HARTCROWSER

Earth and Environmental Technologies

Hart Crowser, Inc.
1910 Fairview Avenue East
Seattle, Washington 98102-3699
FAX 206.328.5581
206.324.9530

J-2359

May 3, 1989

Weyerhaeuser Aviation
Sea-Tac International Airport
Seattle, Washington 98158

Attn: Mr. William Smith

Re: Monitoring Well installation
Sea-Tac International Airport
Seattle, Washington

Dear Mr. Smith:

This letter report presents the results from the monitoring well installation near your underground fuel storage tanks at the Weyerhaeuser Sea-Tac Airport facility (Figure 1). We understand that the purpose of installing the monitoring wells was for compliance with the Port of Seattle's National Pollutant Discharge Elimination System Waste Discharge (NPDES) permit and to assess the subsurface conditions of soils in the vicinity of the underground tanks.

Our work included the installation of 3 monitoring wells designated WY-1, WY-2, and WY-3 (Figure 2). The wells were

drilled and installed at least 5 feet below the bottom of the underground tanks.

During drilling, soil samples were collected at 5-foot-depth intervals. These samples were screened for petroleum product contamination using visual evidence and odor. The field screening was supplemented by organic vapor headspace measurements using an H-Nu photoionization detector.

The work performed by Hart Crowser, Inc., and this letter report were prepared in accordance with generally accepted professional practices related to the nature of the work accomplished in the same or similar localities at the time the services were performed. This report is for the specific application to the referenced project and for the exclusive use of Weyerhaeuser. No other warranty, express or implied, is made.

SUMMARY OF FINDINGS

- Field screening results indicated no detectable concentrations of petroleum product in soils samples from the borings (WY-1, WY-2, and WY-3).

- Soils at the site generally consisted of hard, gravelly, sandy SILT underlain by dense to very dense, damp, gray, silty, gravelly SAND grading to a very dense SAND to a depth of at least 18.5 feet (the deepest depth explored).

- Groundwater was not encountered during our drilling.

RECOMMENDATIONS

In order to maintain the integrity of the monitoring wells, we recommend the following:

- We recommend that vehicles not be parked on the monitoring well monuments. These monuments are rated to withstand the load of a semi-truck at irregular intervals. If the monuments are damaged they should be replaced to minimize the possibility of surface water or surface spills entering the monitoring well.

- Although the monuments have rubber gaskets and a tight-fitting cap on the top of the PVC well pipe; there is always a potential for surface leakage to the well if a product spill occurs. We recommend, should a surface product spill occur, that the monitoring wells be checked for the presence of product. If present, the product should be pumped out immediately.

SITE LOCATION AND TOPOGRAPHY

The Weyerhaeuser facility is located west of the Sea-Tac Airport runways at 17590 Starling Drive South. The site is located at an elevation of approximately 380 above mean sea level. The land surface at this site slopes to the west southwest.

MONITORING WELLS

We installed a monitoring well in each of the 3 borings. The depth of the monitoring wells was about 18 feet below the ground surface. Tanks of the size present on the site are typically placed in excavations 12 to 13 feet below the ground surface. The wells were screened from a depth of about 7 feet to 17 feet. A description of the monitoring well installation and as-built logs for each monitoring well are presented in Appendix A (Figures A-2 through A-4).

SOILS

The soils encountered in the upper 4 feet of borings WY-1 and WY-2 consisted of very dense, damp, gray-brown, gravelly, very silty SAND. The upper 5 feet of WY-3 consisted of very dense, moist, gray-brown, slightly silty, sandy GRAVEL which we interpret to be fill. Below these upper layers the soil generally consisted of a very dense, slightly silty, slightly gravelly to very gravelly SAND to a depth of at least 18.5 feet (the bottom of our borings). Geologic logs are presented on Figures A-2 through A-4. A key describing the classification method and symbols used on the logs is presented on Figure A-1.

GROUNDWATER

Groundwater was not encountered during drilling. Water supply wells from the surrounding area indicate that the

regional water table lies at an elevation of approximately 260 feet above mean sea level or at a depth about 120 feet below the site. Perched water-bearing zones can exist in the upper, more weathered layer of glacial till but no perched water was encountered during our drilling at this site.

