Code	Vendor	Product Name
5631	Safety Kleen Corp	Immersion Cleaner & Carburator & Cold Parts Cleaner 60%
N/A	State Chemical	State TKC
7439-97-6	Troy Chemical	Mercury
WM 3001	Westmar Company	Kar Kleen 100
WM 3021	Westmar Company	Kar Kleen 103
NO ID NUMBER	Westmar Company	Formula 300
NO ID NUMBER	Westmar Company	Tred Off Slm

MISC VENDORS AND CHEMICALS

Product Code	Vendor	Product Name
No Id Number	Alaskan	Welding Rod
05000168 Kerosene	Amoco	Amoco 547-D
400AL Resin	Amaron	Amerlock 400AL Resin
400AL Cure	Amaron	Amerlock 400AL Cure
450GL Resin	Amaron	Amercoat 450GL Resin
65	Amercoat	65 Thinner
450GL Cure	Amaron	Amerlock 450GL Cure
No ID Number	Ansul	Foray
No ID Number	Ansul	Purple K
6001-A	Armite Laboratory	Lead-Plate M0250
07682 Glycols	Dow Chemical	Ambitrol CN
111762	EXSL Chemical	Martin # 950
1818/0072	Gas Tech, Inc.	25 ppm H2s
15130-003	Johnson Wax	J Shop 500
15140-003	Johnson Wax	J Shop 600
NO ID NUMBER	J.H. McCabe	Water Cut Paste
459945	Mine Safety App. Co.	Methane
SnCl4 on Pumice	Mine Safety App. Co	Smoke Tubes
FC 203 Lihgt Water	3M COMPANY	3% AFFF Foam Concentrate
45051000	Naoko	Unibrown Paint
45092000	Naoko	Palomino-Paint
No ID Number	Nassau	Bare Filler Wire
No ID Number	Nassau	Silver-Tin Sodder
VCI-1, 2-1, 2-2,	Nrm Instru	Zerust Vapor Capsule
No ID Number	Nor Western Dist	Leomite
Ethylene Glycol	Quantum Chemical	Norkool Concentrate

Product Code	Vendor	Product Name
06940	Unocal	Anti-Freeze
0755019	Unocal	Disc Brake Fluid
07750-1163	Unocal	Starting Fluid

ZEP MANUFACTURING COMPANY

PRODUCT CODE	VENDOR	PRODUCT NAME
0114	Zep Mfg.	Zep Big Orange
0145	Zep Mgg.	Zep 45
0251	Zep Mfg.	Zepreserve
0282	Zep Mfg.	Zep Powerhouse
0291	Zep Mfg.	Zep Power Solv
0366	Zep Mfg.	ZEP Dyna 143
0408	Zep Mfg.	Zep Fast Gasket Clear
0415	Zep Mfg.	Zep Big Orange
0432	ZEP Mfg.	Zepteen
0916	Zep Mfs.	Zep Handstand Lotion Soap
0925	ZEP Mfg.	Zep Reach
0957	Zep Mfg.	Zep F-10 Shaker
1269	ZEP Mfg.	A-ONE

MECHANICS CHOICE INC

PRODUCT CODE	VENDOR	PRODUCT NAME
78000	Mechanics Choice	Super Grease Gone
78102	Mechanics Choice	Super Silicone
78105	Mechanics Choice	Lube Plate
78107	Mechanics Choice	Gear & Chain Lube
78110	Mechanics Choice	Loosen-It
78113	Mechanics Choice	Brake Cleaner
78130	Mechanics Choice	Gasget & Decal Remover
78134	Mechanics Choice	Battery Cleaner/ Leak Detector
78137	Mechanics Choice	Red Grease
78139	Mechanics Choice	Thread Shred
78140	Mechanics Choice	Non-Flammable Loosen-It
78145	Mechanics Choice	Dry Moly
78146	Mechanics Choice	Battery Cleaner & Protector
78150	Mechanics Choice	5th Wheel Lube
78157	Mechanics Choice	Zinc Galvenizing Coating
78158	Mechanics Choice	Dry Graphite

FEL-PRO INCORPORATED

PRODUCT CODE	VENDOR	PRODUCT NAME
1915-85	Fel-Pro	Pro CS-A
2115-78	Fel-Pro	Pro-Lock Nut Type
2117-78	Fel-Pro	Pro-Lock Wicking Type
2118-78	Fel-Pro	Pro-Lock Retaining 1
2120-85	Fel-Pro	Pro Lock Hydraulic Sealant
2122-78	Fel-Pro	Pro-Lock Flange Sealant

CURTIS INDUSTRIES

PRODUCT CODE	VENDOR	PRODUCT NAME
81867	Curtis Ind.	Silicone Lubricant TM 736
81869	Curtis Ind.	Quik Eas
81871	Curtis Ind.	Power Grip
83997	Curtis Ind.	Brake Clean
84756	Curtis Ind.	Cold Galvanizing Compound TM 1636
85171	Curtis Ind.	Lubricant TM 2044
86425	Curtis Ind.	Decal/Gasket Removal
88726	Curtis Ind.	Curtis Red Oxide Primer
94812-16	Curtis Ind.	Duraflow RTV Silocone Caulk

PRODUCT CODE	VENDOR	PRODUCT NAME
21910	Bowman Dist	4 Way RMC Rust & Moisture Control
21942	Bowman Dist	Battery Cleaner
21945	Bowman Dist	Electric Motor Contact Cleaner
21946	Bowman Dist	Battery Term Protector
21950	Bowman Dist	Spray Adhesive
21961-62	Bowman Dist	Hi Temp Anti Seize Thread Compound
21964	Bowman Dist	Valve Solvent Penetrating Fluid
21971	Bowman Dist	Safety Silicone Lubricant
21975	Bowman Dist	Weatherstrip Adhesive
21978	Bowman Dist	Weatherstrip Adhesive Black
21990	Bowman Dist	F.S.A. Adhesive

TERMINAL MISC CHEMICALS

BOWMAN DISTRIBUTION

PRODUCT CODE	VENDOR	PRODUCT NAME
19022	Bowman Dist	Caulking Strip - White
19023	Bowman Dist	Caulking Strip - Black
19429	Bowman Dist	Dip and Seal
19437	Bowman Dist	Dry Graphite Lube
19452	Bowman Dist	Chain & Cable Lube
19455	Bowman Dist	Cutting Oil
19462	Bowman Dist	Teflon Dry Lube
19464	Bowman Dist	Open Gear & 5th Wheel Lube
19474	Bowman Dist	Easy Anti Seize
19475	Bowman Dist	Gasget, Decal, Paint Remover
19482	Bowman Dist	Blue Universal Hi Temp
19440	Bowman Dist	ATC Air Tool Conditioner Sealant Dressing
21412	Bowman Dist	Lock De-Icer
21418	Bowman Dist	Heavy Load Red Grease
21427	Bowman Dist	Silicone
21421	Bowman Dist	PB Blaster Penetrating Catalyst
21435	Bowman Dist	Silicone Rubber Adhesive Sealant, Clear
21440	Bowman Dist	Cleaning Solvent
21442	Bowman Dist	Low volatile red RTV Silicone
21438	Bowman Dist	Maxi Blue easy gasket maker
21500	Bowman Dist	Sealant Adhesive
21902-1	Bowman Dist	Belt Dressing

3. **GREASES**

Product Code	Vendor	Product Name
05372	Unocal	A Grease 2
05454	Unocal	Unoba EP Grease 1
05455	Unocal	Unoba EP Grease 2
05590	Unocal	MP Automotive Grease 2
05467	Unocal	Moly H.D. Grease
25512	Bowman Dist	Low Temp Grease

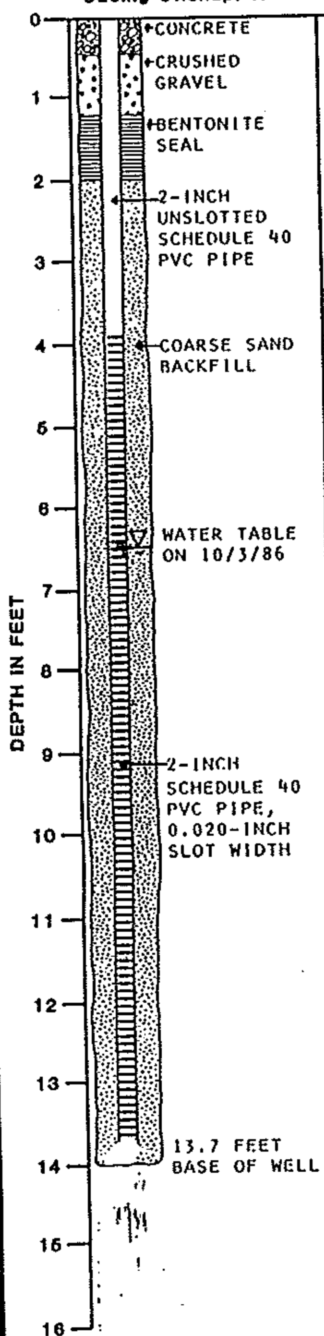
APPENDIX D

WELL LOGS

MONITOR WELL NO. MW-1

WELL SCHEMATIC
Casing Elevation: 16.57
Casing Stickup: 1.33

DESCRIPTION
Surface Elevation: 15.24



Depth (ft)	Blow-Count	Samples	Group Symbol	Description
0			GP	2 INCHES CRUSHED ROCK SURFACING
0.2			SP	BROWN FINE TO MEDIUM SAND (LOOSE, MOIST) (FILL)
2.5			SM/SP	GRAY SILTY FINE TO MEDIUM SAND AND CLEAN FINE TO MEDIUM SAND WITH OCCASIONAL GRAVEL (MEDIUM DENSE, MOIST)
3	18	■		
8	32	■		COLOR CHANGES TO BROWN SLIGHT HYDROCARBON ODOR AT 8 FEET NO GRAVEL PRESENT GRADES TO DENSE AND WET
13	16	■		SLIGHT HYDROCARBON ODOR AT 13 FEET GRADES TO MEDIUM DENSE
14				BORING COMPLETED AT 14.0 FEET ON 8/26/86

Note: See Figure A-2 for Explanation of Symbols

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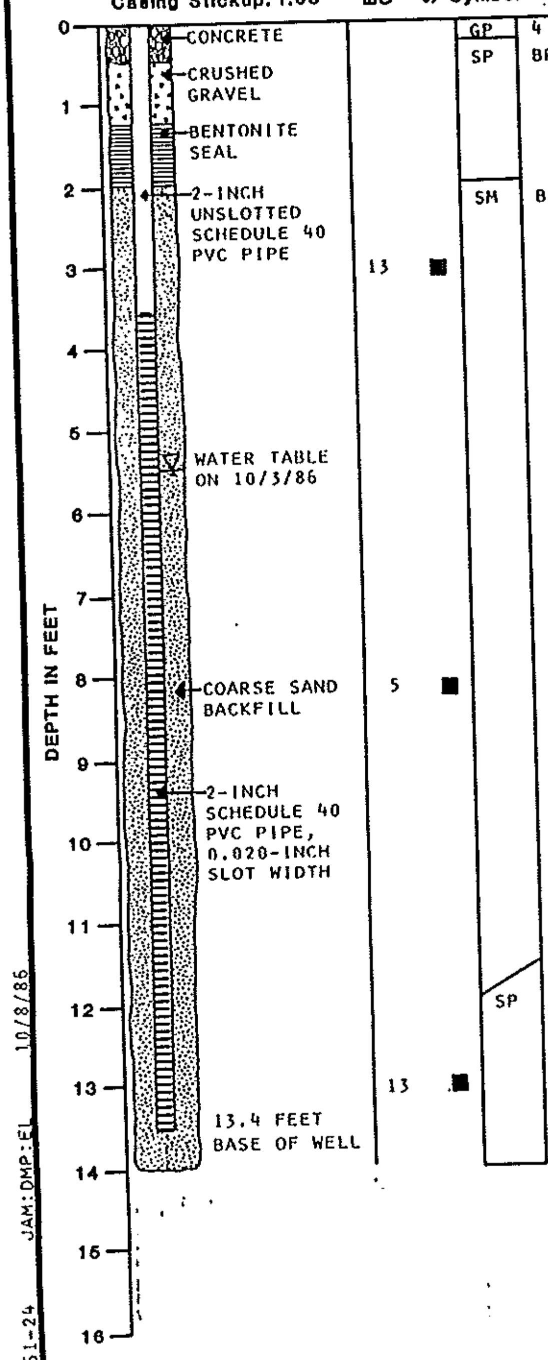
LOG OF MONITOR WELL

FIGURE A-3

MONITOR WELL NO. MW-2

WELL SCHEMATIC
Casing Elevation: 16.63
Casing Stickup: 1.63

Surface Elevation: 14.00



Depth (feet)	Blow Count	Group Symbol	DESCRIPTION
0		GP	4 INCHES CRUSHED ROCK SURFACING
0–1.9		SP	BROWN FINE TO MEDIUM SAND (LOOSE, MOIST) (FILL)
2		SM	BROWN SILTY FINE TO MEDIUM SAND WITH GRAVEL (MEDIUM DENSE, MOIST) (FILL)
3	13		5-INCH LAYER OF ASPHALT AND STRONG HYDROCARBON ODOR AT 3 FEET
8	5		GRADES TO LOOSE AND WET CHUNKS OF ASPHALTIC CONCRETE AT 8 FEET STRONG HYDROCARBON ODOR AT 8 FEET
12		SP	GRAY FINE TO MEDIUM SAND (MEDIUM DENSE, WET)
13	13		
14			BORING COMPLETED AT 14.0 FEET ON 8/26/86

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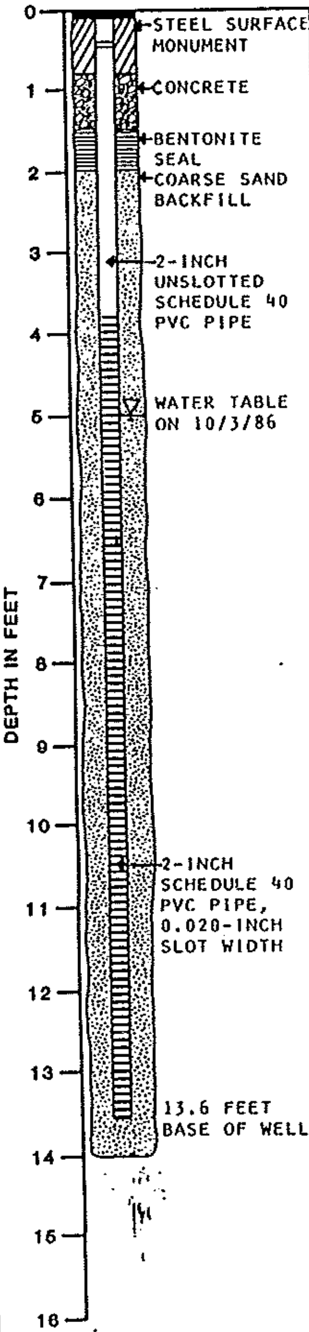
LOG OF MONITOR WELL

FIGURE A-4

MONITOR WELL NO. MW-3

WELL SCHEMATIC
Casing Elevation: 13.80
Casing Stickup: -0.31



DESCRIPTION
Surface Elevation: 14.11

Depth (ft)	Blow-Count	Samples	Group Symbol	Description
0			GP	4 INCHES CRUSHED ROCK SURFACING
			SP	BROWN FINE TO MEDIUM SAND (LOOSE, MOIST) (FILL)
1			ML/SM	GRAYISH BROWN SANDY SILT AND SILTY SAND (SOFT, MOIST) (FILL)
3	4	■		TRACE OF ORGANIC MATTER AND A SLIGHT HYDRO-CARBON ODOR AT 3 FEET
8	6	■		
8.5			SP	GRAY FINE TO MEDIUM SAND (LOOSE, WET)
13	6	■		
14				BORING COMPLETED AT 14.0 FEET ON 8/26/86

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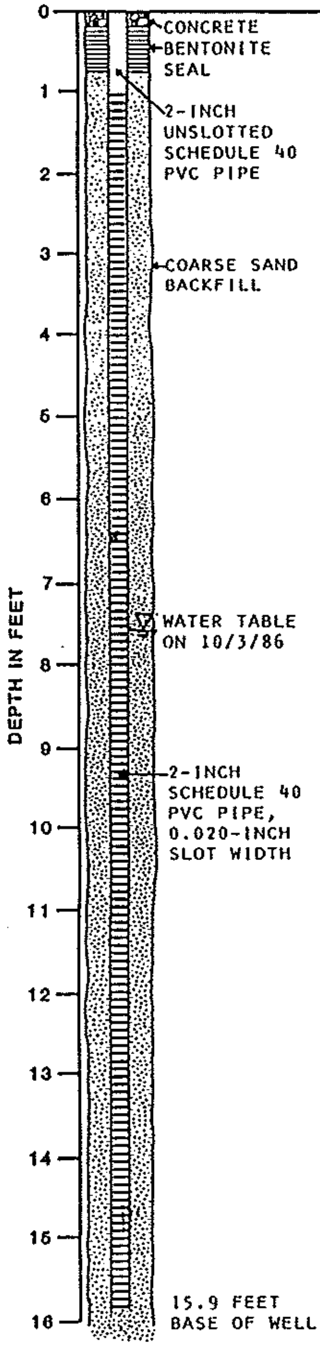
LOG OF MONITOR WELL

FIGURE A-5

MONITOR WELL NO. MW-4

WELL SCHEMATIC
Casing Elevation: 17.37
Casing Stickup: 1.21

DESCRIPTION
Surface Elevation: 16.16



Depth (ft)	Blow-Count	Samples	Group Symbol	Description
0			GP	4 INCH CRUSHED ROCK SURFACING
			SP	BROWN FINE TO MEDIUM SAND WITH OCCASIONAL GRAVEL (DENSE, MOIST)
3	35	■		
8	56	■		CHANGES TO WET
13	33	■		MODERATE HYDROCARBON ODOR AT 13.0 FEET

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LOG OF MONITOR WELL

FIGURE A-6A

MONITOR WELL NO. MW-4 (CONTINUED)

WELL SCHEMATIC
Casing Elevation: 17.37
Casing Stickup: 1.21

Surface Elevation: 16.16

DEPTH IN FEET	Blow-Count	Samples	Group Symbol	DESCRIPTION
16			SP	
17			SW-SM	BROWN FINE TO COARSE SAND WITH SILT AND OCCASIONAL GRAVEL (MEDIUM DENSE, WET)
18				
19	18	■		BORING COMPLETED TO 19.5 FEET ON 8/26/86
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				

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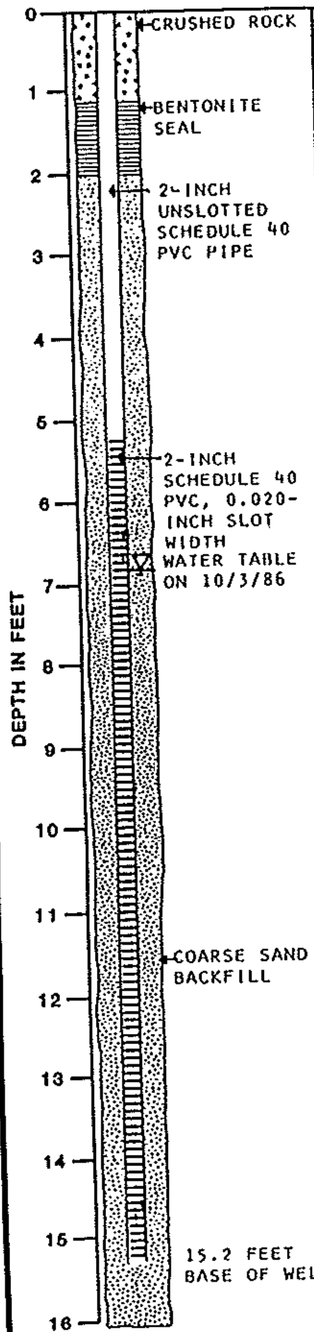
LOG OF MONITOR WELL

FIGURE A-6B

MONITOR WELL NO. MW-5

WELL SCHEMATIC
Casing Elevation: 16.80
Casing Stickup: 1.61

DESCRIPTION
Surface Elevation: 16.19



Depth (feet)	Blow-Count	Samples	Group Symbol	Description
0			GP	4 INCHES CRUSHED ROCK SURFACING
0.3			SP	BROWN FINE TO MEDIUM SAND WITH GRAVEL (DENSE, MOIST)
3	41	■		SLIGHT HYDROCARBON ODOR AT 3 FEET
8	50/3"	■		
12			SW	BROWN FINE TO COARSE SAND WITH OCCASIONAL GRAVEL (MEDIUM DENSE, WET)
13	25	■		SLIGHT HYDROCARBON ODOR AT 13 FEET
15				GRADES TO GRAY AND LOOSE
15.5	9	■		
16				BORING COMPLETED AT 16 FEET ON 8/27/86

10/8/86
JAM:DMP:EL
161-24

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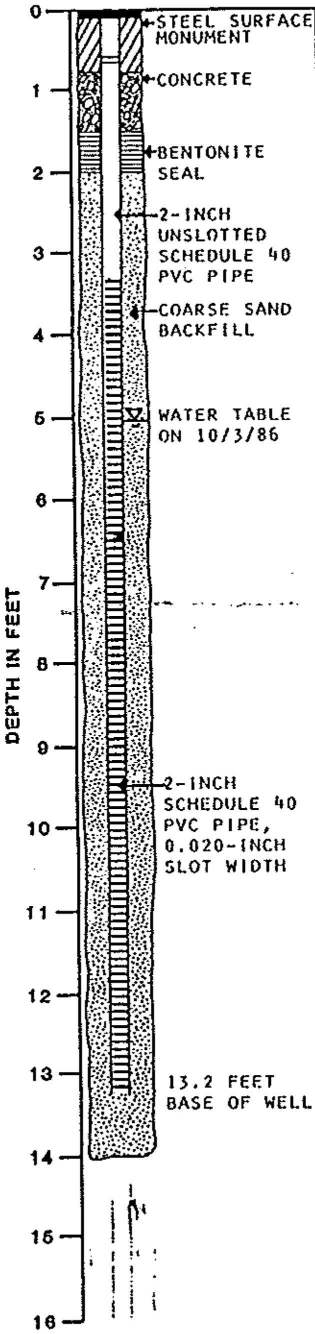
LOG OF MONITOR WELL

FIGURE A-7

MONITOR WELL NO. MW-6

WELL SCHEMATIC
Casing Elevation: 13.58
Casing Stickup: -0.66



DESCRIPTION
Surface Elevation: 14.24

Depth (ft)	Blow-Count	Samples	Group Symbol	Description
0			GP	4 INCH CRUSHED ROCK SURFACING
0–1.7			SP	BROWN FINE TO MEDIUM SAND WITH GRAVEL (LOOSE, MOIST) (FILL)
1.7–7.3	25/9" (at 3)	■	SM	DARK BROWN SILTY FINE TO COARSE SAND WITH A MODERATE HYDROCARBON ODOR (MEDIUM DENSE, MOIST) (FILL) 3 INCH CONCRETE LAYER AT 3.5 FEET WITH OVERLYING THIN ASPHALTIC CONCRETE LAYER
7.3–14.0	10 (at 8); 8 (at 13)	■ ■	SP	GRAY FINE TO MEDIUM SAND (LOOSE, WET) SLIGHT HYDROCARBON ODOR AT 8 FEET

BORING COMPLETED AT 14.0 ON 8/27/86

Note:

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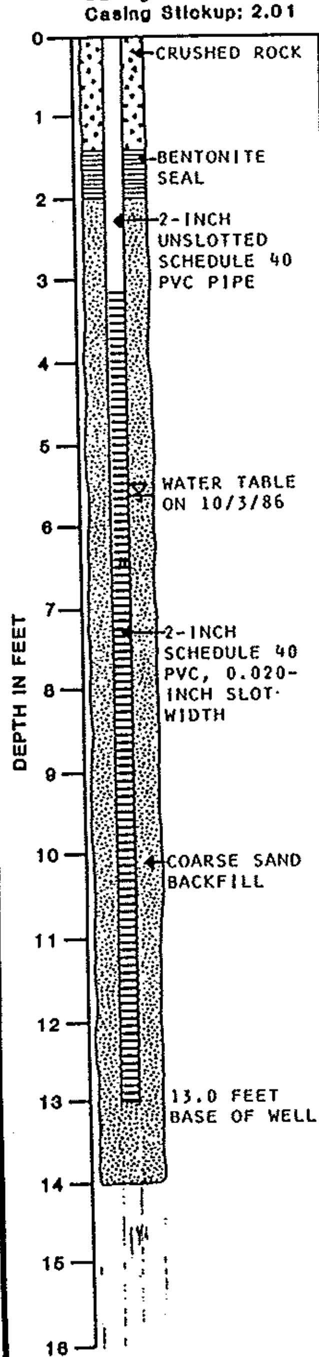
LOG OF MONITOR WELL

FIGURE A-8

MONITOR WELL NO. MW-7

WELL SCHEMATIC
Casing Elevation: 16.50
Casing Stickup: 2.01



DESCRIPTION — Surface Elevation: 14.49

Depth (ft)	Blow-Count	Samples	Group Symbol	Description
0			GP	4 INCH CRUSHED ROCK SURFACING
0.3			SP	BROWN FINE TO MEDIUM SAND WITH OCCASIONAL GRAVEL (LOOSE, MOIST) (FILL)
2.5			SW	GRAY AND BROWN FINE TO COARSE SAND (MEDIUM DENSE, MOIST) (FILL)
3	25	■		
5			SP	BROWN AND GRAY FINE TO MEDIUM SAND WITH OCCASIONAL GRAVEL (DENSE, MOIST)
8	37	■		GRADES TO WET
13	14	■		GRADES TO MEDIUM DENSE
14				BORING COMPLETED AT 14.0 FEET ON 8/27/86

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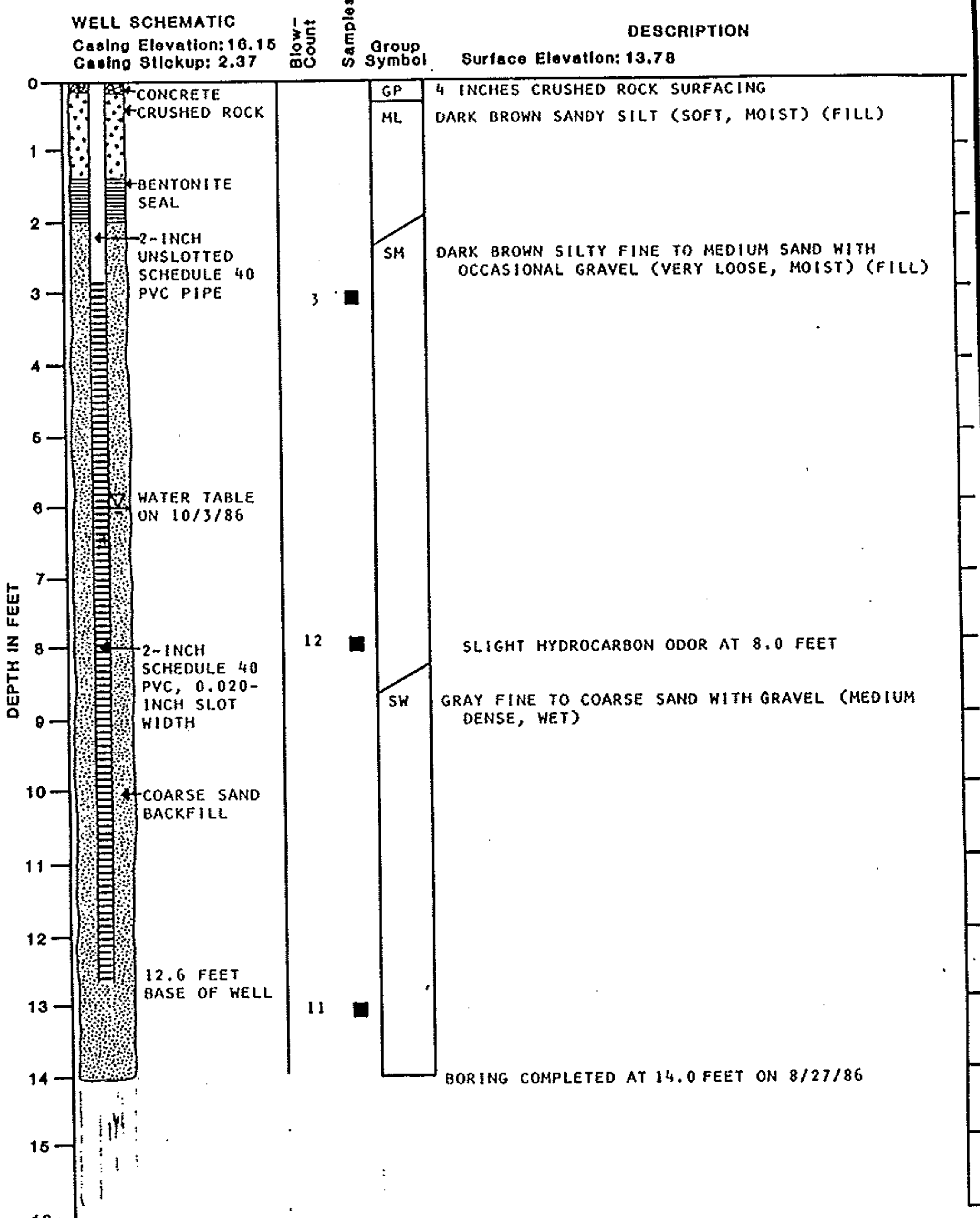
LOG OF MONITOR WELL

FIGURE A-9

MONITOR WELL NO. MW-8



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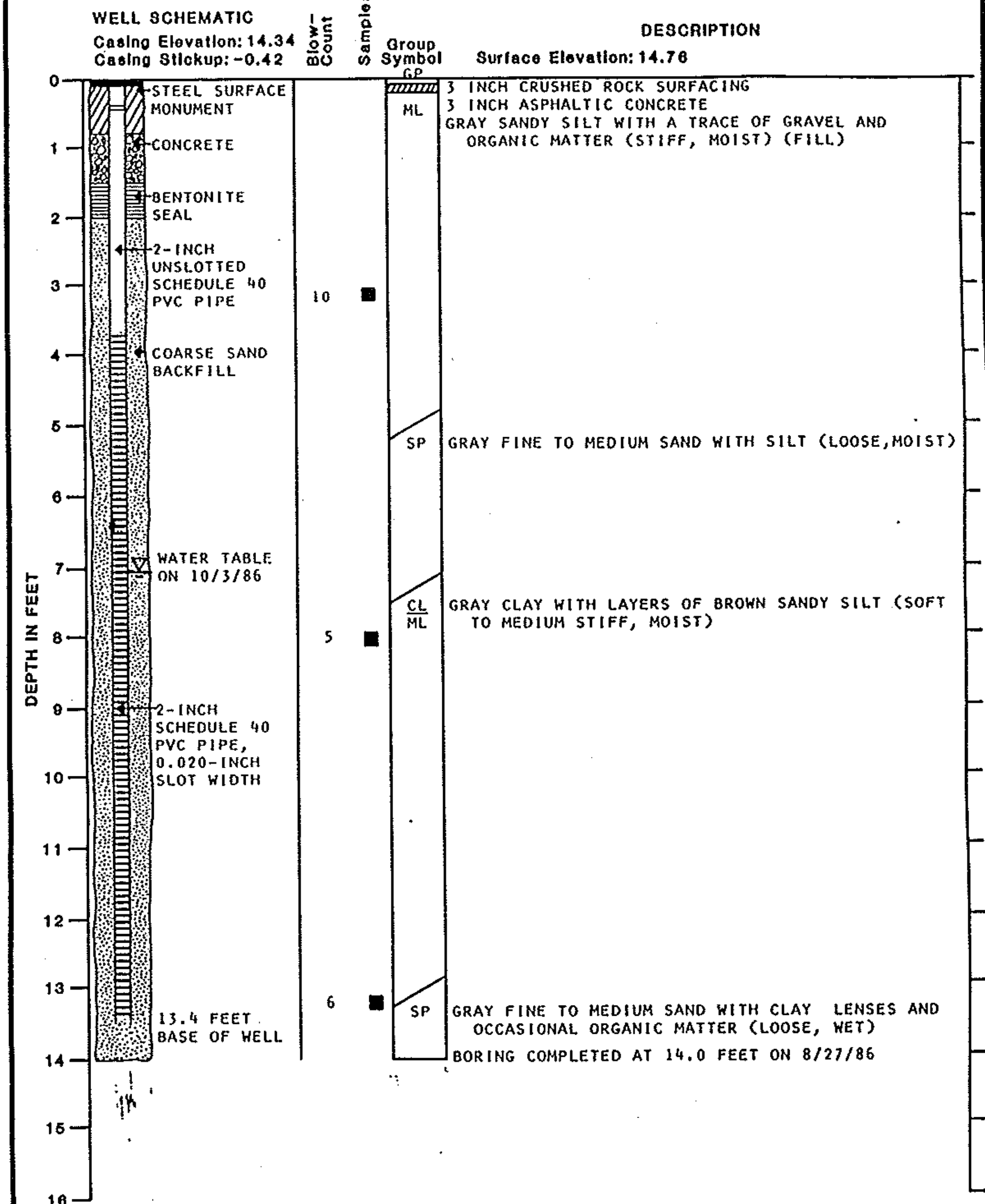
LOG OF MONITOR WELL

FIGURE A-10

MONITOR WELL NO. MW-9



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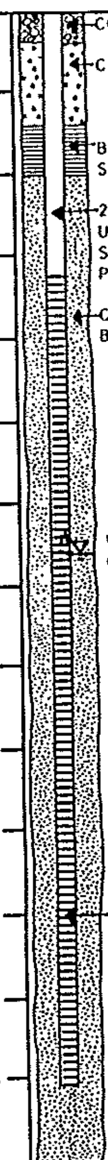
LOG OF MONITOR WELL

FIGURE A-11

161-24 JAM:DMP:EL 10/8/86

MONITOR WELL NO. MW-10

WELL SCHEMATIC
Casing Elevation: 16.15
Casing Stickup: 1.94



Surface Elevation: 14.21

DEPTH IN FEET	Blow-Count	Samples	Group Symbol	DESCRIPTION
0			GP	4 INCHES CRUSHED ROCK SURFACING
			SM	GRAY SILTY FINE SAND (LOOSE, MOIST) (FILL)
3	8	■		MODERATE HYDROCARBON ODOR AT 3 FEET
8	3	■		SLIGHT HYDROCARBON ODOR AT 8 FEET
			SP/SM	GRAY SILTY FINE SAND INTERBEDDED WITH SANDY SILT AND OCCASIONAL ORGANIC MATTER (VERY LOOSE, WET)
13	6	■		MODERATE HYDROCARBON-LIKE ODOR AT 13 FEET
14				BORING COMPLETED AT 14.0 FEET ON 8/27/86

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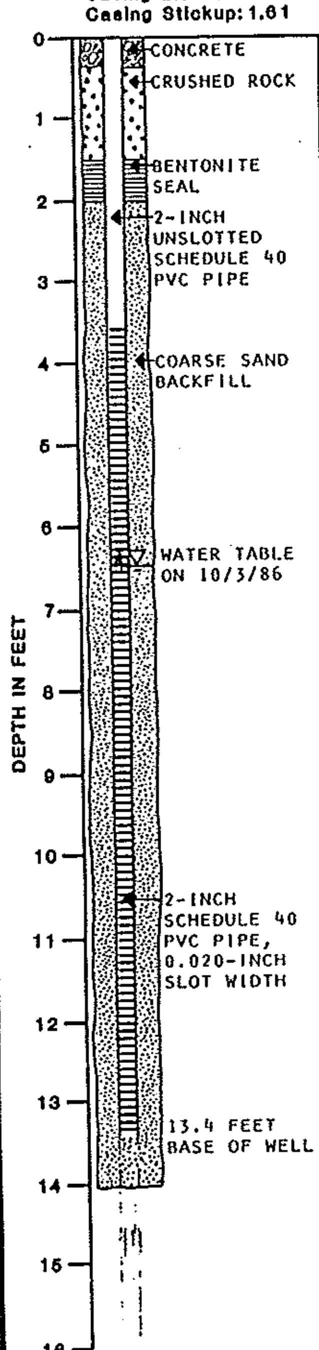
LOG OF MONITOR WELL

FIGURE A-12

MONITOR WELL NO. MW-11

WELL SCHEMATIC
Casing Elevation: 16.04
Casing Stickup: 1.61

DESCRIPTION
Surface Elevation: 14.43



Blow-Count	Samples	Group Symbol	Description
		GP	4 INCH CRUSHED ROCK SURFACING
		SM	DARK BROWN SILTY SAND (LOOSE, MOIST) (FILL)
10	■	SP	GRAYISH BROWN FINE TO MEDIUM SAND (LOOSE TO MEDIUM DENSE, MOIST) (FILL)
9	■	SM	BROWNISH GRAY SILTY SAND (LOOSE, WET)
11	■	SW	GRAY FINE TO COARSE SAND WITH GRAVEL (MEDIUM DENSE, WET)
			BORING COMPLETED AT 14.0 FEET ON 8/27/86

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Note: See figure [illegible]

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LOG OF MONITOR WELL

FIGURE A-13

MONITOR WELL NO. MW-13

WELL SCHEMATIC
Casing Elevation: 16.79
Casing Stickup: 1.27

DESCRIPTION

MONITOR WELL NO. MW-12

WELL SCHEMATIC
Casing Elevation: 16.25
Casing Stickup: 1.51

Surface Elevation: 14.74

Depth in Feet	Well Schematic	Blow Count	Samples	Group Symbol	Description
0	CONCRETE			GP	4 INCH CRUSHED ROCK SURFACING
	CRUSHED ROCK		☒	SM	GRAY SILTY SAND (LOOSE, MOIST) (FILL)
1	BENTONITE SEAL				
2	2-INCH UNSLOTTED SCHEDULE 40 PVC PIPE			SP	GRAY FINE TO MEDIUM SAND WITH A TRACE OF SILT (LOOSE, MOIST)
3		5	■		SLIGHT HYDROCARBON ODOR AT 3 FEET
4	COARSE SAND BACKFILL				
6			☒		
7	WATER TABLE ON 10/3/86				
8		3	■		MODERATE HYDROCARBON ODOR AT 8 FEET
10	2-INCH SCHEDULE 40 PVC PIPE, 0.020-INCH SLOT WIDTH				
11		7	■		
12				SW	GRAY FINE TO COARSE SAND WITH LENSES OF SILT AND A TRACE OF GRAVEL (LOOSE, WET)
13		8	■		
14	13.5 FEET BASE OF WELL				BORING COMPLETED AT 14.0 FEET ON 8/26/86

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LOG OF MONITOR WELL

FIGURE A-15

JAM:DMP:EL
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161-24

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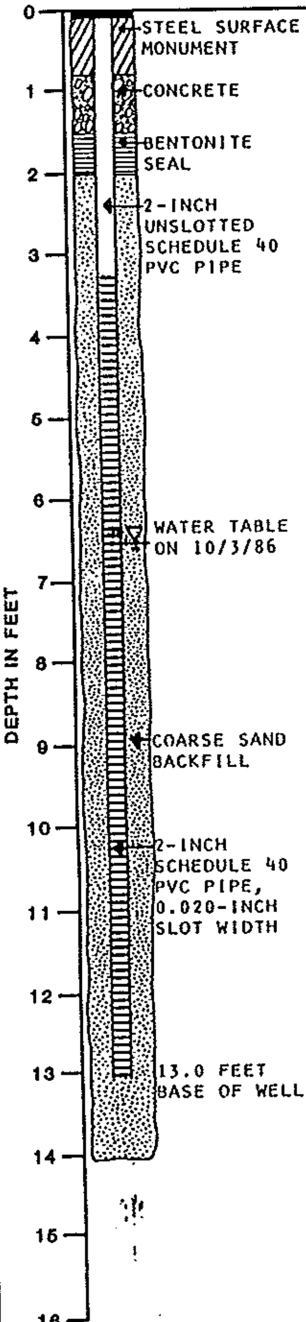
LOG OF MONITOR WELL

FIGURE A-14

MONITOR WELL NO. MW-14

WELL SCHEMATIC
Casing Elevation: 14.21
Casing Stickup: -0.41



DESCRIPTION
Surface Elevation: 14.62

Depth (ft)	Blow-Count	Samples	Group Symbol	Description
0			GP	4 INCH CRUSHED ROCK SURFACING
			ML	BROWN SANDY SILT WITH LENSES OF SILTY SAND AND A A TRACE OF GRAVEL (SOFT, MOIST) (FILL)
~3.4	4	■		
~8	5	■		
~8.5			SW	GRAY FINE TO COARSE SAND WITH A TRACE OF SILT AND ORGANIC MATTER (LOOSE, WET)
~13	5	■		
14				BORING COMPLETED AT 14.0 ON 8/28/86

161-24 JAM:DMP:EL 10/8/86

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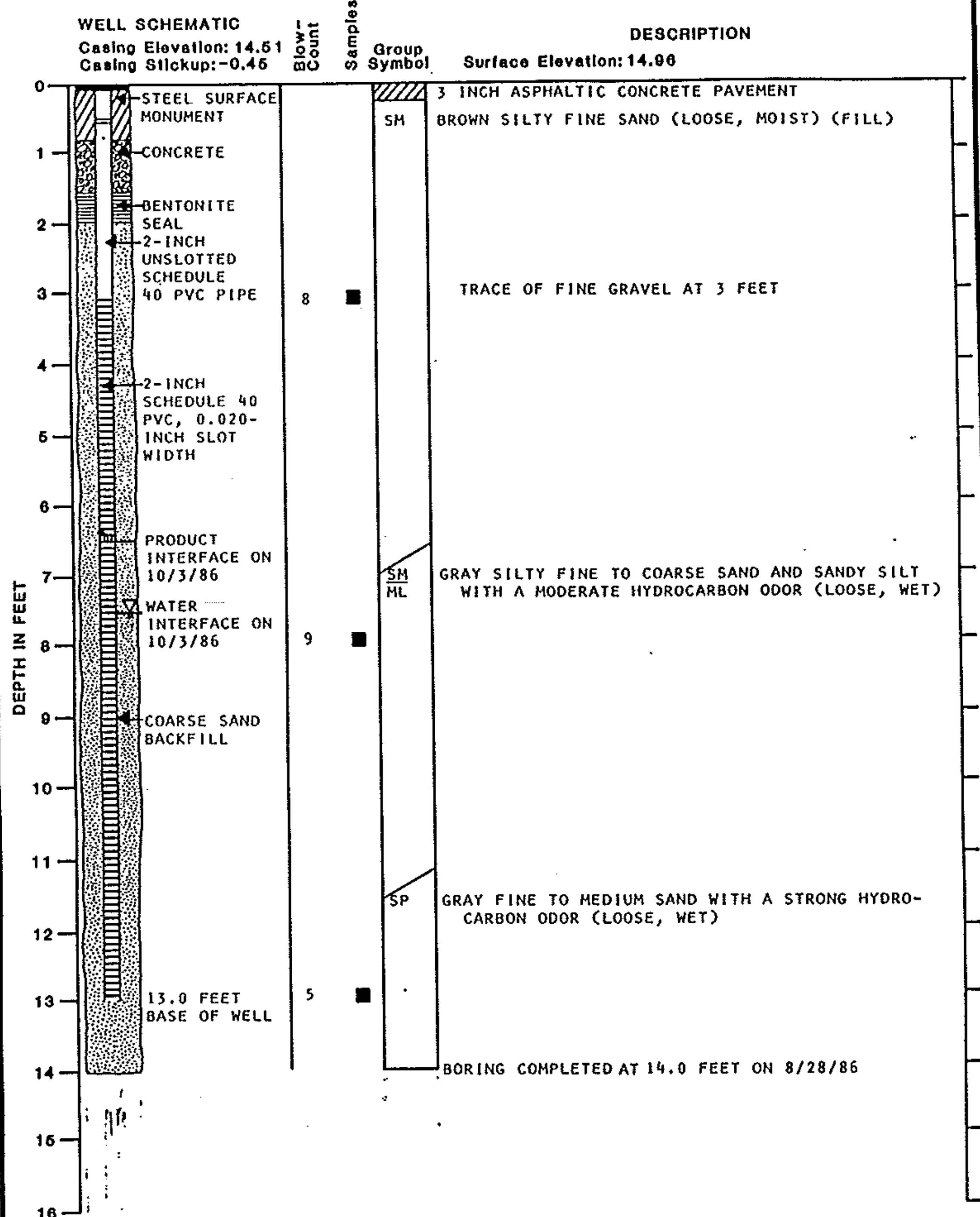
LOG OF MONITOR WELL

FIGURE A-16

MONITOR WELL NO. MW-15



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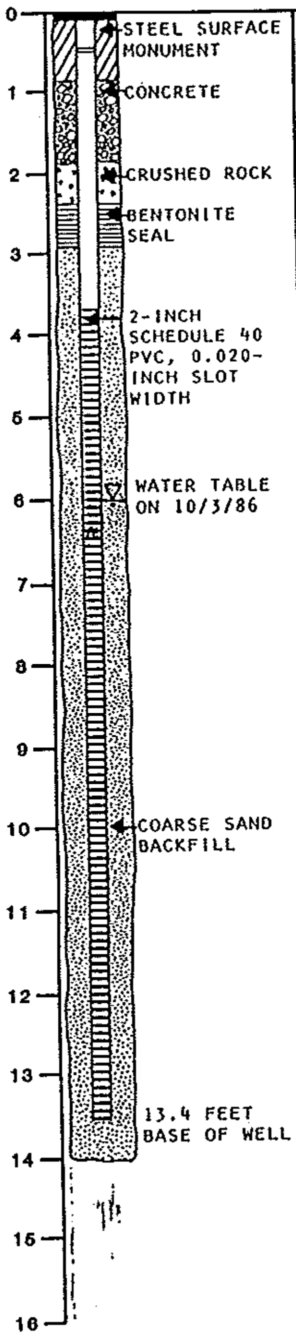
LOG OF MONITOR WELL

FIGURE A-17

MONITOR WELL NO. MW-16

WELL SCHEMATIC
Casing Elevation: 15.81
Casing Stickup: -0.40

DESCRIPTION
Surface Elevation: 16.21



Depth (ft)	Blow Count	Samples	Group Symbol	Description
0				3 INCHES ASPHALT CONCRETE PAVEMENT
0.3			SM	BROWN SILTY FINE TO MEDIUM SAND (LOOSE, MOIST) (FILL)
1.6			SP	BROWN FINE TO MEDIUM SAND (MEDIUM DENSE, MOIST)
3	23	■		
7				CHANGES TO WET
8	23	■		
13	20	■		
14				BORING COMPLETED AT 14.0 FEET ON 8/28/86

161-24 10/8/86 JAM:DMP:El

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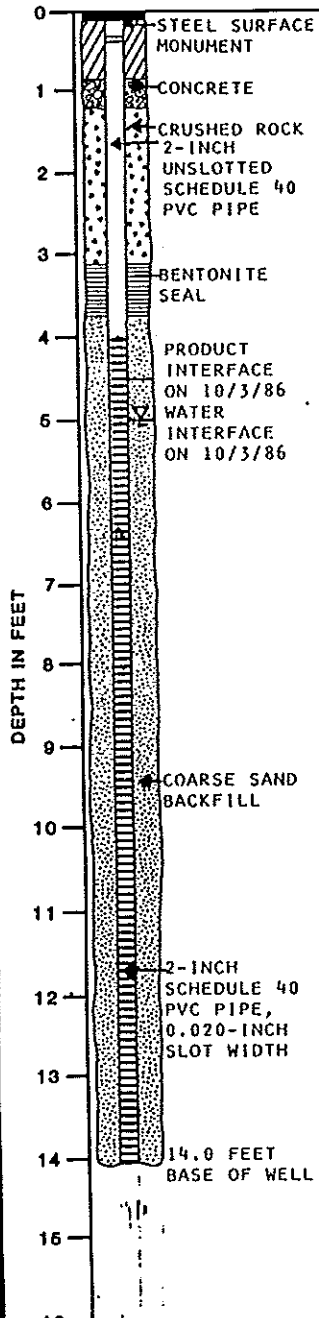
LOG OF MONITOR WELL

FIGURE A-18

MONITOR WELL NO. MW-17

WELL SCHEMATIC
Casing Elevation: 14.48
Casing Stickup: -0.29

Surface Elevation: 14.77



Depth (ft)	Blow Count	Samples	Group Symbol	Description
0			GP	4 INCH CRUSHED ROCK SURFACE LAYER
			SP	GRAY FINE TO MEDIUM SAND WITH A TRACE OF GRAVEL AND A MODERATE HYDROCARBON ODOR (MEDIUM DENSE, MOIST)
3	23	■		
8	27	■		GRADES TO BROWNISH GRAY AND WET
13	29	■		TRACE OF SILT AND ORGANICS
14				BORING COMPLETED AT 14.0 FEET ON 8/28/86