The flow direction for the shallow aquifer underlying the Weyerhaeuser's facility is toward the west. This is based on our examination of local water well records from the Washington State Department of Ecology.

OBSERVATION OF PETROLEUM PRODUCT IN THE SOIL

We did not observe visual evidence or odor of petroleum product in the soils at this site. Soils collected during drilling were placed in jars and screened for volatile petroleum hydrocarbons using an H-Nu photoionization detector (a more detailed account of this method is presented in Appendix A). The H-Nu measurements (Table 1) supported our field observations that petroleum product was not present in the soil encountered. The H-Nu measurements for WY-1 and WY-2 were <1 and the maximum H-Nu measurement in WY-3 was 3.

Table 1 - H-Nu Organic Vapor Headspace Measurements

Sample Depth in Feet	WY-1	WY-2	WY-3
2.5 to 4.0	<1	<1	3
7.5 to 9.0	<1	<1	<1
12.5 to 14.0	<1	<1	<1
17.5 to 19.0	<1	<1	<1

We were pleased with the opportunity to provide our environmental services. If you have any questions please call.

Sincerely,

HART CROWSER, INC.

JENNIFER G. MARTIN
Senior Staff Hydrogeologist

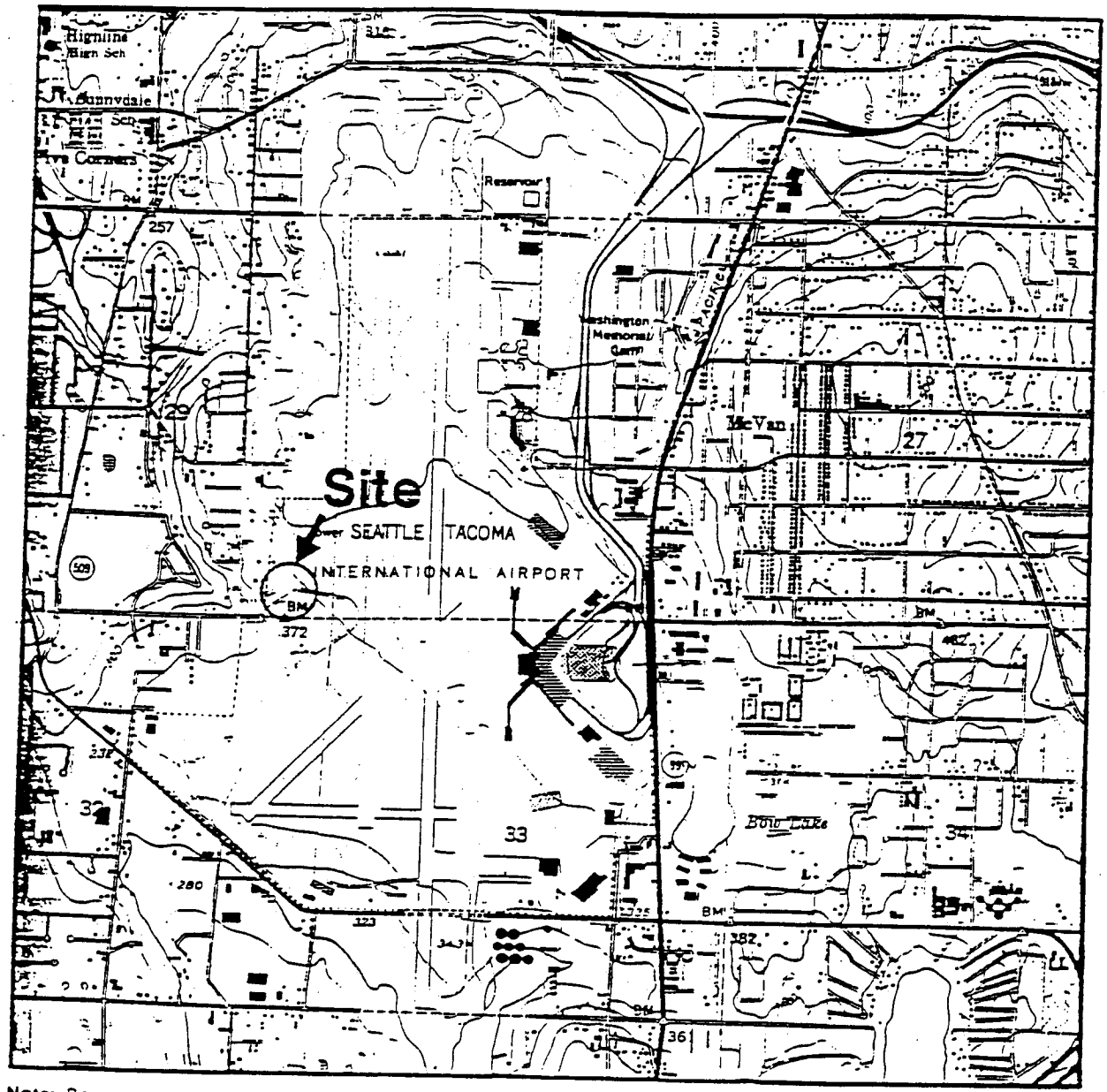
SCOTT S. FERRIS
Associate - Chemical Engineer

JGM/SSF:sek
LR2359/JOBS

Attachments:

Figure 1 - Vicinity Map
Figure 2 - Site and Exploration Plan
Appendix A - Monitoring Well Installation and Soil Testing
Figure A-1 - Key to Exploration Logs
Figures A-2 through A-4 - Boring Log and Construction Data for Monitoring Well WY-1 through WY-3

Vicinity Map



Note: Base map prepared from 7.5 minute quadrangle of Des Moines, Washington.

0 2000 4000

Scale in Feet

N

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J-2359 5/89

Figure 1

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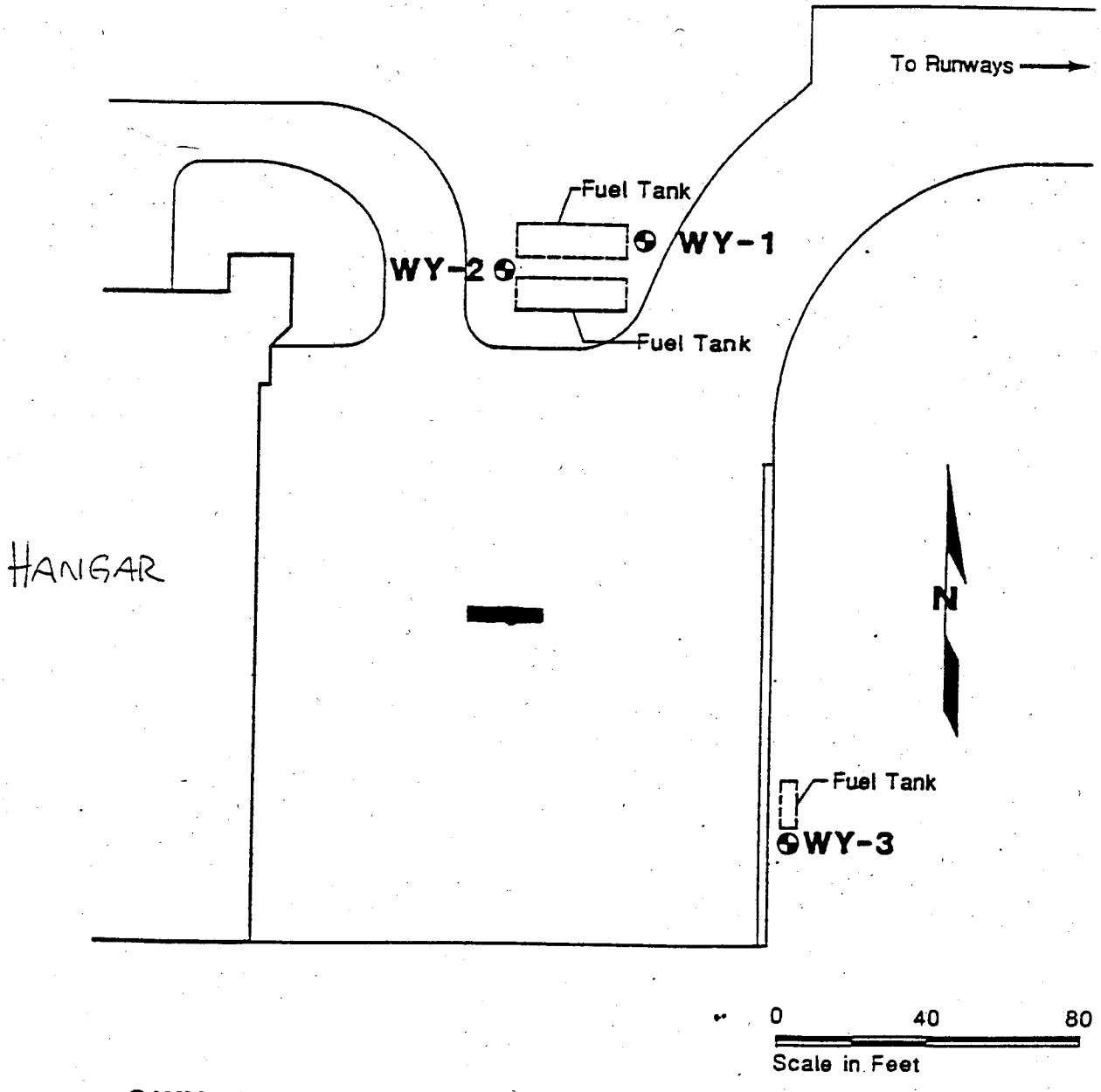
Site and Exploration Plan