161-24 JAM:DMP:EL 10/8/86

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LOG OF MONITOR WELL

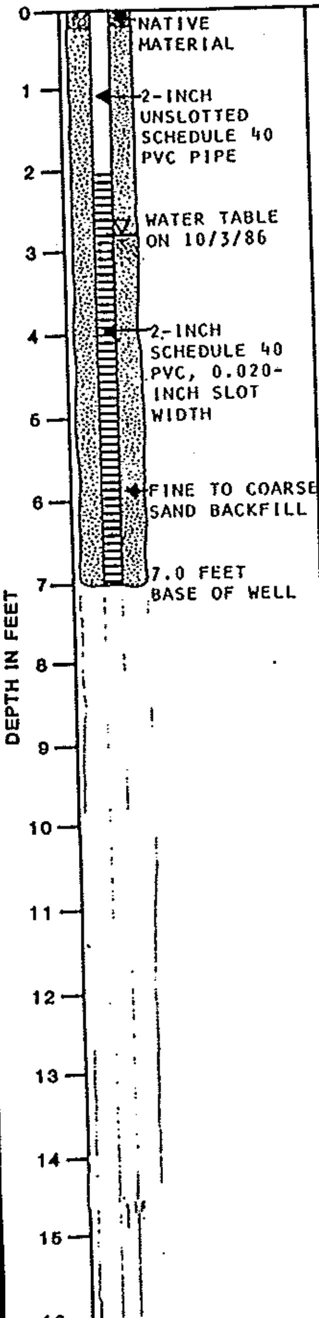
FIGURE A-19

MONITOR WELL NO. MW-18

WELL SCHEMATIC
Casing Elevation: 18.69
Casing Stickup: 0.36

Blow-Count | Samples | Group Symbol

DESCRIPTION
Surface Elevation: 18.33



Group Symbol	Description
SM	DARK BROWN SILTY SAND WITH ORNAMENTAL BARK (LOOSE, DAMP)
SP	BROWN FINE TO MEDIUM SAND (MEDIUM DENSE, MOIST)
	GRADES TO DENSE
	BORING COMPLETED AT 7 FEET ON 9/3/86

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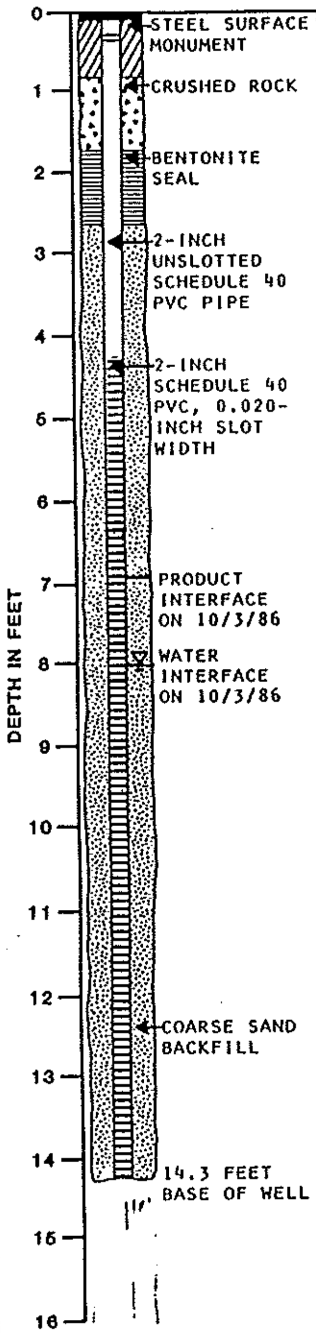
LOG OF MONITOR WELL

FIGURE A-20

MONITOR WELL NO. MW-19

WELL SCHEMATIC
Casing Elevation: 14.97
Casing Stickup: -0.23

DESCRIPTION
Surface Elevation: 15.20



Depth (feet)	Blow-Count	Samples	Group Symbol	Description
0				3 INCH ASPHALT CONCRETE PAVEMENT
0–1			SM	BROWN SILTY FINE TO COARSE SAND (LOOSE, MOIST) (FILL)
1.5			SP	BROWNISH GRAY FINE TO MEDIUM SAND WITH A TRACE OF SILT AND A SLIGHT HYDROCARBON ODOR (DENSE, MOIST)
3	38	■		
8	26	■		CHANGES TO WET WITH A TRACE OF GRAVEL AND A MODERATE HYDROCARBON ODOR
12			SP-SM	BROWNISH GRAY FINE TO MEDIUM SAND WITH SILT AND A STRONG HYDROCARBON ODOR (MEDIUM DENSE, WET)
13	20	■		
14.3				BORING COMPLETED AT 14.3 FEET ON 9/22/86

161-24 10/8/86 JAM:DMP:EL

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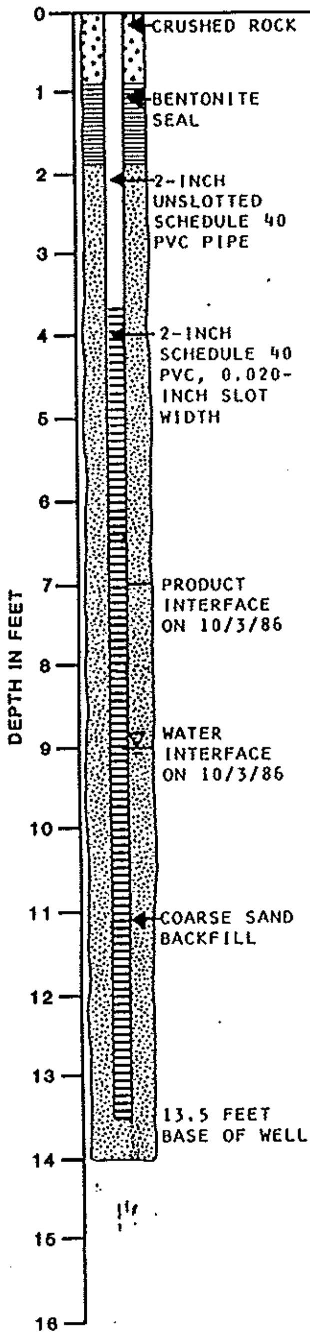
LOG OF MONITOR WELL

FIGURE A-21

MONITOR WELL NO. MW-20

WELL SCHEMATIC
Casing Elevation: 16.65
Casing Stickup: 1.27

Surface Elevation: 15.38



Depth (ft)	Blow-Count	Samples	Group Symbol	DESCRIPTION
0			GP	6 INCH CRUSHED ROCK SURFACING
0.5			SP	BROWNISH GRAY FINE TO MEDIUM SAND WITH A TRACE OF SILT (VERY LOOSE, MOIST)
3	3	■		CHUNKS OF TAR AT 3 FEET
8	3	⊠		SAMPLER COATED WITH LIQUID HYDROCARBON AT 8 FEET
8.5			SW	GRAY FINE TO COARSE SAND WITH A TRACE OF ORGANIC MATTER AND A STRONG HYDROCARBON ODOR (LOOSE, WET)
13	8	■		
14				BORING COMPLETED AT 14.0 FEET ON 9/22/86

161-24 JAM:DMP:EL 10/8/86

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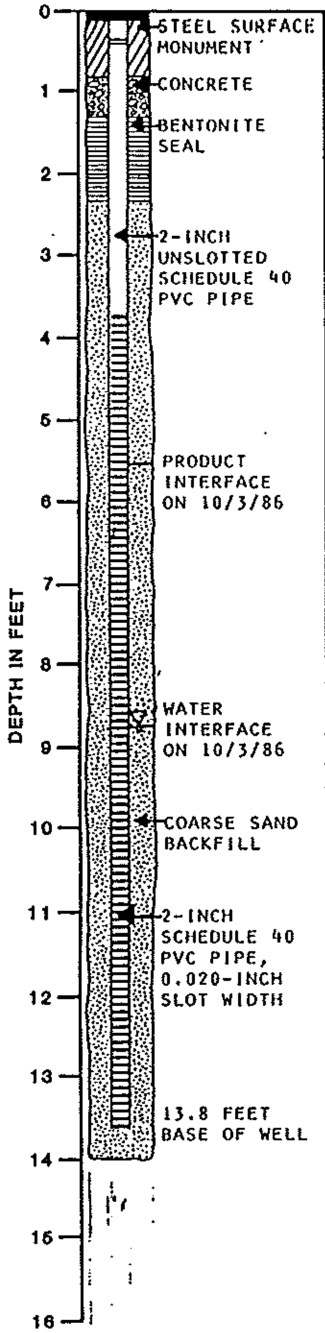
LOG OF MONITOR WELL

FIGURE A-22

MONITOR WELL NO. MW-21

WELL SCHEMATIC
Casing Elevation: 14.27
Casing Stickup: -0.23

DESCRIPTION
Surface Elevation: 14.60



Depth (ft)	Blow-Count	Samples	Group Symbol	Description
0				3 INCH ASPHALT CONCRETE PAVEMENT
0.3			SP-SM	BROWNISH GRAY FINE TO MEDIUM SAND WITH SILT AND A SLIGHT HYDROCARBON ODOR (LOOSE, MOIST) (FILL)
2.5			SW-SM	GRAY FINE TO COARSE SAND WITH SILT AND A TRACE OF GRAVEL (LOOSE, MOIST)
3.2	7	■		
7.2			SM	GRAYISH BROWN SILTY FINE TO MEDIUM SAND WITH A TRACE OF GRAVEL AND WOOD AND A SLIGHT HYDROCARBON ODOR (LOOSE, WET)
8.0	3	■		
12.0			SP	GRAY FINE TO MEDIUM SAND WITH A TRACE OF SILT (LOOSE, WET)
13.0	6	■		
14.0				BORING COMPLETED AT 14.0 FEET ON 9/22/86

161-24 JAM:DMP:EL 10/8/86

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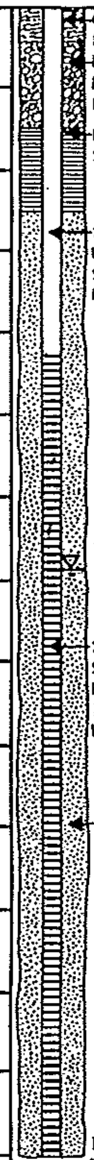
LOG OF MONITOR WELL

FIGURE A-23

MONITOR WELL NO. MW-22

WELL SCHEMATIC
Casing Elevation: 15.68
Casing Stickup: 0.89

DESCRIPTION
Surface Elevation: 14.79



Depth in Feet	Blow-Count	Samples	Group Symbol	Description
0				ORNAMENTAL BARK
1			ML	BROWN SANDY SILT WITH A TRACE OF GRAVEL (VERY SOFT, MOIST) (FILL)
2				
3	2	■		
4				
5				GRADES TO GRAY
6				
7				
8	4	■	SM	GRAY SILTY FINE TO COARSE SAND (LOOSE, WET)
9				
10				
11				
12			SW	GRAY GRAVELLY FINE TO COARSE SAND WITH A TRACE OF SILT AND ORGANIC MATTER (LOOSE, WET)
13	8	■		
14				BORING COMPLETED AT 14.0 FEET ON 9/22/86
15				
16				

161-24 JAM:DMP:EL 10/8/86

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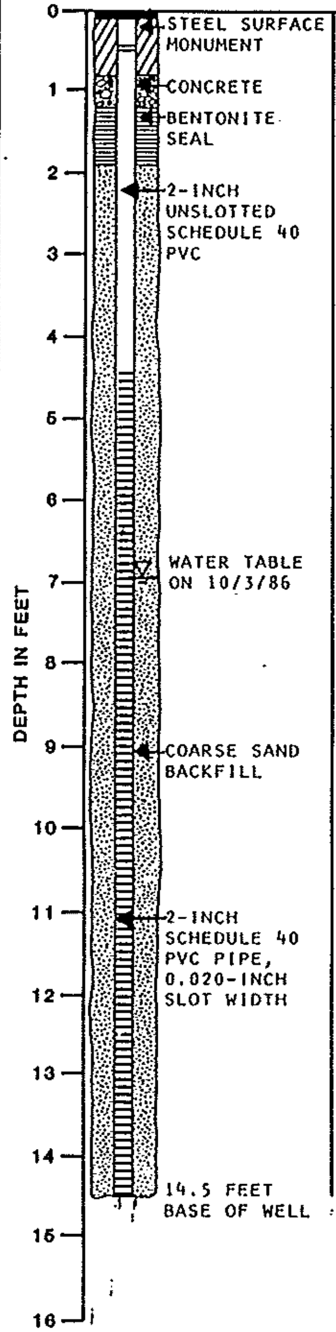
LOG OF MONITOR WELL

FIGURE A-24

MONITOR WELL NO. MW-23

WELL SCHEMATIC
Casing Elevation: 14.31
Casing Stickup: -0.40

DESCRIPTION
Surface Elevation: 14.71



Depth (feet)	Blow-Count	Samples	Group Symbol	Description
0				2 INCH CRUSHED ROCK SURFACING
				2 INCH ASPHALT CONCRETE
			ML	BROWN SANDY SILT WITH A TRACE OF GRAVEL (MEDIUM STIFF, MOIST) (FILL)
2			SM	BROWN AND GRAY SILTY FINE TO MEDIUM SAND WITH GRAVEL (VERY LOOSE, MOIST)
3	2	■		
8	5	■		GRADES TO GRAY
13.5	2	■		
14.5				BORING COMPLETED AT 14.5 FEET ON 9/23/86

161-24 JAM:DMP:EL 10/8/86

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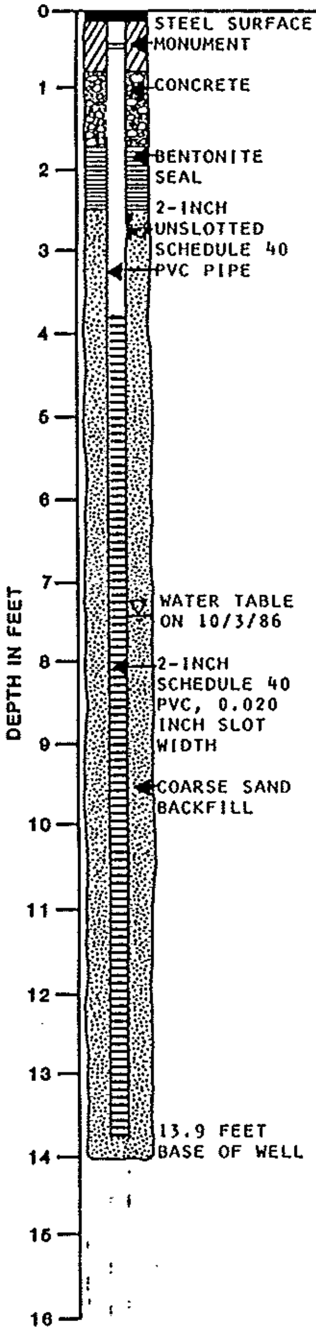
LOG OF MONITOR WELL

FIGURE A-25

MONITOR WELL NO. MW-24

WELL SCHEMATIC
Casing Elevation: 16.13
Casing Stickup: -0.33



DESCRIPTION
Surface Elevation: 16.46

Depth (feet)	Blow-Count	Samples	Group Symbol	Description
0				3 INCH ASPHALT CONCRETE PAVEMENT
0.3			SM	GRAY SILTY FINE TO MEDIUM SAND WITH GRAVEL (LOOSE, MOIST) (FILL)
2			ML	GRAY SILT AND CLAYEY SILT WITH A MODERATE HYDROCARBON ODOR (MEDIUM STIFF, MOIST) (FILL)
3.2	8	■		
8	6	■	SW-SM	GRAY FINE TO COARSE SAND WITH SILT AND A TRACE OF ORGANIC MATTER AND A STRONG HYDROCARBON ODOR (LOOSE, WET)
13	4	■		
14				BORING COMPLETED AT 14.0 FEET ON 9/23/86

161-24 10/8/86 JAM:DMP:EL

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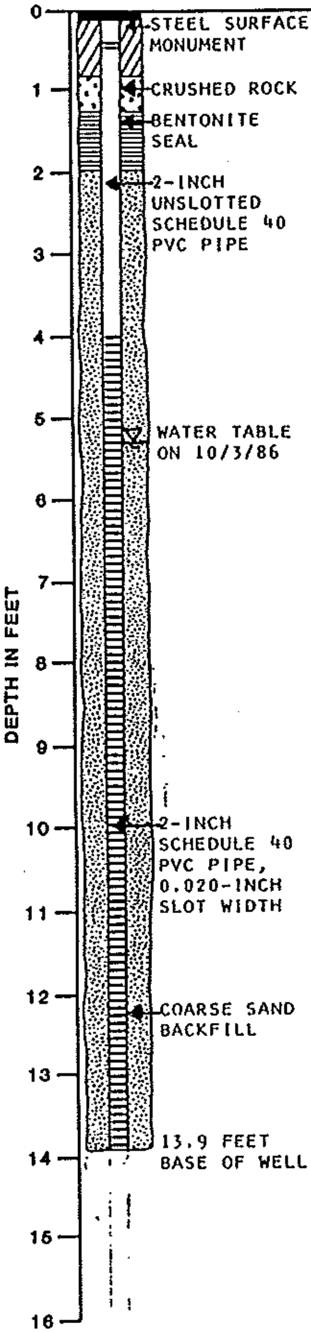
LOG OF MONITOR WELL

FIGURE A-26

MONITOR WELL NO. MW-25

WELL SCHEMATIC
Casing Elevation: 15.27
Casing Stickup: -0.27



DESCRIPTION
Surface Elevation: 15.54

Depth (feet)	Blow-Count	Samples	Group Symbol	Description
0			GP	4 INCH CRUSHED ROCK SURFACING
0.3			SM	BROWN SILTY FINE TO MEDIUM SAND (MEDIUM DENSE, MOIST) (FILL)
2			SP	GRAY FINE TO MEDIUM SAND (MEDIUM DENSE, MOIST)
3.2	27	■		
8	26	■		GRADES TO BROWN AND WET
13	36	■		GRADES TO DENSE
13.9				BORING COMPLETED AT 13.9 FEET ON 9/23/86

161-24 JAM:DMP:EL 10/8/86

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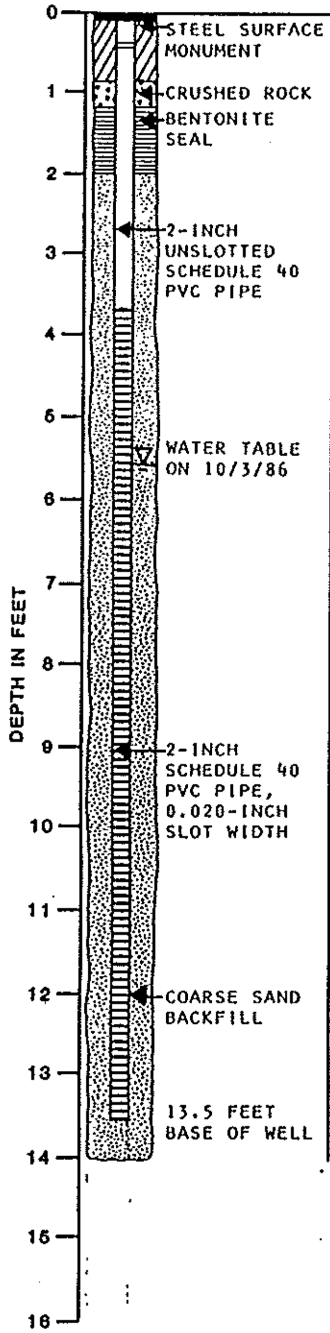
LOG OF MONITOR WELL

FIGURE A-27

MONITOR WELL NO. MW-26

WELL SCHEMATIC
Casing Elevation:15.33
Casing Stickup:-0.38



DESCRIPTION
Surface Elevation: 15.71

Depth (feet)	Blow-Count	Samples	Group Symbol	Description
0			GP	4 INCH CRUSHED ROCK SURFACING
			ML	DARK BROWN SANDY SILT (MEDIUM STIFF, MOIST) (FILL)
~1.5			SP-SM	BROWN FINE TO MEDIUM SAND WITH SILT AND A TRACE OF GRAVEL AND A SLIGHT HYDROCARBON ODOR (MEDIUM DENSE, WET)
~3.3	11	■		
~6			SW	BROWNISH GRAY FINE TO COARSE SAND WITH A TRACE OF SILT (MEDIUM DENSE, WET)
~8.2	27	■		
~12			SP-SM	BROWN FINE TO MEDIUM SAND WITH SILT AND A TRACE OF GRAVEL (DENSE, WET)
~13.1	37	■		
14				BORING COMPLETED AT 14.0 FEET ON 9/23/86

161-24 JAM:DMP:EL 10/8/86

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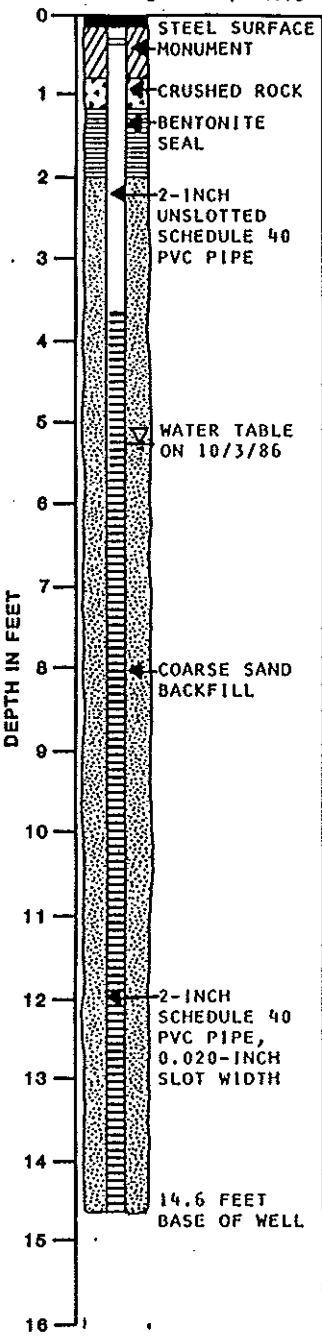
LOG OF MONITOR WELL

FIGURE A-28

MONITOR WELL NO. MW-27

WELL SCHEMATIC
Casing Elevation:14.43
Casing Stickup:-0.15

DESCRIPTION
Surface Elevation:14.58



Depth (ft)	Blow-Count	Samples	Group Symbol	Description
0			GP	4 INCH CRUSHED ROCK SURFACING
~0.3			ML	BROWN SANDY SILT WITH A TRACE OF GRAVEL (MEDIUM STIFF, MOSIT) (FILL)
~2			SM-SP	BROWNISH GRAY FINE TO MEDIUM SAND WITH SILT AND A MODERATE HYDROCARBON ODOR (LOOSE, MOIST)
~3	8	■		
~8	7	■	ML	GRAY SILT WITH A TRACE OF SAND AND A MODERATE HYDROCARBON ODOR (MEDIUM STIFF, WET)
~12.5			SM	GRAY SILTY FINE TO MEDIUM SAND WITH LENSES OF SANDY SILT (LOOSE, WET)
~13	5	■		
14.6				BORING COMPLETED AT 14.6 FEET ON 9/23/86

161-24 10/8/86 JAM:DMP:EL

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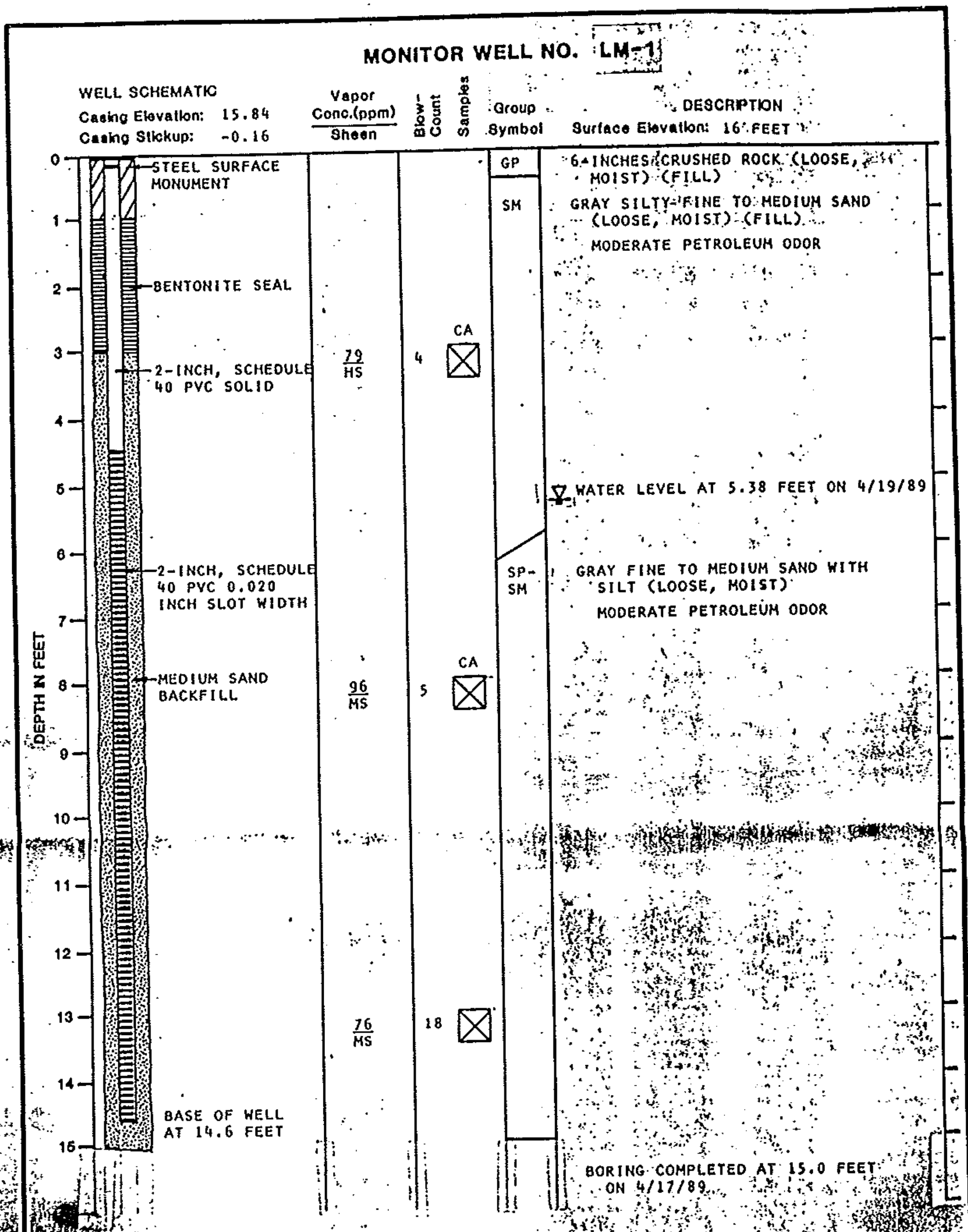
LOG OF MONITOR WELL

FIGURE A-29



Note: See figure A-2 for explanation of symbols

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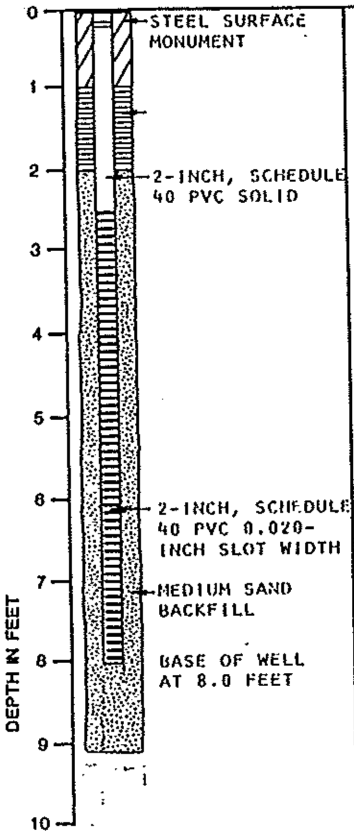
LOG OF MONITOR WELL

FIGURE A-3

GEI 108-101 161-160-4 WSL:RK:KT 5/9/89

MONITOR WELL NO. LM-2

WELL SCHEMATIC
Casing Elevation: 13.19
Casing Stickup: -0.14



Depth (ft)	Vapor Conc.(ppm) / Sheen	Blow-Count	Samples	Group Symbol	DESCRIPTION (Surface Elevation: 13.33 FEET)
0				SP	0.1 FOOT - ORGANIC DEBRIS BROWN FINE SAND WITH ROOTS AND A TRACE OF SILT (LOOSE, MOIST) (FILL)
1.5	34 / SS		CA ☒		
3.3					∇ WATER AT 3.07 FEET ON 4/19/89
3.5	110 / SS		☒	SP-SM	GRAY FINE TO MEDIUM SAND WITH SILT AND ORGANIC MATTER (LOOSE, WET) (FILL)
6.0					GRADES TO MEDIUM TO COARSE SAND AT 6.0 FEET (LOOSE, WET)
8	93 / SS		☒		
9.1					BORING COMPLETED AT 9.1 FEET ON 4/18/89

Note: See figure A-2 for explanation of symbols

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LOG OF MONITOR WELL

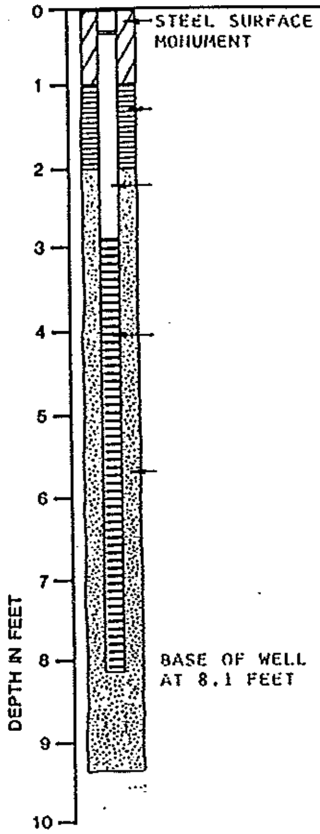
FIGURE A-4

GEI 108-101 161-160-4 WSL:RK:KT 5/8/89

MONITOR WELL NO. LM-3

WELL SCHEMATIC
Casing Elevation: 12.63
Casing Stickup: -0.26

Depth (feet)	Vapor Conc.(ppm) / Sheen	Blow-Count	Samples	Group Symbol	DESCRIPTION — Surface Elevation: 12.89 FEET
0				SP-SM	0 - 0.2 FEET ORGANIC TOPSOIL LIGHT BROWN FINE SAND WITH SILT, OCCASIONAL GRAVEL, ROOTS AND WOOD FRAGMENTS (LOOSE, MOIST) (FILL)
2	120 / MS		CA ☒		▽ WATER AT 2.38 FEET ON 4/19/89
5	93 / SS		☒		SLIGHT TO MODERATE PETROLEUM ODOR AT 5.0 FEET
8.5			☒		
9.3					BORING COMPLETED AT 9.3 FEET ON 4/18/89



Note: See figure A-2 for explanation of symbols

161-160-4 WSL:RK:KT 5/8/89

GEI 108-101

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LOG OF MONITOR WELL

FIGURE A-5

BORING NO. B-1

TEST DATA: Vapor Conc.(ppm) / Sheen	Blow-Count	Samples	Group Symbol	DESCRIPTION
26/SS	CA	☒	SP-SM	BROWN TO GRAY FINE TO MEDIUM SAND WITH SILT, GRAVEL AND OCCASIONAL COBBLES (MEDIUM DENSE, MOIST) (SOIL STOCKPILE)
84/SS	CA	☒		
62/SS		☒		
61/SS		☒		

DEPTH IN FEET: 0 – 6

BORING COMPLETED AT 4.1 FEET ON 4/19/89

GROUND WATER NOT ENCOUNTERED

Note: See Figure A-2 for Explanation of Symbols

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LOG OF BORING

FIGURE A-3

161-161-4 WSL:RK 5/8/89

BORING NO. B-2

Depth in Feet	TEST DATA: Vapor Conc.(ppm) / Sheen	Blow-Count	Samples	Group Symbol	DESCRIPTION
0	15 / NS	CA	☒	SP-SM	BROWN TO GRAY SAND WITH SILT, WOOD, GRAVEL AND OCCASIONAL COBBLES (LOOSE TO MEDIUM DENSE, MOIST) (SOIL STOCKPILE)
	51 / NS		☒		
	55 / SS		☒		
	61 / SS	CA	☒	SM	GRAY SILTY FINE SAND (MEDIUM DENSE, MOIST)
5					BORING COMPLETED AT 4.0 FEET ON 4/19/89
					GROUND WATER NOT ENCOUNTERED

Note: See Figure A-2 for Explanation of Symbols

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LOG OF BORING

FIGURE A-4

161-161-4 WSL:RK 5/8/89

BORING NO. B-3

TEST DATA: Vapor Conc.(ppm) / Sheen	Blow-Count	Samples	Group Symbol	DESCRIPTION
7/NS	CA	⊠	SP-SM	BROWN TO GRAY FINE TO MEDIUM SAND WITH SILT AND GRAVEL (LOOSE TO MEDIUM DENSE, MOIST) (SOIL STOCKPILE)
120/HS		⊠		
6/SS	CA	⊠		
				BORING COMPLETED AT 3.1 FEET ON 4/19/89
				GROUND WATER NOT ENCOUNTERED

DEPTH IN FEET: 0 – 5

Note: See Figure A-2 for Explanation of Symbols

1... -161-4 WSL:RK 5/8/89

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LOG OF BORING

FIGURE A-5

BORING NO. B-4

DEPTH IN FEET	TEST DATA: Vapor Conc.(ppm) / Sheen	Blow-Count	Samples	Group Symbol	DESCRIPTION
0	97 / NS	CA	⊠	SP	BROWN FINE TO MEDIUM SAND WITH GRAVEL, COBBLES AND A TRACE OF SILT (LOOSE, MOIST) (SOIL STOCKPILE)
	390 / MS		⊠	SP-SM	GRAY FINE TO MEDIUM SAND WITH SILT AND GRAVEL (MEDIUM DENSE, MOIST) (SOIL STOCKPILE)
	810 / MS	CA	⊠		
5					BORING COMPLETED AT 3.1 FEET ON 4/19/89
					GROUND WATER NOT ENCOUNTERED

Note: See Figure A-2 for Explanation of Symbols

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LOG OF BORING

FIGURE A-6

161-161-4 WSL:RK 5/8/89

BORING NO. B-5

TEST DATA: Vapor Conc.(ppm) / Sheen	Blow-Count	Samples	Group Symbol	DESCRIPTION
29/NS, 41/SS	CA, CA.	☒ ☒	SP-SM	BROWN FINE TO MEDIUM SAND WITH SILT, GRAVEL AND COBBLES (LOOSE TO MEDIUM DENSE) (SOIL STOCKPILE)
				BORING COMPLETED AT 1.5 FEET ON 4/19/89
				GROUND WATER NOT ENCOUNTERED

DEPTH IN FEET: 0, 5

Note: See Figure A-2 for Explanation of Symbols

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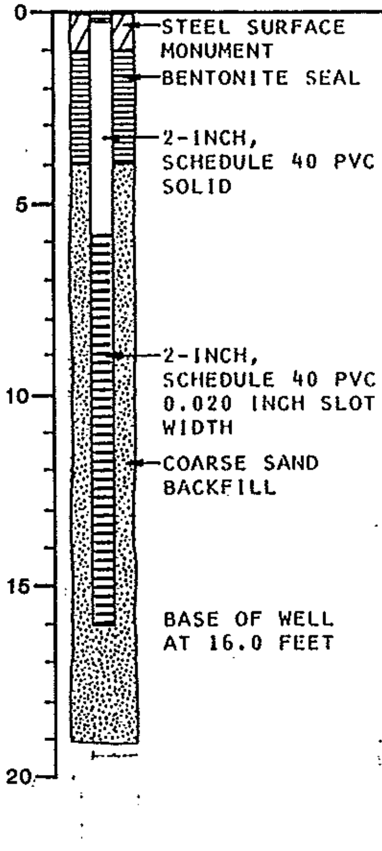
LOG OF BORING

FIGURE A-7

161-161-4 WSL:RK 5/8/89

MONITOR WELL NO. SP-1

WELL SCHEMATIC
Casing Elevation: 17.14
Casing Stickup: -.10



DESCRIPTION
Surface Elevation: 17.24 FEET

Vapor Conc.(ppm) / Sheen	Blow-Count	Samples	Group Symbol	Description
			SM	3-INCHES CRUSHED ROCK PAVING; BROWN SILTY FINE SAND WITH FINE GRAVEL (LOOSE, MOIST)
41 / SS	5	CA ⊠	SM	GRAY SILTY FINE TO MEDIUM SAND (LOOSE, MOIST)
				WATER LEVEL AT 3.79 FEET ON 4/19/89
30 / SS	12	⊠	SP	GRAY FINE TO MEDIUM SAND WITH WOOD FRAGMENTS (MEDIUM DENSE, MOIST)
87 / NS	22	CA ⊠		
61 / SS	68	⊠		GRADES TO VERY DENSE AND BECOMES WET AT 18.0 FEET

BORING COMPLETED AT 19.0 FEET ON 4/17/89

Note: See figure A-2 for explanation of symbols

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LOG OF MONITOR WELL

FIGURE A-8

GEI 109-102 161-161-4 WSL:RK 5/8/89

LOG OF TEST PIT

DEPTH BELOW GROUND SURFACE (FEET)	SOIL GROUP CLASSIFICATION SYMBOL	DESCRIPTION
		TEST PIT DP-1
0.0 - 0.5	SP	Brown fine to medium sand with gravel and silt (medium dense, moist) (fill)
0.5 - 2.0	SP	Gray fine to medium sand with gravel (medium dense to dense, moist) (fill)
2.0 - 3.0	SM	Brown silty fine to medium sand with gravel and occasional cobbles, asphalt blocks present (dense, moist)
3.0 - 5.0	SP	Gray fine to medium sand with gravel (dense, moist to wet) (fill)
		Test pit completed at 5.0 feet on 06/28/90
		Ground water seepage observed at 5.0 feet
		Sample collected at 2.0 feet
		Strong petroleum-like odor detected at 1-2 feet
		TEST PIT DP-2
0.0 - 1.5	SP	Reddish-brown fine to medium sand with silt and gravel (loose to medium dense, moist) (fill)
1.5 - 2.5	SP	Black to gray fine to medium sand with gravel (dense, moist) (fill)
2.5 - 4.0	SP	Gray fine to medium sand with silt and gravel (dense, moist) (fill)
		Test pit completed at 4.0 feet on 06/28/90
		Sample collected at 2.0 feet
		Strong petroleum-like odor detected at 1-2 feet.
		TEST PIT DP-3
0.0 - 1.0	SP	Brown fine to medium sand with gravel (loose to medium dense, moist) (fill)
1.0 - 1.5	SP	Gray fine to medium sand with silt and gravel (medium dense, moist) (fill)
1.5 - 5.0	SP	Gray to brown fine to medium sand with gravel and silt and occasional asphalt and concrete rubble (dense, moist to wet) (fill)
		Test pit completed at 5.0 feet on 06/28/90
		Moderate ground water seepage observed at 5.0 feet
		Sample collected at 2.0 feet

THE DEPTHS ON THE TEST PIT LOGS, ALTHOUGH SHOWN TO 0.1 FOOT, ARE BASED ON AN AVERAGE OF MEASUREMENTS ACROSS THE TEST PIT AND SHOULD BE CONSIDERED ACCURATE TO 0.5 FOOT.

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LOG OF TEST PIT

FIGURE A-2.

GEI 110-103

LOG OF TEST PIT

DEPTH BELOW GROUND SURFACE (FEET)	SOIL GROUP CLASSIFICATION SYMBOL	DESCRIPTION
		TEST PIT TP-1
0.0 - 5.5	ML	Brownish-gray sandy silt with occasional cobbles (medium dense, moist) (fill)
		Grades to gray at 3.0 feet
		Test pit completed at 5.5 feet on 09/04/90
		Heavy ground water seepage observed at 5.5 feet
		Disturbed soil samples obtained at 2.0 and 4.0 feet
		TEST PIT TP-2
0.0 - 4.0	SM	Brown silty sand with organics (medium dense, dry)
4.0 - 12.0	SM	Gray silty sand with cobbles and organics (medium dense, moist)
		Test pit completed at 12.0 feet on 09/04/90
		Disturbed soil samples obtained at 2.0, 4.0, 6.0, 8.0, 10.0 and 12.0 feet
		TEST PIT TP-3
0.0 - 3.0	SP-SM	Gray sand with silt and organic debris (medium dense, moist) (fil'
3.0 - 12.0	SM	Brown silty sand with organic material (medium dense, moist)
		Test pit completed at 12.0 feet on 09/04/90
		No ground water seepage observed
		Disturbed soil samples obtained at 7.0 and 12.0 feet
		TEST PIT TP-4
0.0 - 4.0	SM	Gray silty sand with gravel
		Grades to brown
4.0 - 12.0	SP	Gray fine sand (medium dense, moist)
		Test pit completed at 12.0 feet on 09/04/90
		Disturbed soil samples obtained at 2.0, 4.0, 6.0, 8.0, 10.0 and 12.0 feet

THE DEPTHS ON THE TEST PIT LOGS, ALTHOUGH SHOWN TO 0.1 FOOT, ARE BASED ON AN AVERAGE OF MEASUREMENTS ACROSS THE TEST PIT AND SHOULD BE CONSIDERED ACCURATE TO 0.5 FOOT.

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LOG OF TEST PIT

FIGURE A-3

LOG OF TEST PIT

DEPTH BELOW GROUND SURFACE (FEET)	SOIL GROUP CLASSIFICATION SYMBOL	DESCRIPTION
		TEST PIT TP-5
0.0 - 1.0	SM	Brown silty fine sand with gravel
1.0 - 6.5	SP-SM	Gray fine sand with silt and occasional gravel (medium dense, moist)
6.5 - 8.0	SM	Gray silty fine sand with occasional gravel (medium dense, moist)
8.0 - 11.0	SP-SM	Gray fine sand with silt and occasional gravel (medium dense, wet)
		Test pit completed at 11.0 feet on 09/04/90
		Ground water seepage observed at 8.0 feet
		Disturbed soil samples obtained at 2.0, 4.0, 6.0, 8.0 and 10.0 feet
		TEST PIT TP-6
0.0 - 0.3	GP	Crushed rock surface
0.3 - 1.0	SM	Brown silty fine sand with gravel (fill)
1.0 - 3.0	SP-SM	Gray fine sand with silt (medium dense, moist)
3.0 - 10.0	SM	Brown silty fine sand (medium dense, moist)
		Grades to gray with occasional gravel
		Test pit completed at 10.0 feet on 09/04/90
		Ground water seepage observed at 7.5 feet
		Disturbed soil samples obtained at 2.0, 4.0, 6.0, 8.0 and 10.0 feet
		TEST PIT TP-7
0.0 - 0.3	GP	Crushed rock surface
0.3 - 1.0	SM	Brown silty fine sand (dense, moist) (fill)
1.0 - 6.5	SM	Gray silty sand with occasional gravel (medium dense, moist)
6.5 - 9.0	ML	Gray fine sandy silt (medium stiff, moist)
9.0 - 12.0	SM	Gray silty fine sand (medium dense, wet)
		Test pit completed at 12.0 feet on 09/04/90
		Ground water seepage observed at 10.0 feet
		Disturbed soil samples obtained at 2.0, 4.0, 6.0, 8.0, 10.0 and 12.0 feet

THE DEPTHS ON THE TEST PIT LOGS, ALTHOUGH SHOWN TO 0.1 FOOT, ARE BASED ON AN AVERAGE OF MEASUREMENTS ACROSS THE TEST PIT AND SHOULD BE CONSIDERED ACCURATE TO 0.5 FOOT.

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LOG OF TEST PIT

FIGURE A-4

LOG OF TEST PIT

DEPTH BELOW GROUND SURFACE (FEET)	SOIL GROUP CLASSIFICATION SYMBOL	DESCRIPTION
		TEST PIT TP-8
0.0 - 0.3	GP	Crushed rock surface
0.3 - 10.0	SP-SM	Gray fine to medium sand with silt and occasional gravel (medium dense, moist) (fill)
		Grades to brown at 3.5 feet
		Grades to gray at 5.0 feet
		Test pit completed at 10.0 feet on 09/04/90
		Ground water seepage observed at 9.0 feet
		Disturbed soil samples obtained at 2.0, 4.0, 6.0, 8.0 and 10.0 feet
		TEST PIT TP-9
0.0 - 1.0	SM	Brown silty sand with gravel
1.0 - 3.0	ML	Gray sandy silt with gravel (fill)
3.0 - 9.0	SM	Brown silty sand with occasional gravel and organic material
9.0 - 12.0	SP	Gray fine sand
		Test pit completed at 12.0 feet on 09/06/90
		Disturbed soil samples obtained at 2.0, 4.0, 6.0, 8.0, 10.0 a 12.0 feet
		TEST PIT TP-10
0.0 - 0.3	GP	Crushed rock surface
0.3 - 1.0	SM	Brown silty fine sand with gravel and occasional cobbles (medium dense, moist) (fill)
1.0 - 3.0	SP-SM	Brown fine sand with silt and occasional gravel (medium dense, moist)
3.0 - 9.0	SM	Gray silty fine sand with organic material and occasional gravel (medium dense, moist)
		Test pit completed at 9.0 feet on 09/04/90
		Disturbed soil samples obtained at 2.0, 4.0, 6.0 and 8.0 feet

THE DEPTHS ON THE TEST PIT LOGS, ALTHOUGH SHOWN TO 0.1 FOOT, ARE BASED ON AN AVERAGE OF MEASUREMENTS ACROSS THE TEST PIT AND SHOULD BE CONSIDERED ACCURATE TO 0.5 FOOT.

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LOG OF TEST PIT

FIGURE A-5

DEPTH BELOW GROUND SURFACE (FEET)	SOIL GROUP CLASSIFICATION SYMBOL	DESCRIPTION
		TEST PIT TP-11
0.0 - 0.3	GP	Crushed rock surface
0.3 - 1.0	SM	Brown silty fine sand with gravel and cobbles (very dense, moist) (fill)
1.0 - 4.0	SP-SM	Brown fine sand with silt and gravel (medium dense, moist)
4.0 - 7.5	SM	Brown silty fine sand with organic material and occasional gravel (medium dense, moist)
7.5 - 11.0	SP-SM	Gray fine sand with silt and occasional gravel (medium dense, moist)
		Test pit completed at 11.0 feet on 09/05/90
		Disturbed soil samples obtained at 2.0, 4.0, 6.0, 8.0 and 10.0 feet
		TEST PIT TP-12
0.0 - 1.0	SM	Gray silty sand with gravel (fill)
1.0 - 5.0	SM	Brown silty sand with organic material (fill)
5.0 - 10.0	SP	Gray fine sand
		Test pit completed at 10.0 feet on 09/06/90
		Disturbed soil samples obtained at 2.0, 4.0, 6.0, 8.0 and 10.0 feet
		TEST PIT TP-13
0.0 - 0.5	SM	Gray silty gravel with sand (fill)
0.5 - 8.0	SM	Brown silty sand with organics
		Test pit completed at 8.0 feet on 09/06/90
		Disturbed soil samples obtained at 2.0, 4.0, 6.0 and 8.0 feet

THE DEPTHS ON THE TEST PIT LOGS, ALTHOUGH SHOWN TO 0.1 FOOT, ARE BASED ON AN AVERAGE OF MEASUREMENTS ACROSS THE TEST PIT AND SHOULD BE CONSIDERED ACCURATE TO 0.5 FOOT.

LOG OF TEST PIT

DEPTH BELOW GROUND SURFACE (FEET)	SOIL GROUP CLASSIFICATION SYMBOL	DESCRIPTION
		TEST PIT TP-14
0.0 - 0.5	GP	Crushed rock surface
0.5 - 1.0	SM	Brown silty fine sand with gravel (dense, moist) (fill)
1.0 - 3.5	SP-SM	Gray fine sand with silt, occasional gravel and wood fibers (medium dense, moist)
3.5 - 11.5	ML	Gray fine sandy silt with occasional wood fibers (medium stiff, moist)
11.5 - 12.0	SM	Gray fine silty sand (medium dense, wet)
		Test pit completed at 12.0 feet on 09/05/90
		Ground water seepage observed at 10.0 feet
		Disturbed soil samples obtained at 2.0, 4.0, 6.0, 8.0, 10.0 and 12.0 feet
		TEST PIT TP-15
0.0 - 0.5	GP	Crushed rock surface
0.5 - 1.0	SM	Brown silty fine sand with gravel (medium dense, moist) (fill)
1.0 - 3.5	SP-SM	Gray fine sand with silt (medium dense, moist)
3.5 - 11.0	ML	Gray fine sandy silt (medium stiff, moist)
		Test pit completed at 11.0 feet on 09/05/90
		Heavy ground water seepage observed at 10.0 feet
		Disturbed soil samples obtained at 2.0, 4.0, 6.0, 8.0 and 10.0 feet

THE DEPTHS ON THE TEST PIT LOGS, ALTHOUGH SHOWN TO 0.1 FOOT, ARE BASED ON AN AVERAGE OF MEASUREMENTS ACROSS THE TEST PIT AND SHOULD BE CONSIDERED ACCURATE TO 0.5 FOOT.

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LOG OF TEST PIT

FIGURE A-7

LOG OF TEST PIT

DEPTH BELOW GROUND SURFACE (FEET)	SOIL GROUP CLASSIFICATION SYMBOL	DESCRIPTION
		TEST PIT TP-16
0.0 - 0.5	GP	Crushed rock surface
0.5 - 3.0	SM	Brown silty fine sand with gravel (fill)
3.0 - 8.0	SP-SM	Gray fine sand with silt (medium dense, moist)
8.0 - 9.5	SM	Gray silty fine sand with occasional organic material (medium dense, wet)
9.5 - 10.0	SP	Gray fine to medium sand with a trace of silt (medium dense, wet)
		Test pit completed at 10.0 feet on 09/05/90
		Ground water seepage observed at 10.0 feet
		Disturbed soil samples obtained at 2.0, 4.0, 6.0, 8.0 and 10.0 feet
		TEST PIT TP-17
0.0 - 0.5	GP	Crushed rock surface
0.5 - 1.0	SM	Brown silty fine sand with gravel (medium dense, moist) (fill)
1.0 - 8.0	SP-SM	Gray fine sand with silt, occasional gravel and lenses of silty sand (medium dense, moist)
		Test pit completed at 8.0 feet on 09/05/90
		Ground water seepage observed at 8.0 feet
		Disturbed soil samples obtained at 2.0, 4.0, 6.0 and 8.0 feet
		TEST PIT TP-18
0.0 - 0.5	GP	Crushed rock surface
0.5 - 1.0	SM	Brown silty fine sand (medium dense, moist) (fill)
1.0 - 5.0	SP-SM	Brown fine sand with silt (medium dense, moist)
		Grades to gray at 3.0 feet
		Grades to loose at 4.0 feet
		Test pit completed at 5.0 feet on 09/05/90
		Disturbed soil samples obtained at 2.0 and 4.0 feet

THE DEPTHS ON THE TEST PIT LOGS, ALTHOUGH SHOWN TO 0.1 FOOT, ARE BASED ON AN AVERAGE OF MEASUREMENTS ACROSS THE TEST PIT AND SHOULD BE CONSIDERED ACCURATE TO 0.5 FOOT.

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LOG OF TEST PIT

FIGURE A-8

LOG OF TEST PIT

DEPTH BELOW GROUND SURFACE (FEET)	SOIL GROUP CLASSIFICATION SYMBOL	DESCRIPTION
		TEST PIT TP-19
0.0 - 0.5	GP	Crushed rock surface
0.5 - 1.0	SM	Brown silty fine sand with gravel (medium dense, moist) (fill)
1.0 - 5.0	SP-SM	Gray fine sand with silt and gravel
5.0 - 9.5	ML	Gray fine sandy silt with organic material (medium stiff, moist)
9.5 - 12.0	SM	Gray fine silty sand (medium dense, wet)
		Test pit completed at 12.0 feet on 09/05/90
		Ground water seepage observed at 10.0 feet
		Disturbed soil samples obtained at 2.0, 4.0, 6.0, 8.0, 10.0 and 12.0 feet
		TEST PIT TP-20
0.0 - 0.5	GP	Crushed rock surface
0.5 - 1.5	SM	Brown silty sand with gravel and cobbles (very dense, moist) (fill)
1.5 - 10.0	SP-SM	Gray fine sand with silt (medium dense, moist)
		Test pit completed at 10.0 feet on 09/05/90
		Ground water seepage observed at 2.0 feet
		Disturbed soil samples obtained at 2.0, 4.0, 6.0, 8.0 and 10.0 feet
		TEST PIT TP-21
0.0 - 0.5	GP	Crushed rock surface
0.5 - 1.0	SM	Brown silty fine sand with gravel (medium dense, moist) (fill)
1.0 - 3.5	SM	Gray silty fine sand (medium dense, moist)
3.5 - 9.0	CL	Gray clay with a trace of organic material (medium stiff, moist)
		Test pit completed at 9.0 feet on 09/05/90
		Disturbed soil samples obtained at 2.0 and 4.0 feet

THE DEPTHS ON THE TEST PIT LOGS, ALTHOUGH SHOWN TO 0.1 FOOT, ARE BASED ON AN AVERAGE OF MEASUREMENTS ACROSS THE TEST PIT AND SHOULD BE CONSIDERED ACCURATE TO 0.5 FOOT.

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LOG OF TEST PIT

FIGURE A-9

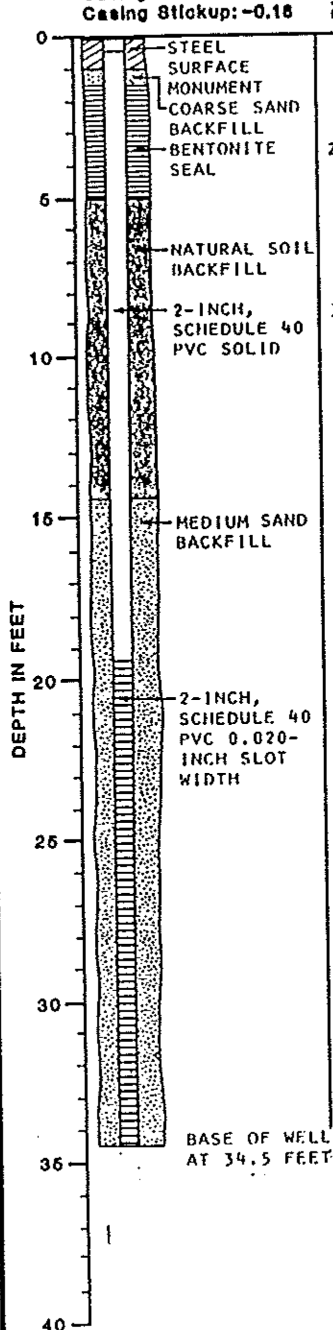
DEPTH BELOW GROUND SURFACE (FEET)	SOIL GROUP CLASSIFICATION SYMBOL	DESCRIPTION
		TEST PIT TP-22
0.0 - 0.5	GP	Crushed rock surface
0.5 - 2.0	SM	Brown silty fine sand with gravel and occasional cobbles (medium dense, moist) (fill)
2.0 - 4.5	SP	Gray fine sand with a trace of silt (medium dense, moist)
4.5 - 7.0	ML	Gray sandy silt (medium stiff, wet)
		Test pit completed at 7.0 feet on 09/05/90
		Heavy ground water seepage observed at 5.0 feet
		Disturbed soil samples obtained at 2.0, 4.0 and 6.0 feet
		TEST PIT TP-23
0.0 - 0.5	GP	Crushed rock surface
0.5 - 2.0	SM	Brown silty fine sand with gravel and cobbles (medium dense, moist) (fill)
2.0 - 5.0	SP-SM	Gray fine sand with silt (medium dense, moist)
5.0 - 6.5	SM	Brown silty sand with organic material (medium dense, moist)
6.5 - 11.0	ML	Brown to gray fine sandy silt with organics and occasional gravel (medium stiff, moist)
11.0 - 12.0	SP	Gray fine sand with silt (medium dense, moist)
		Test pit completed at 12.0 feet on 09/05/90
		Ground water seepage observed at 9.0 feet
		TEST PIT TP-24
0.0 - 0.7	GP	Crushed rock surface
0.7 - 5.5	SP-SM	Gray fine sand with silt and gravel (medium dense, moist) (fill)
5.5 - 7.5	SM	Brown silty fine sand with organic material (medium dense, moist)
7.5 - 9.0	SP-SM	Gray fine sand with silt and organic material (medium dense, moist)
		Test pit completed at 9.0 feet on 09/05/90
		Disturbed soil samples obtained at 2.0, 4.0, 6.0 and 8.0 feet

THE DEPTHS ON THE TEST PIT LOGS, ALTHOUGH SHOWN TO 0.1 FOOT, ARE BASED ON AN AVERAGE OF MEASUREMENTS ACROSS THE TEST PIT AND SHOULD BE CONSIDERED ACCURATE TO 0.5 FOOT.

MONITOR WELL NO. 1

WELL SCHEMATIC
Casing Elevation: 93.07
Casing Stickup: -0.16

DESCRIPTION
Surface Elevation: 93.25 feet



Blow-Count	Samples	Group Symbol	Description
		ML	BROWN SANDY SILT WITH GRAVEL (STIFF, MOIST) (FILL)
21	■	ML/SP	INTERBEDDED GRAY SILT AND BROWNISH-GRAY FINE SAND (MEDIUM DENSE TO VERY STIFF, MOIST)
30	■		
48	■		
		ML	GRAY SILT (HARD, MOIST)
86	■		
51	■		GRADES TO VERY STIFF
			▽ WATER LEVEL AT 26.8 ON 2/23/88
44	■		
48	■		
			BORING COMPLETED AT 34.5 FEET ON 2/11/87
			NO HYDROCARBON ODOR DETECTED

Note: See Figure A-2 for Explanation of Symbols

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LOG OF MONITOR WELL

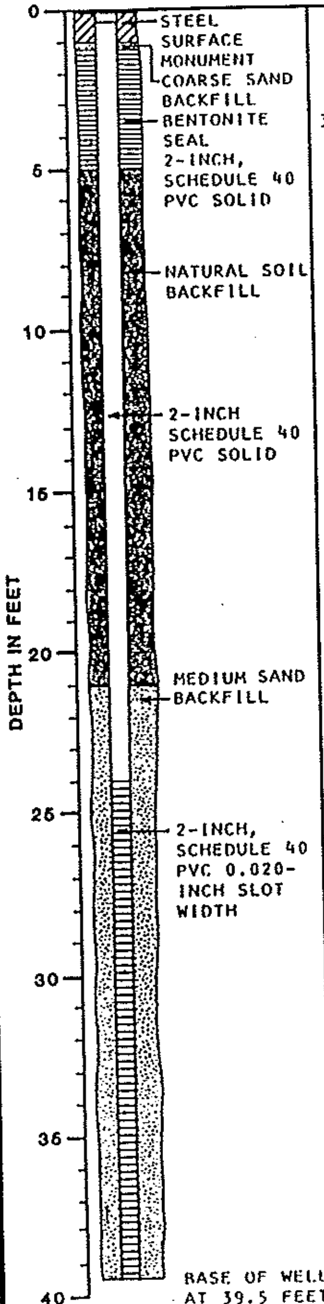
FIGURE A-3

0161-84-4   DJK:JF:TDN:EL

MONITOR WELL NO. 2

WELL SCHEMATIC
Casing Elevation:133.62
Casing Stickup: -0.32

DESCRIPTION
Surface Elevation: 133.94 feet



Blow-Count	Samples	Group Symbol	Description
		ML	BROWN SANDY SILT WITH GRAVEL (VERY STIFF, MOIST) (FILL)
38	CA ■	ML	MOTTLED GRAY AND BROWN SILT (VERY STIFF, MOIST) SLIGHT HYDROCARBON ODOR SOIL COATED WITH PETROLEUM PRODUCT AT 3.5 FEET
51	■		
51	■		GRADES TO GRAY SILT WITH LENSES OF SAND
36	■		
37	■		
41	■		▽ WATER LEVEL AT 29.6 FEET ON 2/23/88
44	■		
		ML/SP	INTERBEDDED GRAY SILT AND FINE TO MEDIUM SAND (HARD TO VERY DENSE, WET)
70/10"	■		
			BORING COMPLETED AT 39.5 FEET ON 2/12/88

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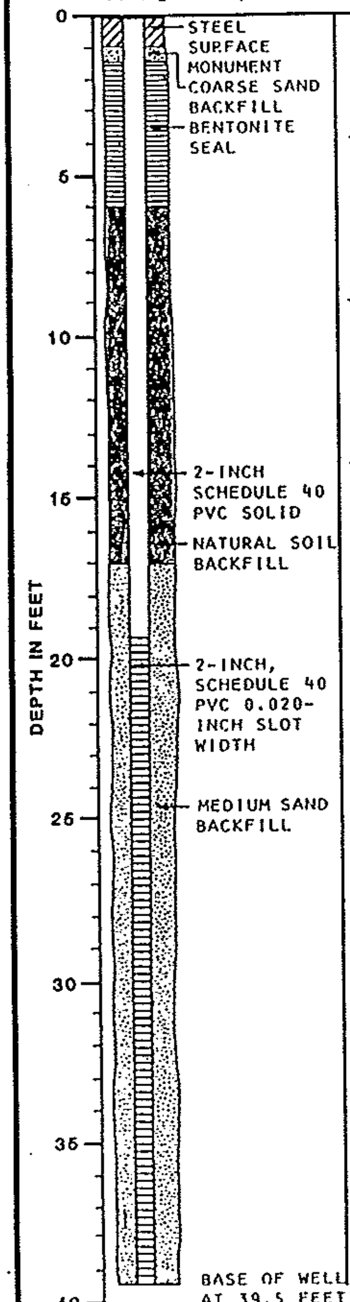
LOG OF MONITOR WELL

FIGURE A-4

0161-34-4 DJK:JF:TN:EL

MONITOR WELL NO. 3

WELL SCHEMATIC
Casing Elevation: 116.99
Casing Stickup: -0.55



DESCRIPTION
Surface Elevation: 116.57 feet

Blow-Count	Samples	Group Symbol	Description
		ML	BROWN SANDY SILT WITH GRAVEL (MEDIUM STIFF, MOIST) (FILL)
54	■		GRADES TO GRAYISH-BROWN SANDY SILT WITH OCCASIONAL GRAVEL AND VERY STIFF
50/3"	□	ML	GRAY SILT (HARD, MOIST)
50/5"	■		
56	■		GRADES TO VERY STIFF
50/4"	■	SP	BROWN MEDIUM SAND WITH COBBLES AND GRAVEL (VERY DENSE, MOIST)
72	CA ■	SP-SM	GRAY MEDIUM TO COARSE SAND WITH SILT (MEDIUM DENSE, MOIST)
77/10"	■		▽ WATER LEVEL AT 33.6 FEET ON 2/23/88 GRADES TO VERY DENSE AND WET
84	■	ML	GRAY SILT (HARD, MOIST)

BORING COMPLETED AT 39.5 FEET ON 2/15/88
NO HYDROCARBON ODOR DETECTED

0161-84-4 DJK:JF:TN:EL 02/29/88

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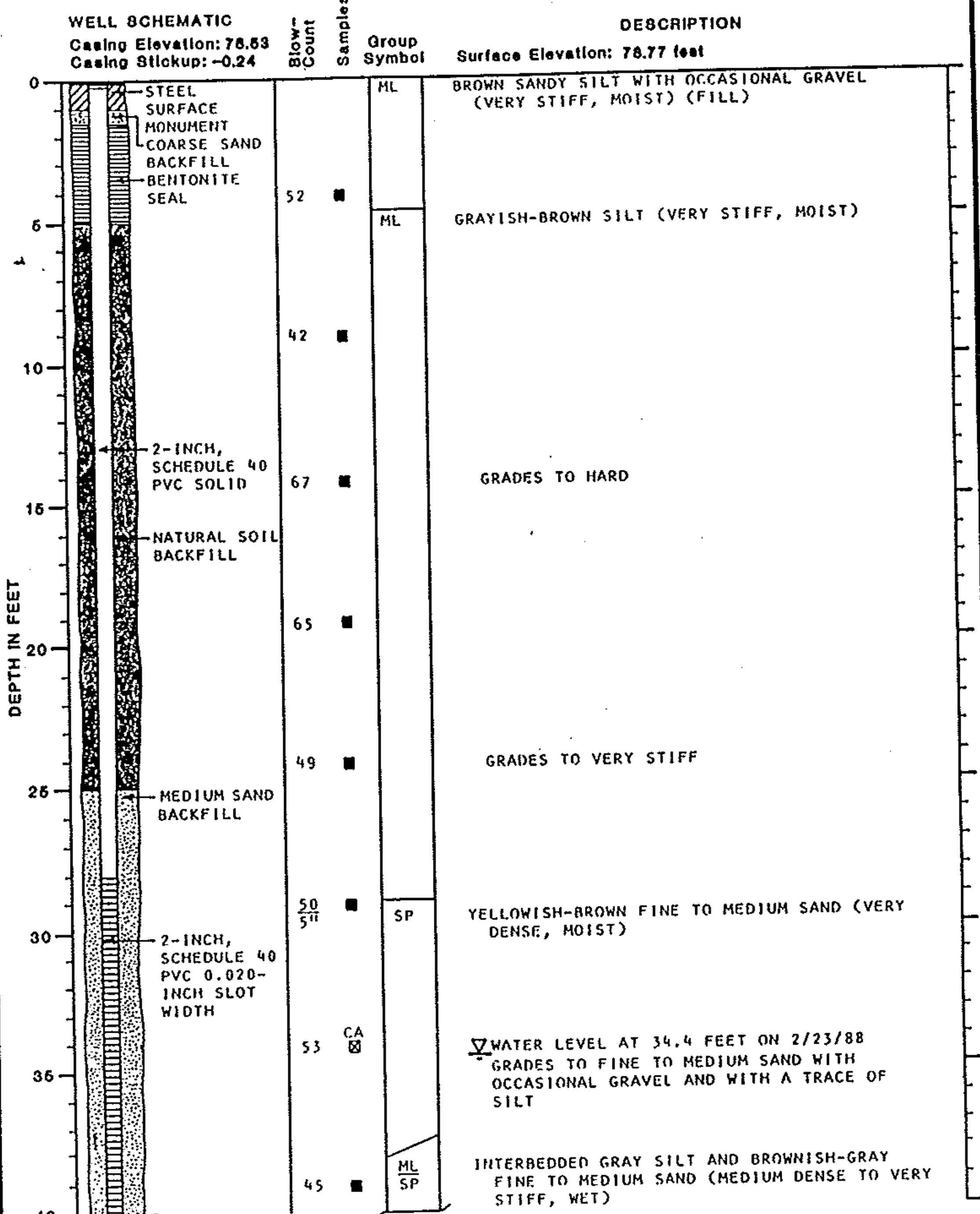
LOG OF MONITOR WELL

FIGURE A-5

MONITOR WELL NO. 4



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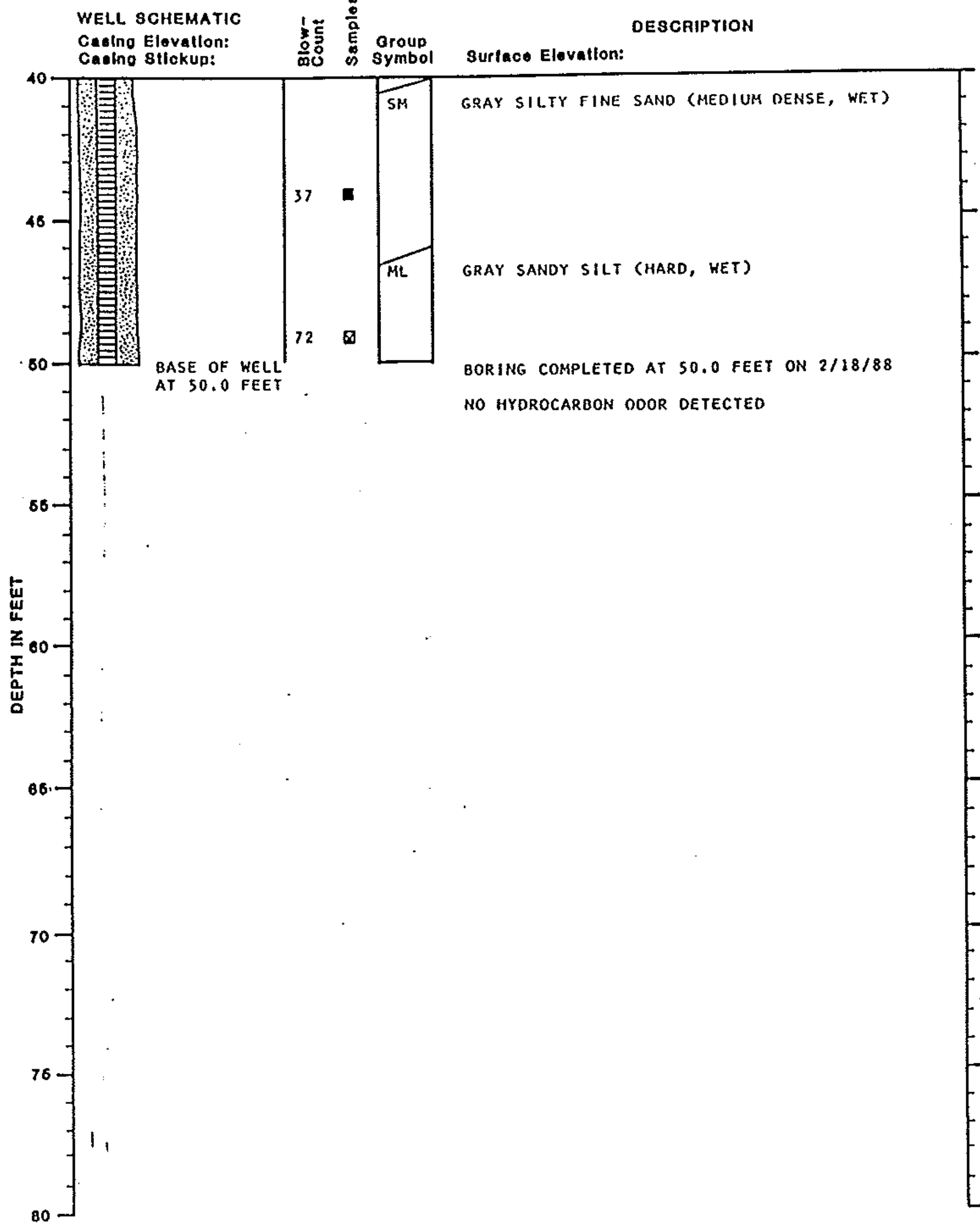
LOG OF MONITOR WELL

FIGURE A-6

02/29/88 0161-84-4 DJK:JF:TN:EL

MONITOR WELL NO. 4
(continued)



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LOG OF MONITOR WELL

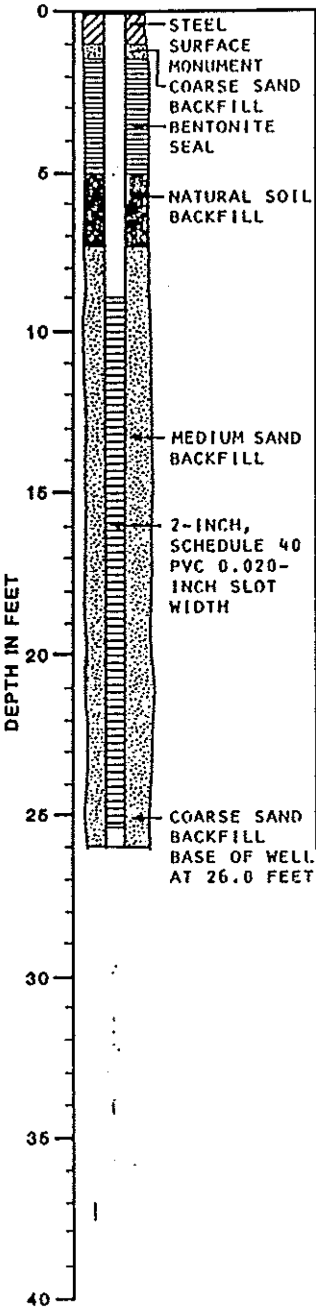
FIGURE A-7

0161-84-4 02/29/88 DJK:JF:TN:EL

MONITOR WELL NO. 5

WELL SCHEMATIC
Casing Elevation: 61.48
Casing Stickup: -0.19

Surface Elevation: 61.67 feet



Blow-Count	Samples	Group Symbol	DESCRIPTION
		ML	BROWN SANDY SILT (STIFF, MOIST)
31	■	SP-SM	BROWN FINE SAND WITH SILT (MEDIUM DENSE, MOIST)
26	■	SP	BROWN FINE TO MEDIUM SAND WITH A TRACE OF SILT (MEDIUM DENSE, MOIST)
45	CA ■		
			▽ WATER LEVEL AT 16.3 FEET ON 2/23/88
70	■		
30	■		

BORING COMPLETED AT 26.0 FEET ON 2/18/88

NO HYDROCARBON ODOR DETECTED

GeoEngineers Incorporated

LOG OF MONITOR WELL

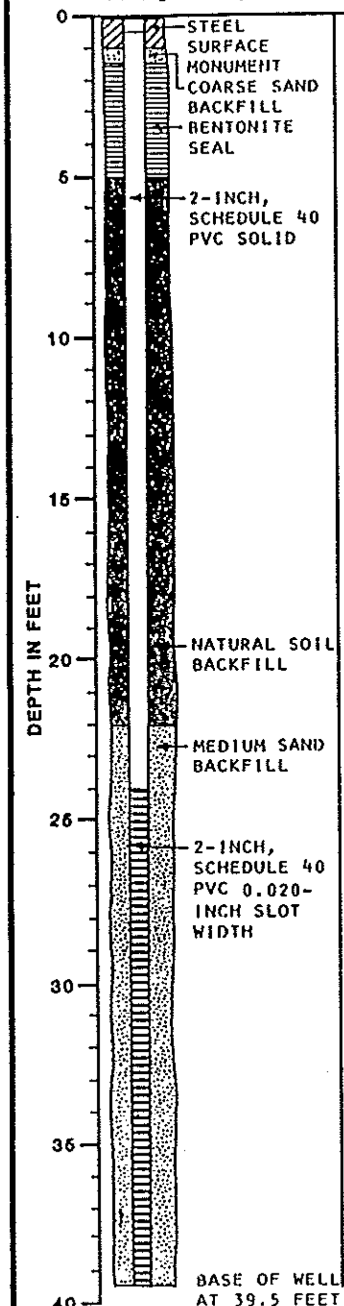
FIGURE A-8

02/29/88 0161-84-4 DJK:JF:TN:EL

MONITOR WELL NO. 6

WELL SCHEMATIC
Casing Elevation: 88.61
Casing Stickup: -0.04

DESCRIPTION
Surface Elevation: 88.65 feet



Blow Count	Samples	Group Symbol	Description
		ML	MOTTLED BROWN AND GRAY SANDY SILT WITH GRAVEL (VERY STIFF, MOIST)
45	■		
		ML/SM	INTERBEDDED GRAY SILT AND BROWNISH-GRAY SILTY FINE SAND (VERY STIFF TO MEDIUM DENSE, MOIST)
52	CA ■		
66/11"	■		GRADES TO HARD TO VERY DENSE
50/5"	■		
70/11"	■		
71	■	SP-SM	BROWN FINE SAND WITH SILT (MEDIUM DENSE, MOIST)
		SM/ML	INTERBEDDED GRAY SILTY FINE SAND AND GRAY SILT (VERY DENSE TO HARD, MOIST)
63/9"	■		
92/9"	■		

BORING COMPLETED AT 39.5 FEET ON 2/18/88

NO HYDROCARBON ODOR DETECTED

GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-9

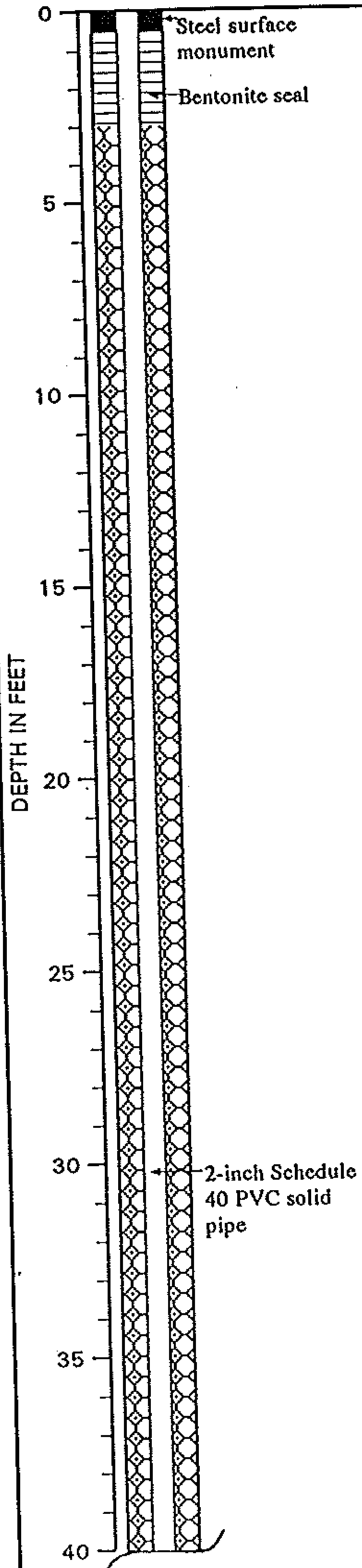
DJF:JF:TN:EL 0161-84-4 02/29/88

MONITORING WELL NO. MW-7(U)

WELL SCHEMATIC

Casing Elevation (ft.): 110.76

Casing Stickup (ft.): -0.24



DESCRIPTION

Surface Elevation (ft.): 111.00

Vapor Conc.(ppm) / Sheen	Blow Count	Samples	Group Symbol	Description
			GP	Brown coarse gravel with fine to medium sand (medium dense, moist)
			ML	Gray silt (very stiff, moist)
≤100 / NS	26	⊠		
≤100 / NS	26	⊠		
			SP-SM	Brown fine sand with silt (very dense, moist)
≤100 / SS	50	CA ⊠		
≤100 / SS	50/5"	⊠		
≤100 / SS	50/6"	⊠		
≤100 / SS	50/6"	⊠		Becomes gray
			SP	Gray fine to medium sand (very dense, moist)
≤100 / SS	50/6"	⊠		
≤100 / NS	50/6"	⊠		

Note: See Figure A-2 for explanation of symbols

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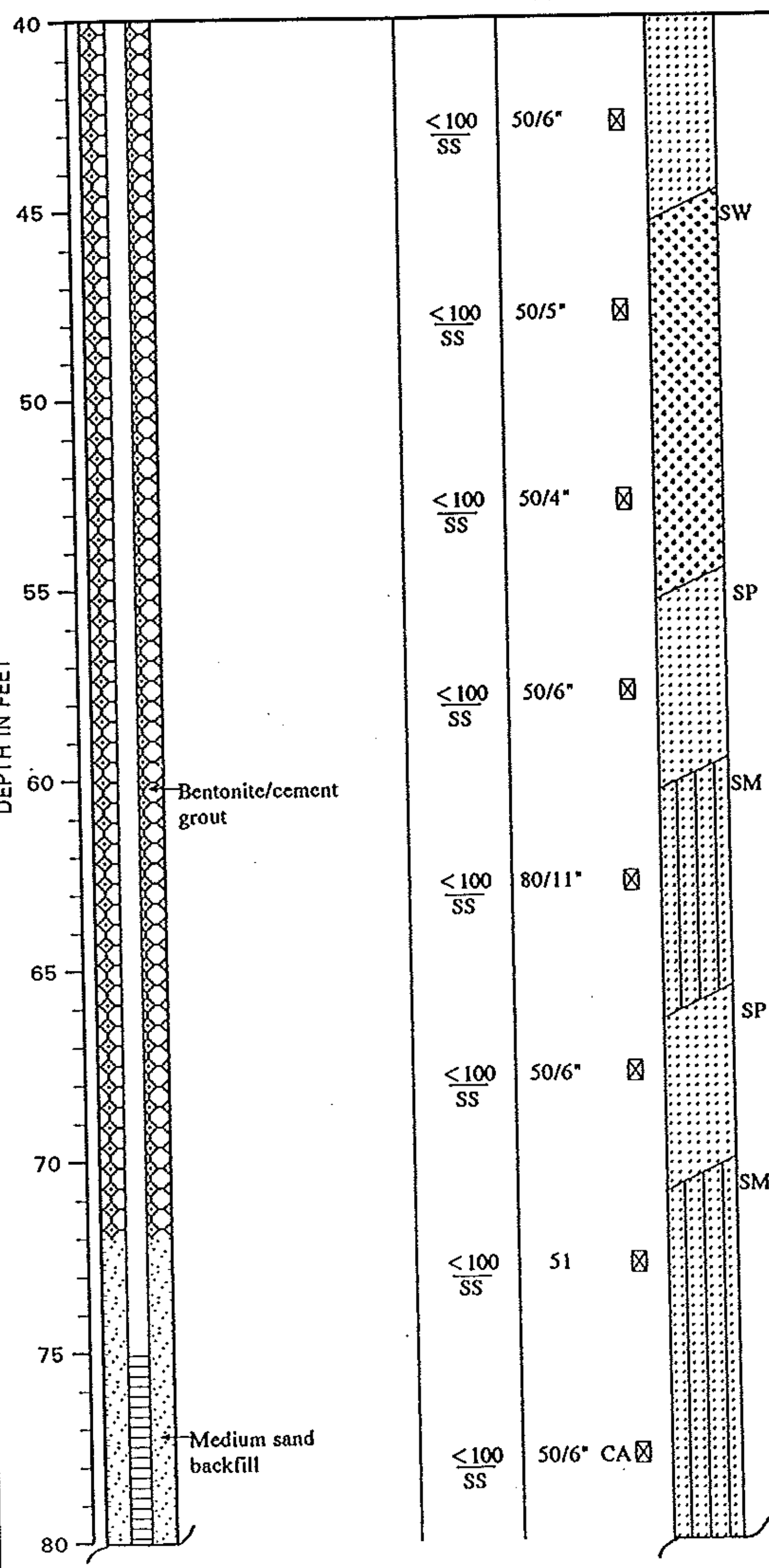
LOG OF MONITORING WELL

FIGURE A-18

31-289-R04 Tsk 1.3 :MDW:DEH:CMS 10/22/92

MONITORING WELL NO. MW-7(U)
(Continued)



Vapor Conc.(ppm) / Sheen	Blow Count	Samples	Group Symbol	DESCRIPTION
≤100 / SS	50/6"	⊠		
			SW	Gray fine to coarse sand with fine gravel (very dense, moist)
≤100 / SS	50/5"	⊠		
≤100 / SS	50/4"	⊠		
			SP	Gray fine sand (very dense, moist)
≤100 / SS	50/6"	⊠		
			SM	Brown silty fine to medium sand with organic matter (very dense, moist)
≤100 / SS	80/11"	⊠		
			SP	Brown fine to medium sand (very dense, moist)
≤100 / SS	50/6"	⊠		
			SM	Gray silty fine to medium sand (very dense, moist)
≤100 / SS	51	⊠		
				▽ Water level at 75.14 feet on 05/07/91
≤100 / SS	50/6"	CA ⊠		Occasional gravel, becomes wet

Note: See Figure A-2 for explanation of symbols

61-289-R04 Tsk 1.3 :MDW:DEH:CMS 10/22/92

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LOG OF MONITORING WELL

FIGURE A-18

DRAFT

MONITORING WELL NO. MW-7(U)
(Continued)

DEPTH IN FEET	WELL SCHEMATIC	Vapor Conc.(ppm) / Sheen	Blow Count	Samples	Group Symbol	DESCRIPTION
80	2-inch Schedule 40 PVC screen, 0.020-inch slot width	≤100 / SS	50/6"	⊠		
85			51	⊠		
90	Base of well at 90.0 feet					Boring completed at 90.0 feet on 04/30/91
95						
100						
105						
110						
115						
120						

Note: See Figure A-2 for explanation of symbols

51-289-R04 Tsk 1.3 :MDW:DEH:CMS 10/22/92

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LOG OF MONITORING WELL

FIGURE A-18

DRAFT

MONITORING WELL NO. MW-9(U)

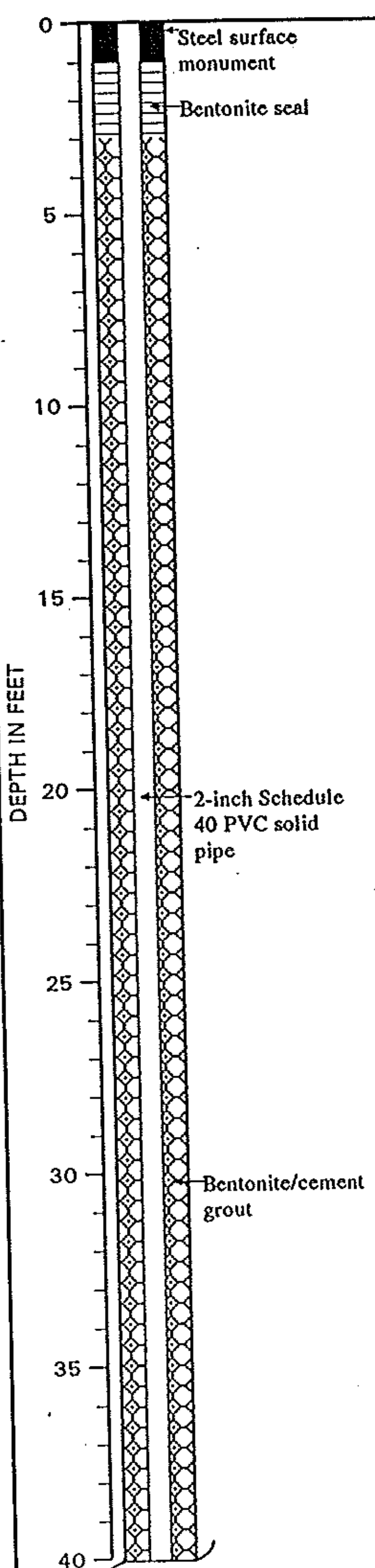
WELL SCHEMATIC

Casing Elevation (ft.): 99.29

Casing Stickup (ft.): -0.26

DESCRIPTION

Surface Elevation (ft.): 99.55



Vapor Conc.(ppm) / Sheen	Blow Count	Samples
<100 / HS	12	CA ☒
<100 / SS	24	CA ☒
<100 / NS	28	☒
<100 / NS	25	CA ☒
<100 / NS	56	☒
<100 / SS	60	☒
<100 / SS	54	☒
<100 / NS	50/6"	☒

Group Symbol	Description
SW—SM	Brown fine to coarse sand with gravel (medium dense, wet)
SM	Brown fine to medium silty sand (medium dense, wet)
ML	Gray sandy silt with occasional gravel (very stiff, moist)
SP—SM	Brown fine to medium sand with silt (very dense, moist)
GP—GM	Brown fine gravel with sand and silt (very dense, moist)

Note: See Figure A-2 for explanation of symbols

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LOG OF MONITORING WELL

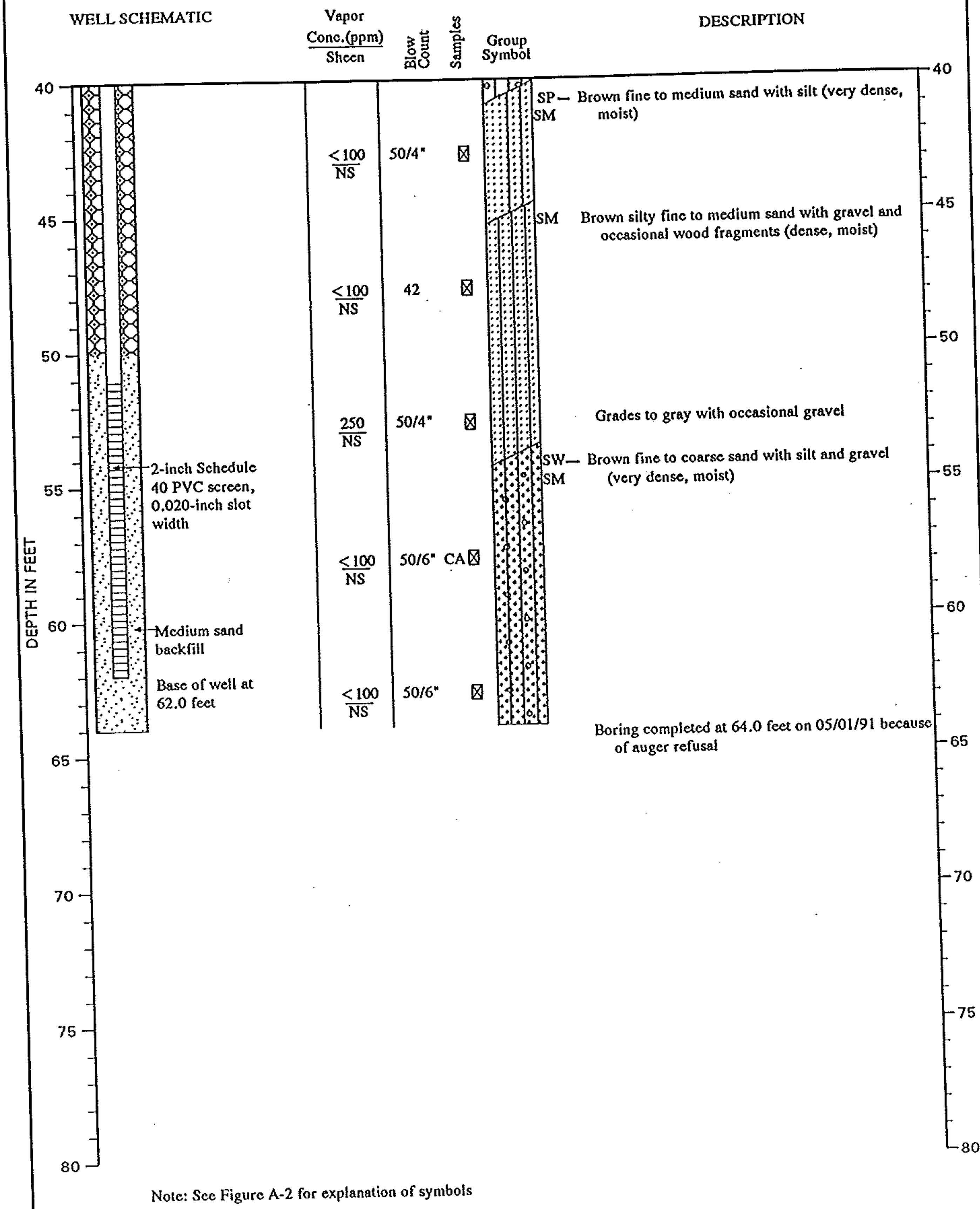
FIGURE A-19

:MDW:DEH:CMS 10/22/92

61-289-R04 Tsk 1.3

DRAFT

MONITORING WELL NO. MW-9(U)
(Continued)



Note: See Figure A-2 for explanation of symbols

61-289-R04 Tsk 1.3 :MDW:DEH:CMS 10/22/92

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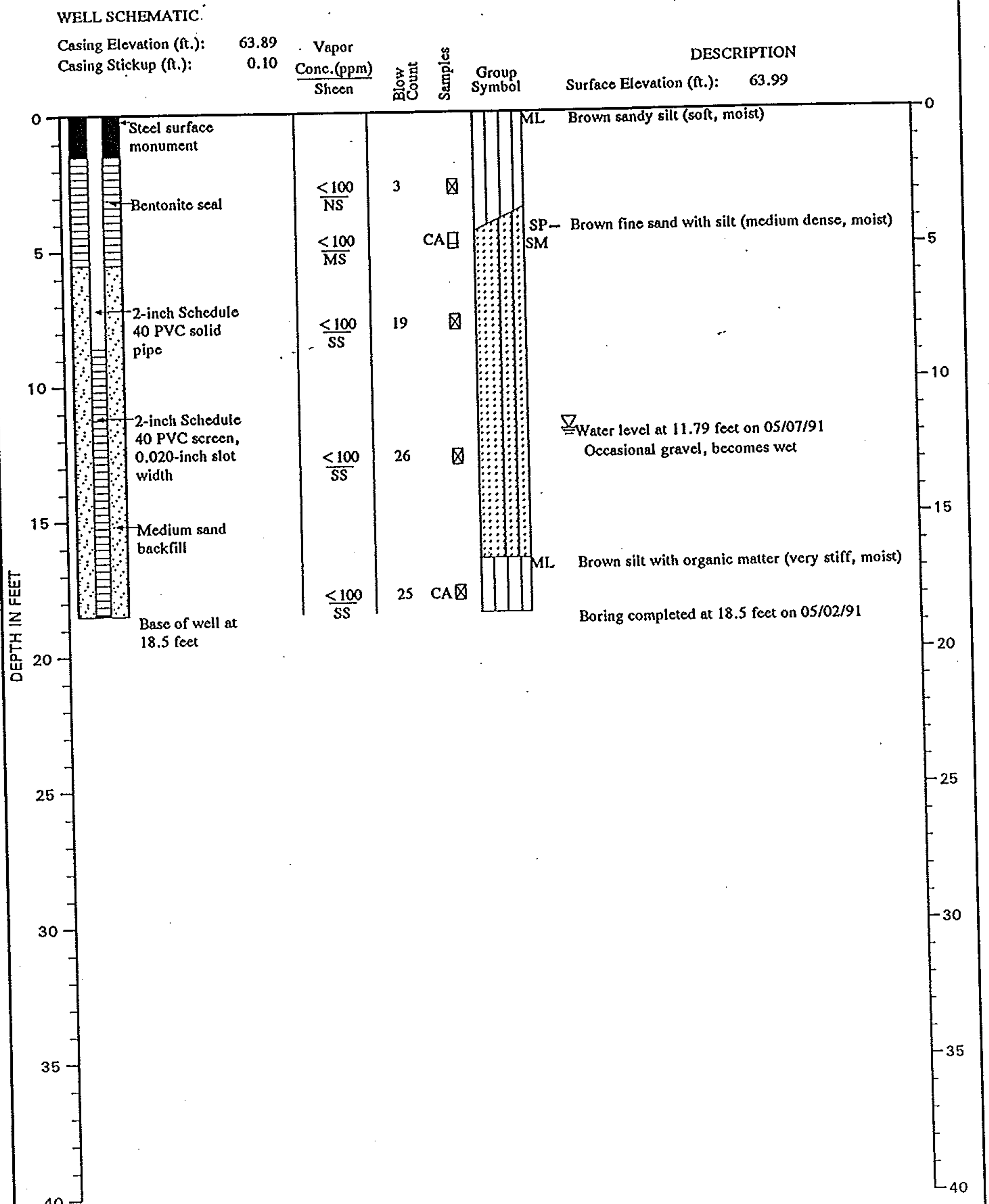
LOG OF MONITORING WELL

FIGURE A-19

DRAFT

MONITORING WELL NO. MW-10(U)



Note: See Figure A-2 for explanation of symbols

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LOG OF MONITORING WELL

FIGURE A-20

.61-289-R04 Tsk 1.3 :MDW:DEH:CMS 10/22/92

DRAFT

MONITORING WELL NO. MW-11(U)

WELL SCHEMATIC

Casing Elevation (ft.): 106.53
Casing Stickup (ft.): 0.16

DESCRIPTION
Surface Elevation (ft.): 106.69

Well schematic labels: Steel surface monument (0 to about 1.5 ft); Bentonite/cement grout; 2-inch Schedule 40 PVC solid pipe

Depth in Feet	Vapor Conc.(ppm) / Sheen	Blow Count	Samples	Group Symbol	Description
0				SP–SM	Brown fine to medium sand with silt and occasional gravel (loose, moist) (fill)
	≤100 / SS	10	CA ⊠		
about 4.5				SM	Brown silty fine sand (medium dense, moist)
	≤100 / NS	10	⊠		
	≤100 / NS	17	⊠		
	≤100 / NS	19	⊠		
	≤100 / NS	23	⊠		Occasional silt lenses
	≤100 / NS	13	⊠		
about 31	≤100 / NS	18	⊠	ML	Gray silt with fine sand (stiff, wet)
	≤100 / NS	23	⊠		Grades to very stiff
40					

Note: See Figure A-2 for explanation of symbols

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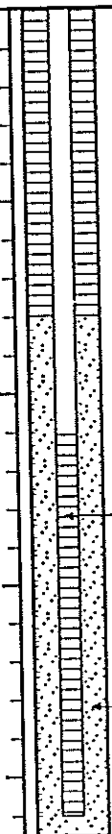
LOG OF MONITORING WELL

FIGURE A-21

.61-289-R04 Tsk 1.3 :MDW:DEH:CMS 10/22/92

MONITORING WELL NO. MW-11(U)
(Continued)

WELL SCHEMATIC



DEPTH IN FEET (40–80)

Vapor Conc.(ppm) / Sheen	Blow Count	Samples	Group Symbol	DESCRIPTION
≤100 / SS	59	CA ⊠	SP	Brown fine to medium sand (very dense, moist)
≤100 / NS	64	⊠	SP-SM	Gray fine sand with silt (very dense, moist)
			SW	Brown fine to coarse sand with gravel (very dense, moist)
≤100 / NS	50/6"	⊠		Water level at 52.43 feet on 05/07/91
≤100 / NS	50/6"	⊠	GW-GM	Brown fine to coarse gravel with sand and silt (very dense, wet)
≤100 / NS	50/6"	⊠		Boring completed at 61.5 feet on 05/01/91

Note: See Figure A-2 for explanation of symbols

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LOG OF MONITORING WELL

FIGURE A-21

:MDW:DEH:CMS 10/22/92

.61-289-R04 Tsk 1.3

DRAFT

MONITORING WELL NO. MW-13(U)

WELL SCHEMATIC

Casing Elevation (ft.): 52.19

Casing Stickup (ft.): -0.37

Surface Elevation (ft.): 52.56

Well schematic (DEPTH IN FEET):
- Steel surface monument
- Bentonite seal
- 2-inch Schedule 40 PVC solid pipe
- 2-inch Schedule 40 PVC screen, 0.020-inch slot width
- Medium sand backfill
- Base of well at 24.0 feet

Vapor Conc.(ppm) / Sheen	Blow Count	Samples
<100 / NS	24	CA ⊠
<100 / NS	7	⊠
<100 / SS	72	⊠
<100 / SS	24	CA ⊠
<100 / NS	66	⊠

Group Symbol	DESCRIPTION
	Asphalt concrete
SP-SM	Brown fine to medium sand with silt, organic matter and occasional gravel (medium dense, moist)
ML	Mottled orange and brown silt with occasional organic matter (medium stiff, moist)
SP-SM	Brown fine to medium sand with silt (very dense, moist)
	∇ Water level at 17.20 feet on 05/07/91
	Becomes coarser, grades to medium dense
	Becomes very dense, wet
	Boring completed at 25.0 feet on 04/29/91

Note: See Figure A-2 for explanation of symbols

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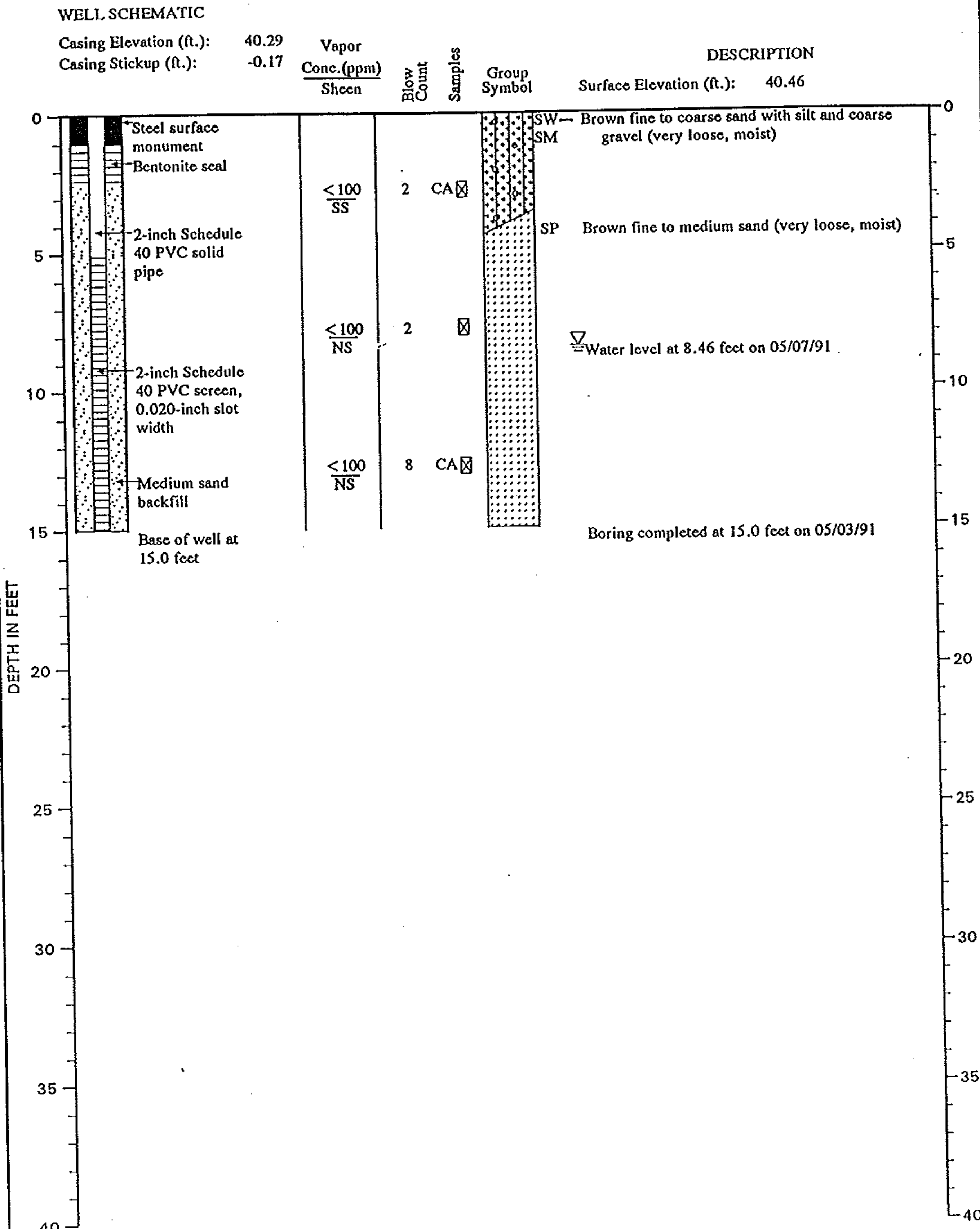
LOG OF MONITORING WELL

FIGURE A-22

.61-289-R04 Tsk 1.3 :MDW:DEH:CMS 10/22/92

DRAFT

MONITORING WELL NO. MW-27



Note: See Figure A-2 for explanation of symbols

:MDW:DEH:CMS 10/22/92

51-289-R04 Tsk 1.3

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LOG OF MONITORING WELL

FIGURE A-23

DRAFT

MONITORING WELL NO. MW-28

WELL SCHEMATIC

Casing Elevation (ft.): 39.71
Casing Stickup (ft.): -0.19

Surface Elevation (ft.): 39.90

Well schematic labels (depth in feet):
- Steel surface monument
- Bentonite seal
- 2-inch Schedule 40 PVC solid pipe
- 2-inch Schedule 40 PVC screen, 0.020-inch slot width
- Medium sand backfill
- Base of well at 15.0 feet
- Natural soil backfill

Depth (ft)	Vapor Conc.(ppm) / Sheen	Blow Count	Samples	Group Symbol	Description
0				SW–SM	Brown fine to coarse sand with silt and gravel (medium dense, moist)
~2.5	<100 / SS	12	⊠		
~7.5	200 / NS	5	CA ⊠		∇ Grades to loose and becomes wet; Water level at 7.85 feet on 05/07/91
~12.5	400 / NS	8	CA ⊠		
~17.5	150 / NS	26	⊠		Grades to medium dense
18.5					Boring completed at 18.5 feet on 05/03/91

DEPTH IN FEET: 0, 5, 10, 15, 20, 25, 30, 35, 40

Note: See Figure A-2 for explanation of symbols

:MDW:DEH:CMS 10/23/92

161-289-R04 Tsk 1.3

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LOG OF MONITORING WELL

FIGURE A-24

DRAFT

MONITORING WELL NO. MW-29

WELL SCHEMATIC

Casing Elevation (ft.): 38.15
Casing Stickup (ft.): -0.38

Surface Elevation (ft.): 38.53

Depth (ft)	Well Schematic	Vapor Conc.(ppm) / Sheen	Blow Count	Samples	Group Symbol	Description
0	Steel surface monument; Bentonite seal				SW-SM	Brown fine to coarse sand with silt and gravel (medium dense, moist)
~3		<100 / SS	17	⊠		
~5	2-inch Schedule 40 PVC solid pipe				SP	Gray fine to medium sand with gravel (medium dense, wet)
~7						∇ Water level at 7.21 feet on 05/07/91
~8		<100 / SS	16	CA ⊠		
~10	2-inch Schedule 40 PVC screen, 0.020-inch slot width				SM	Gray silty fine to coarse sand with gravel (medium dense, wet)
~13	Medium sand backfill	<100 / NS	12	CA ⊠		
15	Base of well at 15.0 feet					Boring completed at 15.0 feet on 05/03/91

DEPTH IN FEET (scale 0–40)

Note: See Figure A-2 for explanation of symbols

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LOG OF MONITORING WELL

FIGURE A-25

:MDW:DEH:CMS 10/22/92

.61-289-R04 Tsk 1.3

LOG OF HAND BORING

DEPTH BELOW GROUND SURFACE (FEET)	GROUP SOIL CLASSIFICATION SYMBOL	DESCRIPTION
		<u>HAND BORING HA-1</u>
0 - 0.6	ML	BROWNISH GRAY SILT (SOFT, MOIST)
0.6 - 2.5	ML	GRAY SILT (HARD, MOIST)
		MODERATE HYDROCARBON ODOR FROM 0.6 TO 1.0 FEET
		SLIGHT HYDROCARBON ODOR FROM 1.0 TO 2.0 FEET
		SOIL VISIBLY STAINED BY PRODUCT FROM 0.6 TO 1.6 FEET
		SEEPAGE AT 1.25 FEET
		HAND BORING COMPLETED AT 2.5 FEET ON 2/11/88
		SAMPLES OBTAINED AT 1.0 AND 2.5 FEET
		<u>HAND BORING HA-2</u>
0 - 0.4	AC	ASPHALTIC CONCRETE
0.4 - 1.3	ML	BROWN SANDY SILT (STIFF, WET)
1.3 - 3.6	SM	GRAY SILTY FINE TO MEDIUM SAND (DENSE, MOIST TO WET)
		GRAVEL AT 3.4 FEET
		SEEPAGE AT 0.5 FEET
		HAND BORING COMPLETED AT 3.6 FEET ON 2/11/88
		NO HYDROCARBON ODOR DETECTED
		SAMPLES OBTAINED AT 1.0 AND 3.6 FEET
		<u>HAND BORING HA-3</u>
0 - 3.0	SP	BROWN FINE TO MEDIUM SAND WITH A TRACE OF SILT (MEDIUM DENSE, MOIST)
		CHUNKS OF ASPHALT AT 0.5 FEET
3.0 - 3.5	SP	GRAYISH BROWN COARSE SAND WITH OCCASIONAL GRAVEL AND A TRACE OF SILT (VERY DENSE, MOIST)
		HAND BORING COMPLETED AT 3.5 FEET ON 2/11/88
		NO HYDROCARBON ODOR DETECTED
		SAMPLES OBTAINED AT 1.0 AND 3.5 FEET
		<u>HAND BORING HA-4</u>
0 - 0.5	GP	BROWN SANDY COARSE GRAVEL WITH COBBLES (DENSE, MOIST)
0.5 - 3.0	SM	GRAYISH-BROWN SILTY FINE TO MEDIUM SAND WITH LENSES OF SANDY SILT (DENSE, MOIST)
		GRADES TO SILTY SAND WITH OCCASIONAL GRAVEL AND VERY DENSE AT 2.5 FEET
		HAND BORING COMPLETED AT 3.0 FEET ON 2/11/88
		NO HYDROCARBON ODOR DETECTED
		SAMPLES OBTAINED AT 1.0 AND 3.0 FEET

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LOG OF HAND BORING

FIGURE A-10

LOG OF HAND BORING

DEPTH BELOW GROUND SURFACE (FEET)	GROUP SOIL CLASSIFICATION SYMBOL	DESCRIPTION
		HAND BORING HA-5
0 - 0.3	SM	DARK BROWN SILTY FINE SAND (LOOSE, MOIST)
0.3 - 4.0	SP-SM	BROWN FINE SAND WITH SILT (LOOSE, MOIST)
4.0 - 4.5	SP	GRAY FINE TO MEDIUM SAND (LOOSE, MOIST)
4.5 - 8.0	ML	GRAY SILT WITH LENSES OF FINE SAND AND A TRACE OF ORGANIC MATERIAL (STIFF, MOIST)
		MODERATE HYDROCARBON ODOR FROM 4.0 TO 7.5 FEET
		SLIGHT HYDROCARBON ODOR FROM 7.5 TO 8.0 FEET
		BECOMES WET AT 5.8 FEET
		HAND BORING COMPLETED AT 8.0 FEET ON 2/11/88
		2-INCH SLOTTED PVC PIPE INSTALLED FROM 3.0 TO 8.0 FEET WITH 2-INCH UNSLOTTED PVC PIPE FROM ABOVE GROUND SURFACE TO 3.0 FEET
		SAMPLES OBTAINED AT 1.0, 4.0 AND 5.5 FEET
		HAND BORING HA-6
0 - 0.7	SM/AC	BROWN SILTY FINE TO MEDIUM SAND INTERBEDDED WITH LAYERS OF ASPHALTIC CONCRETE (MEDIUM DENSE, MOIST)
0.7 - 4.0	ML	GRAY SILT (STIFF, MOIST)
4.0 - 5.0	SM	BROWN SILTY MEDIUM SAND (LOOSE, MOIST)
5.0 - 5.5	ML	GRAY SANDY SILT (STIFF, MOIST)
		SLIGHT HYDROCARBON ODOR FROM 0.7 TO 3.5 FEET
		HAND BORING COMPLETED AT 5.5 FEET ON 2/11/88
		SAMPLES OBTAINED AT 1.0 AND 5.5 FEET
		HAND BORING HA-7
0 - 1.0	SP-SM	BROWN COARSE SAND WITH SILT AND CHUNKS OF ASPHALT (DENSE, MOIST)
1.0 - 4.0	SM	BROWNISH-GRAY SILTY MEDIUM SAND (DENSE, MOIST)
		GRADES TO GRAY SILTY FINE TO MEDIUM SAND AT 1.5 FEET
		TRACE OF ORGANIC MATERIAL AT 3.0 FEET
		SLIGHT HYDROCARBON ODOR FROM 1.5 TO 3.5 FEET
		HAND BORING COMPLETED AT 4.0 FEET ON 2/11/88
		SAMPLES OBTAINED AT 1.0 AND 3.0 FEET

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LOG OF HAND BORING

FIGURE A-11

LOG OF HAND BORING

DEPTH BELOW GROUND SURFACE (FEET)	GROUP SOIL CLASSIFICATION SYMBOL	DESCRIPTION
		HAND BORING HA-8
0 - 0.6	SP	BROWN MEDIUM SAND WITH A TRACE OF SILT AND OCCASIONAL GRAVEL (DENSE, MOIST)
0.6 - 2.0	ML	BROWN SANDY SILT WITH OCCASIONAL GRAVEL AND CHUNKS OF ASPHALT (STIFF, MOIST)
2.0 - 2.5	ML	GRAY SILT (HARD, MOIST TO WET)
		SLIGHT HYDROCARBON ODOR AT 0.7 FEET
		MODERATE HYDROCARBON ODOR FROM 2.0 TO 2.5 FEET
		SEEPAGE AT 1.0 FEET
		HAND BORING COMPLETED AT 4.0 FEET ON 2/12/88
		SAMPLES OBTAINED AT 1.0 AND 2.5 FEET
		HAND BORING HA-9
0 - 0.5	SP	BROWN MEDIUM SAND WITH OCCASIONAL GRAVEL AND CHUNKS OF ASPHALT (DENSE, MOIST)
0.5 - 4.0	ML	GRAYISH-BROWN SILT WITH A TRACE OF SAND (VERY STIFF, MOIST)
		SOIL PARTICLES COATED WITH PRODUCT AT 2.0 FEET
		MODERATE HYDROCARBON ODOR FROM 1.5 TO 2.0 FEET
		HAND BORING COMPLETED AT 4.0 FEET ON 2/12/88
		SAMPLES OBTAINED AT 1.0, 2.0 AND 4.0 FEET
		HAND BORING HA-10
0 - 0.4	SP-SM	BROWN MEDIUM SAND WITH SILT (LOOSE, MOIST)
0.4 - 3.0	ML	BROWN SANDY SILT WITH A TRACE OF ORGANIC MATERIAL (STIFF, MOIST)
		GRADES TO BROWNISH-GRAY SILT AND HARD AT 1.0 FEET
		VERY SLIGHT HYDROCARBON ODOR AT 1.5 FEET
		HAND BORING COMPLETED AT 3.0 FEET ON 2/12/88
		SAMPLES OBTAINED AT 1.0 AND 3.0 FEET
		HAND BORING HA-11
0 - 0.5	SM	DARK BROWN SILTY MEDIUM TO COARSE SAND (DENSE, MOIST)
0.5 - 1.3	SP-SM	BROWN MEDIUM SAND WITH SILT (DENSE, MOIST)
1.3 - 3.0	ML	GRAYISH-BROWN SANDY SILT WITH LENSES OF SAND (HARD, MOIST)
3.0 - 3.9	SP-SM	BROWN MEDIUM SAND WITH SILT (MEDIUM DENSE, MOIST TO WET)
3.9 - 4.2	ML	GRAYISH-BROWN SILT WITH A TRACE OF SAND (HARD, MOIST)
		SEEPAGE AT 1.0 AND 3.0 FEET
		HAND BORING COMPLETED AT 4.2 FEET ON 2/12/88
		NO HYDROCARBON ODOR DETECTED
		SAMPLES OBTAINED AT 1.0 AND 3.9 FEET

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LOG OF HAND BORING

FIGURE A-12

0161-84-4 JF: JAM: TDW: CS 3/9/88

LOG OF HAND BORING

DEPTH BELOW GROUND SURFACE (FEET)	GROUP SOIL CLASSIFICATION SYMBOL	DESCRIPTION
		HAND BORING HA-12
0 - 0.4	GP	GRAY COARSE GRAVEL (MEDIUM DENSE, MOIST)
0.4 - 0.5	AC	ASPHALTIC CONCRETE
0.5 - 7.2	SP	BROWN FINE TO MEDIUM SAND WITH A TRACE OF SILT (MEDIUM DENSE, MOIST)
		HAND BORING COMPLETED AT 7.2 FEET ON 2/12/88
		NO HYDROCARBON ODOR DETECTED
		2-INCH SLOTTED PVC PIPE INSTALLED FROM 2.2 TO 7.2 FEET WITH 2-INCH UNSLOTTED PVC PIPE FROM ABOVE GROUND SURFACE TO 2.2 FEET
		SAMPLES OBTAINED AT 1.0 AND 7.2 FEET

0161-84-4 TF:JAM:TDN:CS 31288

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LOG OF HAND BORING

FIGURE A-13

HAND BORING HA-13

TEST DATA

Depth (feet)	Sheen	Vapor Conc. (ppm)	Other Tests	Blow Count	Samples	Group Symbol	DESCRIPTION Surface Elevation (ft.):
0						SP	Brown fine to medium sand with a trace of silt (loose, moist)
1	SS	40	CA		⊠		
2	NS	20			⊠		
3							
3.5	NS	20			⊠		
4							Boring completed at 4.25 feet on 05/03/91 Ground water encountered from 2.0 to 4.25 feet Loose sand caving into hole limited depth to 4.25 feet

DEPTH IN FEET (scale 0–16)

Note: See Figure A-2 for explanation of symbols

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LOG OF HAND BORING

FIGURE A-3

TEST DATA

HAND BORING HA-14

Depth (ft)	Sheen	Vapor Conc. (ppm)	Other Tests	Blow Count	Samples	Group Symbol	DESCRIPTION Surface Elevation (ft.):
0						SP	Brown fine to medium sand with a trace of silt (loose, moist)
1	NS	30	CA		☒		
2	NS	20			☒		
3	NS	20			☒		
4	NS	20			☒		

Hand boring completed at 4.5 feet on 05/03/91
Ground water observed from 2.5 to 4.5 feet
Loose sand caving into hole limited depth to 4.5 feet

DEPTH IN FEET: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Note: See Figure A-2 for explanation of symbols

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LOG OF HAND BORING

FIGURE A-4

0101-269-R04 Tsk 1.3 :MDW:DEH:CMS 10/22/92

TEST DATA

HAND BORING HA-15

DESCRIPTION

Surface Elevation (ft.):

Depth (ft)	Sheen	Vapor Conc. (ppm)	Other Tests	Blow Count	Samples	Group Symbol	Description
0						GP	Coarse gravel with fine to medium sand (loose, moist)
0.5						SM	Brown silty fine to medium sand with gravel (loose, moist)
1	NS	<20			X		
2	NS	20			X		
3	NS	20	CA		X		
3.5						ML	Gray sandy silt (medium stiff, moist)
4	NS	20			X		
5	NS	20			X		

Hand boring completed at 5.5 feet on 04/29/91
Ground water seepage observed at 4.5 feet

DEPTH IN FEET

Note: See Figure A-2 for explanation of symbols

0161-289-R04 Tsk 1.3 MDW:DEH:CMS 10/22/92

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LOG OF HAND BORING

FIGURE A-5

TEST DATA

HAND BORING HA-16

Depth (ft)	Sheen	Vapor Conc. (ppm)	Other Tests	Blow Count	Samples	Group Symbol	DESCRIPTION Surface Elevation (ft.):
0						SW	Brown fine to coarse sand with occasional gravel and a trace of silt (loose, moist)
1	SS	70			⊠		
2	HS	200	CA		⊠		Grades to gray
3	HS	200			⊠		Grades to medium dense, wet
4	HS	200			⊠		
5	HS	100	CA		⊠		

Hand boring completed at 5.8 feet on 04/30/91
Ground water observed between 2.5 and 5.8 feet

DEPTH IN FEET (scale 0–16)

Note: See Figure A-2 for explanation of symbols

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LOG OF HAND BORING

FIGURE A-6

0161-289-R04 Tsk 1.3 :MDW:DEH:CMS 10/22/92

HAND BORING HA-17

TEST DATA

Depth (ft)	Sheen	Vapor Conc. (ppm)	Other Tests	Blow Count	Samples	Group Symbol	DESCRIPTION (Surface Elevation (ft.):)
0						SM	Brown silty fine to coarse sand with gravel (medium dense, moist)
1	SS	50			X		
2	NS	40			X		
	NS	40	CA		X		
3							Hand boring completed at 3.0 feet on 05/01/91 Ground water observed from 2.0 to 3.0 feet Refusal at 3.0 feet because of large cobbles

DEPTH IN FEET: 0–16

Note: See Figure A-2 for explanation of symbols

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LOG OF HAND BORING

FIGURE A-7

0161-289-R04 Tsk 1.3 :MDW:DEH:CMS 10/22/92

HAND BORING HA-18

TEST DATA

DESCRIPTION

Surface Elevation (ft.):

Depth in Feet	Sheen	Vapor Conc. (ppm)	Other Tests	Blow Count	Samples	Group Symbol	Description
0						SP-SM	Brown fine sand with silt (medium dense, moist)
1	SS	<20			X		
2	NS	<20	CA		X		
3	NS	<20			X		
3.5						ML	Brown sandy silt (medium stiff, wet)
4	NS	<20			X		
5	SS	<20			X		
	NS	<20			X		
6							Hand boring completed at 6.0 feet on 05/01/91 Ground water observed from 2.5 to 6.0 feet Tar-like contamination observed between 2.0 and 3.0 feet

Note: See Figure A-2 for explanation of symbols

0161-289-R04 Tsk 1.3 :MDW:DEH:CMS 10/22/92

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LOG OF HAND BORING

FIGURE A-8

TEST DATA

HAND BORING HA-19

DESCRIPTION

Surface Elevation (ft.):

Depth in Feet	Sheen	Vapor Conc. (ppm)	Other Tests	Blow Count	Samples	Group Symbol	Description
0						ML	Brownish orange mottled sandy silt (soft, moist)
1	NS	40			X		
2	SS	60			X		
3	NS	20			X		
4	SS	30			X		
4.5						SP-SM	Brown fine to medium sand with silt (loose, moist)
5	SS	40			X		
6	SS	30	CA		X		
7	SS	45			X		
8	SS	40			X		
8.5	NS	35	CA		X		
9							Hand boring completed at 9.0 feet on 05/01/91 Ground water observed at 8.5 feet

Note: See Figure A-2 for explanation of symbols

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LOG OF HAND BORING

FIGURE A-9

0101-269-R04 T&K 1.3 :MDW:DEH:CMS 10/22/92

HAND BORING HA-20

TEST DATA

Depth (ft)	Sheen	Vapor Conc. (ppm)	Other Tests	Blow Count	Samples	Group Symbol	DESCRIPTION — Surface Elevation (ft.):
0						SP-SM	Brown fine to medium sand with silt (loose, moist)
1	SS	35	CA		☒		
2	NS	45			☒		
3	SS	30			☒		
4	SS	20			☒		
5	SS	30	CA		☒		
	NS	25			☒		
6							Hand boring completed at 6.0 feet on 05/01/91 Ground water observed from 2.0 to 6.0 feet

DEPTH IN FEET (scale 0–16; elevation scale 0, 5, 10, 15)

Note: See Figure A-2 for explanation of symbols

0161-289-R04 Tsk 1.3 :MDW:DEH:CMS 10/22/92

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LOG OF HAND BORING

FIGURE A-10

TEST DATA

HAND BORING HA-21

Depth (ft)	Sheen	Vapor Conc. (ppm)	Other Tests	Blow Count	Samples	Group Symbol	DESCRIPTION Surface Elevation (ft.):
0						ML	Bluish gray fine sandy silt (soft, moist)
1	MS	100	CA		⊠		
2	NS	20			⊠		
3	NS				⊠		
4	NS	30			⊠		
	NS	20	CA		⊠		
5							Hand boring completed at 5.0 feet on 05/02/91 Ground water seepage observed at 2.0 feet

DEPTH IN FEET

Note: See Figure A-2 for explanation of symbols

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LOG OF HAND BORING

FIGURE A-11

0161-289-R04 Tsk 1.3 :MDW:DEH:CMS 10/22/92

TEST DATA

HAND BORING HA-22

DESCRIPTION

Surface Elevation (ft.):

Depth in Feet	Sheen	Vapor Conc. (ppm)	Other Tests	Blow Count	Samples	Group Symbol	Description
0						ML/SM	Gray sandy silt and silty fine to medium sand (soft/loose, moist)
1	NS	20			☒		
2	HS	200			☒	SM	Brown silty fine to medium sand with wood debris (loose, moist)
3	HS	210	CA		☒	ML	Gray sandy silt with organic matter (soft, wet)
4	HS	150			☒		
5	HS	110			☒		
6	MS	90			☒		
7	MS	100			☒		
8	HS	100			☒		
9	MS	110	CA		☒		Organic matter decreases
	SS	--	CA		☒		
10							Hand boring completed at 10.0 feet on 05/02/91 Ground water seepage observed from 2.5 to 10.0 feet

Depth scale: 0 to 16 feet (left); Elevation scale: 0, 5, 10, 15 (right)

Note: See Figure A-2 for explanation of symbols

0161-289-R04 Tsk 1.3 :MDW:DEH:CMS 10/22/92

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LOG OF HAND BORING

FIGURE A-12

TEST DATA

HAND BORING HA-23

Depth (ft)	Sheen	Vapor Conc. (ppm)	Other Tests	Blow -Count	Samples	Group Symbol	DESCRIPTION Surface Elevation (ft.):
0						ML	Brown silt with sand and organic matter (soft, moist)
1	MS	20	CA		X		
2	SS	20			X		
3	NS	20			X		
4	SS	10			X		
5	NS	10	CA		X		

Hand boring completed 5.5 feet on 05/03/91
Ground water not encountered
Contaminated water from leaking tank valve was entering hand boring

DEPTH IN FEET (0–16)

Note: See Figure A-2 for explanation of symbols

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LOG OF HAND BORING

FIGURE A-13

TEST DATA

HAND BORING HA-24

Depth (ft)	Sheen	Vapor Conc. (ppm)	Other Tests	Blow Count	Samples	Group Symbol	DESCRIPTION Surface Elevation (ft.):
0						SP-SM	Brown fine sand with silt and occasional roots (loose, moist)
1	SS	<20	CA		X	ML	Brown silt with a trace of sand and organic matter (medium stiff, moist)
2	NS	<20			X		
2.5						SP	Black fine sand (loose, moist)
3	NS	<20			X		
4	NS	<20			X	SP-SM	Brown fine sand with silt (loose, moist)
5	NS	20			X		

Hand boring completed at 5.3 feet on 04/30/91
Ground water not observed

DEPTH IN FEET: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

Note: See Figure A-2 for explanation of symbols

0161-289-R04 Tsk 1.3 :MDW:DEH:CMS 10/22/92

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LOG OF HAND BORING

FIGURE A-14

TEST DATA

HAND BORING HA-25

DESCRIPTION

Surface Elevation (ft.):

Depth (ft)	Sheen	Vapor Conc. (ppm)	Other Tests	Blow Count	Samples	Group Symbol	Description
0						SP-SM	Brown fine sand with silt and organic matter (loose, moist)
1	NS	<20			X		
2	SS	50	CA		X	SP	Brown fine sand with a trace of silt (loose, moist)
3	NS	40			X		
3.5	NS	40			X	SP-SM	Brown fine sand with silt and organic matter (loose, moist)
4							Hand boring completed at 4.0 feet on 04/30/91 Ground water not observed

DEPTH IN FEET (scale 0–16)

Note: See Figure A-2 for explanation of symbols

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0161-285-R04 Tsk 1.3

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LOG OF HAND BORING

FIGURE A-15

TEST DATA

HAND BORING HA-26

Depth (ft)	Sheen	Vapor Conc. (ppm)	Other Tests	Blow Count	Samples	Group Symbol	DESCRIPTION Surface Elevation (ft.):
0						SM	Gray silty fine sand (moist)
1	NS	65			X		
2	NS	55	CA		X		
3	NS	50			X		
4	NS	45			X	ML	Gray fine sandy silt (wet)
	NS	40	CA		X		
5							Hand boring completed at 5.0 feet on 05/02/91 Ground water seepage observed from 2.0 to 5.0 feet

DEPTH IN FEET (0–16)

Note: See Figure A-2 for explanation of symbols

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LOG OF HAND BORING

FIGURE A-16

MDW:DEH:CMS 10/22/92

TEST DATA

HAND BORING HA-27

DESCRIPTION

Surface Elevation (ft.):

Depth in Feet	Sheen	Vapor Conc. (ppm)	Other Tests	Blow Count	Samples	Group Symbol	Description
0						SP-SM	Black-brown fine to medium sand with slight organic matter, stained (moist)
1	SS	<20			X	ML	Gray-tan silt with sand and occasional gravel (moist)
2	NS	<20	CA		X	ML	Light brown fine sandy silt (moist)
3	SS	<20			X		
4	SS	<20			X	SP-SM	Light brown fine to medium sand with silt (wet)
5						SM	Light brown silty fine to medium sand (wet)
5.5	NS	<20	CA		X		

Hand boring completed at 6.0 feet on 05/08/91
Ground water encountered at 4.5 feet
Soil samples obtained at one foot intervals for field screening

Note: See Figure A-2 for explanation of symbols

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LOG OF HAND BORING

FIGURE A-17

LOG OF TEST PIT

DEPTH BELOW GROUND SURFACE (FEET)	SOIL GROUP CLASSIFICATION SYMBOL	DESCRIPTION
		<u>TEST PIT 26</u>
0.0 - 1.0	GP	Gray sandy gravel with a trace of silt (medium dense, moist)
1.0 - 4.5	ML	Tan silt with sand (stiff, moist)
4.5 - 6.4	ML	Gray silt with lenses of silty sand (stiff, moist)
		Test pit completed at 6.4 feet on 04/29/91
		No ground water seepage observed
		Disturbed soil sample obtained at 6.4 feet for chemical analysis; soil samples obtained at 1-foot intervals for field screening
		<u>TEST PIT 27</u>
0.0 - 2.0	OL	Blackish brown organic soil with sand (soft, wet)
2.0 - 3.0	ML	Gray silt with a trace of sand (medium stiff, moist)
3.0 - 6.0	SP-SM	Dark gray fine to medium sand with silt (medium dense, moist)
6.0 - 10.0	ML	Dark gray silt with a trace of sand (medium stiff, moist)
		Test pit completed at 10.0 feet on 04/29/91
		Ground water seepage observed at 1.5 feet
		Disturbed soil samples obtained at 7.0 and 10.0 feet for chemical analysis; soil samples obtained at 2-foot intervals for field screening.

THE DEPTHS ON THE TEST PIT LOGS, ALTHOUGH SHOWN TO 0.1 FOOT, ARE BASED ON AN AVERAGE OF MEASUREMENTS ACROSS THE TEST PIT AND SHOULD BE CONSIDERED ACCURATE TO 0.5 FOOT.

LOG OF TEST PIT

DEPTH BELOW GROUND SURFACE (FEET)	SOIL GROUP CLASSIFICATION SYMBOL	DESCRIPTION
		<u>TEST PIT 28</u>
0.0 - 1.5	GP	Brown fine gravel with sand (medium dense, wet)
1.5 - 7.0	SP-SM	Gray fine sand with lenses of gray silt (medium dense, moist)
7.0 - 8.5	SP-SM	Gray fine sand with lenses of gray silt (medium dense, moist)
		Test pit completed at 8.5 feet on 04/29/91
		Ground water seepage observed at 1.5 feet
		Disturbed soil sample obtained at 1.0 foot for chemical analysis; soil samples obtained at variable intervals for field screening
		<u>TEST PIT 29</u>
0.0 - 0.5	SP	Brown sand with gravel and a trace of silt (medium dense, moist)
0.5 - 3.0	SP-SM	Brown fine sand with silt and occasional gravel (medium dense, moist)
3.0 - 9.0	ML	Gray silt with a trace of sand (stiff, moist)
		Test pit completed at 9.0 feet on 04/29/91
		No ground water seepage observed
		Disturbed soil sample obtained at 1.0 foot for chemical analysis; soil samples obtained at variable intervals for field screening

THE DEPTHS ON THE TEST PIT LOGS, ALTHOUGH SHOWN TO 0.1 FOOT, ARE BASED ON AN AVERAGE OF MEASUREMENTS ACROSS THE TEST PIT AND SHOULD BE CONSIDERED ACCURATE TO 0.5 FOOT.

Geo Engineers

LOG OF TEST PIT

FIGURE A-27

APPENDIX E

DATA VALIDATION REPORTS

DATA VALIDATION REPORT

UNOCAL EDMONDS BULK FUEL TERMINAL

DATA REVIEW

The following report presents a summary of the data validation review of analytical results for samples collected from the UNOCAL Edmonds Bulk Fuel Terminal during investigations occurring from 1988 to 1991. Samples were analyzed by Analytical Technologies, Inc. (ATI), Farr, Friedman and Bruya, Inc. (FFBI), and Enviros Analytical Services (Enviros). Samples were analyzed for volatile and semivolatile organic compounds, TCLP volatile organics, TCLP metals, EP Tox Metals, total lead, volatile chlorinated hydrocarbons, polychlorinated biphenyls (PCBs), and moisture. Batch identification numbers and identification numbers for associated samples analyzed by each laboratory include the following:

Laboratory	Sample Batch Identification	Sample Identification
Enviros	Project Landfarm	DP1; DP2; DP3
ATI	161-164-4	TS-1; TS-2; SP-3; SP-4
ATI	161-275-B04	TP-1(6'); TP-3(12'); TP-4(6'); TP-8(6')
ATI	161-275-4	TP-6 5'; TP-11 4'; TP-17 6'; TP-18 6'; TP-2 12'; TP-5 10'; TP-7 6'; TP-10 8'; TP-9 12'; TP-12 4'; TP-13 6'; TP-14 8'; TP-15 6'; TP-16 6'; TP-19 6'; TP-20 6'; TP-21(7'); TP-22(6'); TP-23(6'); TP-24(6'); TP-25(6'); TP-7(12'); TP-5(2'); B-2(4'); SP-105B (WEST); SP-105A (EAST); B-1(2')
Enviros	0161-259-B04	A; B1; B2; B3; C1; C2; D1; D2; D3; E1
ATI	161-161-4	C-1 (B1-5); B-1 (1-2); B-2 (3-4); B-3 (1-2); B-4 (2-3); B-5 (1-1.5); MWD (1); MWD (3); MWD
ATI	161-160-4	MWA (2); MWA; MWB (1); MWB; MWC (1); MWC (2); MWC; MW-1; MW-2
ATI	161-98-4	TAR SLUDGE; LAKE MCGUIRE SOIL #1; LAKE MCGUIRE #1 11:00; LAKE MCGUIRE #1 11:10; LAKE MCGUIRE #1 11:15; LAKE MCGUIRE #2 12:00; LAKE MCGUIRE #2 12:05; LAKE MCGUIRE #2 12:15; LAKE MCGUIRE #3 12:40; LAKE MCGUIRE #3 12:45; LAKE MCGUIRE #3 12:55
FFBI	161-84-4	HA-1 #1; HA-1 #2; HA-2 #1; HA-2 #2; HA-3 #1; HA-3 #2; HA-4 #1; HA-4 #2; HA-5 #1; HA-5 #3; B-1 #5; HA-6 #1; HA-6 #2; HA-7 #1; HA-7 #3; HA-8 #1; HA-8 #2; HA-9 #2; HA-9 #3; HA-10 #1; HA-10 #2; HA-11 #1; HA-11 #2; HA-12 #1; HA-12 #2; B2-#1
FFBI	0161-84-4	B-3, #6; B-4, #7; B-5, #3; B-6, #2; MW-1; MW-2; MW-3; MW-4; MW-5; MW-6; HA-5

DATA QUALIFICATIONS

The following comments refer to the laboratory performance in meeting the quality control (QC) specifications outlined in the analytical procedures referenced here (e.g., USEPA 1986). Analytical results were reviewed using criteria specified in *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses* (USEPA 1988a) and *Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses* (USEPA 1988b) and method QC criteria, where appropriate.

Timeliness

All sample analyses met holding time criteria except the following:

Sample Number	Date Collected	Analysis	Date Extracted	Date Analyzed	Holding Time(s) (days)	Holding Time Criteria (days)
TP-4(6')	9-4-90	8020	9-7-90	9-20-90	16	14
TP-8(6')	9-4-90	8020	9-10-90	9-21-90	17	14
TP-18(6')	9-6-90	8240	NA	9-26-90	NA/20	14
TP-6(5')	9-6-90	8020	9-14-90	9-21-90	15	14
TP-17(6')	9-6-90	8020	9-14-90	9-22-90	16	14
TP-18(6')	9-6-90	8020	9-14-90	9-22-90	8/16	14
TP-11(4')[a]	9-6-90	8270	9-24-90	9-28-90	18/22	14/40
TP-13(6')	9-6-90	8270	9-24-90	9-28-90	18/22	14/40
TP-5(10')	9-6-90	8020	9-11-90	9-21-90	15	14
TP-14(8')	9-6-90	8020	9-12-90	9-25-90[b]	19	14
TP-23(6')	9-6-90	8020	9-12-90	9-21-90	15	14
TP-24(6')	9-6-90	8020	9-12-90	9-21-90	15	14
Tar Sludge	8-5-88	8270	9-17-88	10-17-88	43/73	14/40
Lake McGuire Soil #1	8-5-88	8270	9-17-88	10-17-88	43/73	14/40

[a] Transcription error: TP-11(4') was incorrectly recorded by analytical laboratory as TP-12(4').
[b] Transcription error: date of analysis incorrectly reported in analytical data as 9-15-90.

No holding times were provided by Farr, Friedman and Bruya, Inc., for samples analyzed from batches 161-84-4 and 0161-84-4.

Method Blank Results

No compounds were detected in method blanks at concentrations greater than ten percent of the sample analyte concentrations.

When run, method blanks were analyzed at the required frequency. No method blank data were provided for the following analyses and sample batches:

Laboratory	Sample Batch	Analysis
ATI	all	418.1
ATI	161-161-4	8020
ATI	161-161-4	602
ATI	161-160-4	602
FFBI	0161-84-4	total lead
FFBI	0161-84-4	volatile chlorinated hydrocarbons
ATI	161-98-4	EP Tox-Metals
ATI	161-275-4	TCLP-Metals

Matrix Spike/Matrix Spike Duplicate Results

Organics

All matrix spike/matrix spike duplicate (MS/MSD) results were within QC criteria for percent recovery (%R) and percent relative percent difference (%RPD) between MS and MSD percent recovery except for the following:

Lab	Sample Batch	Analysis	Compound	MS %R	MSD %R	%RPD	QC Limits %R	QC Limits %RPD
ATI	161-275-4	TCLP/ 8270	Pentachlorophenol	22	10	70[a]	9-103	50
			Phenol	30	18	49[a]	12-110	42
			2-Chlorophenol	31	17[a]	57[a]	27-123	40
ATI	161-275-4	8020	total xylenes	105	245[a]	13	65-135	35
ATI	161-275-4	418.1	TPH	0[b]	—	—	65-135	35
ATI	161-161-4	418.1	TPH	46[a]	—	—	65-135	35
ATI	161-160-4	602	benzene	0	—	—	65-135	35
FFBI	0161-84-4	gas, diesel#1 diesel#2	diesel	140[a]	—	—	65-135	35
FFBI	0161-84-4	BTEX	o-xylene	58[a]	—	—	65-135	35

[a] out of limits
[b] no recovery due to sample dilution

The following sample batches did not include MS results:

Analytical Laboratory	Sample Batch	Analysis
Enviros	0161-259-1304	418.1
ATI	161-160-4	8270
ATI	161-160-4	418.1
FFBI	161-84-4	418.1
FFBI	161-84-4	TPH
FFBI	161-84-4	volatile chlorinated hydrocarbons

Inorganics

MS were analyzed at the required frequency. All MS percent recoveries were within QC limits.

Surrogate Recoveries

The percent recoveries for surrogate compounds were within QC criteria for all analyses except the following:

Sample Number	Analysis	Surrogate Compound	%R	QC Criteria (%R)
TP-11(4')	8270	Terphenyl-d_{14}	23	33-141
		Phenol-d_6	6	10-110
TP-13(6')	8270	2-Fluorophenol	6	21-110
		2,4,6-Tribromophenol	9	10-123
TP-12(4')	8020	Bromofluorobenzene	0[a]	60-140
TP-13(6')	8020	Bromofluorobenzene	0	60-140
TP-24(6')	8020	Bromofluorobenzene	0	60-140
TP-15(6')	8020	Bromofluorobenzene	0[a]	60-140
TP-16(6')	8020	Bromofluorobenzene	0[a]	60-140
TP-20(6')	8020	Bromofluorobenzene	0[a]	60-140
TP-21(7')	8020	Bromofluorobenzene	0[a]	60-140
TP-25(6')	8020	Bromofluorobenzene	0[a]	60-140
MW-2	602	Bromofluorobenzene	0	60-140
MWB	8270	Nitrobenzene-d5	0	33-141
		Terphenyl-d_{14}	28	33-141

Sample Number	Analysis	Surrogate Compound	%R	QC Criteria (%R)
Tar Sludge	8270	2-Fluorobiphenyl	139	30-115
		2,4,6-Tribromophenol	150	19-122
		Terphenyl-d_{14}	141	18-137
Lake McGuire Soil #1	8270	Phenol-d_5	16	24-113
Lake McGuire #1	625	Nitrobenzene-d_5	27	35-114
Lake McGuire #2	625	2-Fluorobiphenyl	32	43-116
12:00		Terphenyl	16	33-141
Lake McGuire #3	625	2-Fluorobiphenyl	37	43-116
12:40		Terphenyl	25	33-141
Tar Sludge	8020	Bromochloromethane	32[a]	60-140

[a] Low recovery due to sample dilution

No surrogate recovery data were provided for the following sample batches:

Laboratory	Sample Batch	Analysis
ATI	161-98-4	EP Tox
ATI	161-160-4	8270
ATI	all	8015M
FFBI	0161-84-4	gas, diesel #1, diesel #2
FFBI	0161-84-4	total lead
FFBI	0161-84-4	TPH (soil and water)
FFBI	0161-84-4	BTEX (water)
FFBI	0161-84-4	volatile chlorinated hydrocarbons
FFBI	0161-84-4	volatile organic compounds (soil)

Overall Assessment of Data

The usefulness of the data is based on the criteria outlined in:

- *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses* (USEPA 1988a)
- *Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses* (USEPA 1988b)

A complete validation of sample results could not be conducted due to missing data for method blanks, matrix spikes, and surrogate recovery. No data qualifiers were assigned to sample results based on this data validation. Sample analyses that exceeded holding times or did not meet surrogate recovery QC criteria should be considered estimated values. Based on the relative percent difference between MS/MSD results, the precision of the results were within QC limits. The accuracy of the analyses was generally acceptable. However, based on low surrogate and spike compound recoveries, individual sample results may be biased low. Qualitatively, the results provide useful indicators for sample contaminants. Results should only be used quantitatively to provide relative comparisons for contaminant concentrations.

LIST OF REFERENCES

U.S. Environmental Protection Agency. 1988a. *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses*. Prepared for the Hazardous Site Evaluating Division, U.S. Environmental Protection Agency. Prepared by the USEPA Data Review Work Group.

U.S. Environmental Protection Agency. 1988b. *Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses*. Prepared for the Hazardous Site Evaluation Division, U.S. Environmental Protection Agency. Prepared by the USEPA Data Review Work Group.

U.S. Environmental Protection Agency. 1986. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*. USEPA, Office of Solid Waste and Emergency Response. EPA 530/SW-846.

DATA VALIDATION REPORT

HARBOR SQUARE SITE ASSESSMENT

DATA REVIEW

The following report is a summary of the data validation review of analytical data presented in the Harbor Square Site Assessment report (dated January 2, 1992). Samples were analyzed by Analytical Resources Incorporated (ARI) of Seattle, Washington. Samples were analyzed for: volatile and semivolatile organic compounds, total petroleum hydrocarbons, total diesel range hydrocarbons, metals, and pesticides/PCBs. ARI batch (job) identification numbers and identification numbers for associated samples are listed below:

Batch (Job) Identification Number	Sample Identification
09006	HS1-A, HS2-A, HS2-B, HS3-A, HS4-A, HS4-B, HSFW, HSFBLANK
09428	MW2-1.5-2.5, MW2-5.8-6.2, HS8-6.1-6.5, MW4-7.5-8.2, MW1-5.0-6.0, HS5-2.0-3.5, HS6-4.3-5.1, HS6-7.0-8.2, HS6-10.0-11.0, MW3-4.5-5.1, MW5-4.5-6.0, MW6-4.5-6.0, HS7-2.0-2.3, HS7-4.5-5.5, HS9-3.5-4.5, RB-1
09452	MW1, MW2, MW3, MW4, MW5, DCW, MW6

DATA QUALIFICATIONS

The following comments refer to the laboratory performance in meeting the quality control (QC) specifications outlined in the analytical procedures referenced here (e.g., USEPA 1986). Analytical results were reviewed using *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses* (USEPA 1988a) and *Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses* (USEPA 1988b) and method QC criteria, where appropriate.

Timeliness

All sample analyses met holding time criteria.

Method Blank Results

Laboratory method blank analyses were conducted at the required frequency for all analytical methods. No compounds were detected in method blanks at concentrations greater than the method detection limits (MDLs) for all analyses except the following:

Batch (Job) Identification Number	Blank Identification	Analysis	Compound	Blank Concentration (ppb)	Associated Sample	Sample Concentration (ppb)
09006	0912MB	8240	Methylene chloride	1.1	Trip Blank	0.9
09006	0912MB	8240	Acetone	1.4	Trip Blank	1.9
09452	1120 MBA	8240	Acetone	9.2	MW-1 MW-2	20 12
09452	1120 MBA	8240	Toluene	1.2	MW-1 MW-2 MW-3	1.4 1.4 1.6
09452	1121 MBA	8240	Methylene chloride	0.3	MW-3[a]	1.0 U
09452	1123 MBA	8240	Acetone	2.5	MW-5 MW-6 MW-6[a] Trip Blank	8.7 5.0 U 5.0 U 5.0 U
09452	1123 MBA	8240	2-Hexanone	2.3	MW4 MW5 MW6 MW6[a] Trip Blank	2.0 U 2.0 U 5.0 U 2.0 U 2.0 U
09452	1123 MBA	8240	1,1,2,2-Tetrachloroethane	1.0	MW4 MW5 MW6 MW6[a] Trip Blank	2.0 U 2.0 U 1.0 U 2.0 U 2.0 U
09452	1123 MBA	8240	Total Xylenes	1.5	MW4 MW5 MW6 MW6[a] Trip Blank	2.0 U 2.0 U 2.0 U 2.0 U 2.0 U

a Re-analysis

Based on data validation guidelines (USEPA, 1988b), an undetected (U) data qualifier was assigned to the following results: methylene chloride and acetone in the trip blank associated with batch number 09006; acetone in samples MW-1 and MW-2; toluene in samples MW-1, MW-2, and MW-3; and acetone in sample MW-5.

Matrix Spike/Matrix Spike Duplicate Results

Organics

All matrix spike (MS) results were within QC criteria for percent recovery (%R) except for the following:

Sample Batch	Analysis	Compound	MS %R	MSD %R	%RPD	QC Limits %R	QC Limits %RPD
09006	8270	N-Nitroso-Di-n-Propylamine	38.1	—	—	41-126	38

The following sample batches were submitted with no MS or matrix spike duplicate (MSD) data:

Sample Batch	Analysis
09006	8240 8080 418.1 8015M
09428	8240 8080 418.1 8015M
09452	8240 WTPH-D 8015M 624

Following data validation procedures (USEPA, 1988b), no data qualifiers were assigned to sample results based on MS/MSD analyses.

Inorganics

No MS results were reported.

Surrogate Recoveries

The percent recoveries for surrogate compounds were within QC criteria for all analyses except the following:

Batch	Sample Number	Analysis	Surrogate Compound	%R	QC Criteria (%R)
09428	HS5-2.0-3.0	8240	Bromofluoro-benzene	115	59-113
09428	HS5-2.0-3.0	8080	Decachloro-biphenyl	NR[b]	60-150
09006	HS2-A	8015M		D[c]	—
09452	MW3[a]	8240	d_8-Toluene	113	88-110
			Bromofluoro-benzene	77	86-115
09452	MW6	8240	d_4-1,2-Dichloro-ethane	126	76-114
09452	MW6[a]	8240	d_4-1,2-Dichloro-ethane	125	76-114
09428	MW2-1.5-2.5	WTPH-D	Methyl-Arachidate	D[c]	50-150
09428	HS5-2.0-3.5	WTPH-D	Methyl-Arachidate	D[c]	50-150

[a] Re-analysis
[b] NR = Not reported
[c] D = Diluted out of range

Based on data validation guidelines (USEPA, 1988b), an estimated (J) data qualifier was assigned to volatile organic compound results for samples H55-2.0-3.0, MW-3 and MW-6. Based on professional judgment, data for diluted sample analyses were not assigned data qualifiers.

Overall Assessment of Data

The usefulness of the data is based on the criteria outlined in:

- *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses* (USEPA 1988a)
- *Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses* (USEPA 1988b)

The data are judged to be ACCEPTABLE for use. Results for inorganics matrix spike analyses were not provided, so it was not possible to evaluate method accuracy. Based on review of the available results, precision and accuracy of the organics data are judged to be within method QC limits. The usefulness of results for individual compounds and samples are modified by the following data qualifiers:

J—The associated numerical value is an estimated quantity.

U—The material was analyzed for, but was not detected at a concentration greater than the associated value. The associated numerical value is the sample quantitation limit or sample detection limit.

LIST OF REFERENCES

U.S. Environmental Protection Agency. 1988a. *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses*. Prepared for the Hazardous Site Evaluating Division, U.S. Environmental Protection Agency. Prepared by the USEPA Data Review Work Group.

U.S. Environmental Protection Agency. 1988b. *Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses*. Prepared for the Hazardous Site Evaluation Division, U.S. Environmental Protection Agency. Prepared by the USEPA Data Review Work Group.

U.S. Environmental Protection Agency. 1986. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*. USEPA, Office of Solid Waste and Emergency Response. EPA 530/SW-846.

APPENDIX F

LIST OF DATA SOURCES

LIST OF DATA SOURCES

- UNOCAL Corporation Files
  - Seattle, Washington
  - Edmonds, Washington Marketing Terminal
  - Portland, Oregon Marketing Terminal
  - Los Angeles, California Corporate Headquarters
- LeSourd & Patten, Seattle, Washington
- UNOCAL Employee Interviews
- Walker & Associates, Seattle, Washington
- Washington Department of Ecology, NWRO, Bellevue, Washington
- USEPA Region 10, Seattle, Washington
- Puget Sound Air Pollution Control Agency, Seattle, Washington
- Snohomish County Assessors Office, Everett, Washington
- City of Edmonds, Edmonds, Washington
- Charles Gove & Associates, Bellevue, Washington
- Army Corps of Engineers, Seattle, Washington
- Stewart Title Company
- Washington State Archives