WY-1 Monitoring Well Location and Number

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J-2359 5/89

Figure 2

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APPENDIX A
MONITORING WELL INSTALLATION AND SOIL TESTING

Monitoring Well Installation

The monitoring wells were installed on February 13, 1989. The wells were drilled using a truck-mounted hollow-stem auger under subcontract to Hart Crowser, Inc. Drilling was done under the observation of a Hart Crowser representative. Field logs were prepared for each boring. Interpretive logs and monitoring well as-builts are presented in this appendix on Figures A-2 through A-4. A explanation of the terms and symbols used on these logs is presented on Figure A-1.

The wells were constructed of 2-inch PVC with a 10-foot screen. The depth of the monitoring wells was about 17 feet. A uniform sand pack was placed in the space between the PVC casing and the wall of the boring from the bottom of the boring to 2 feet above the screen section. Bentonite was placed from the top of the sand pack to about 2 to 1.5 feet below the ground surface. A concrete surface seal was installed to the ground surface and the monitoring well completed with a locking flush-mounted monument with a load rating of H-20.

Soil Sampling

Soil samples were generally obtained at 5-foot-depth intervals using the Standard Penetration Test procedure as described in ASTM D 1587. A standard 2-inch outside diameter, 18-inch split-spoon sampler was driven into the soil a distance of 18 inches using a 140-pound hammer, free-falling 30 inches. The number of blows required to drive the sample the last 12 inches is the Standard Penetration Resistance recorded at the respective depths on the boring logs. This resistance, or blow counts, provides a measure of the relative density of granular soils and consistency of cohesive soils. Samples were recovered from the split-spoon samplers and described using the soil classification system presented on Figure A-1.

Drilling and sampling equipment were cleaned after the completion of each boring or sampling event to minimize the potential for cross contamination between soil borings or sample intervals. The augers were steam-cleaned after

each boring. Split-spoon samplers were cleaned with Alconox and rinsed with distilled water between each sample run. Soil cuttings were disposed of on-site.

H-Nu Measurements

Organic vapor measurements were made in the sample jar headspace using an H-Nu photoionization detector to assess the possible presence of petroleum product in soils beneath and in the vicinity of the buried tanks. Soil samples from the split-spoon sampler were collected in glass jars (filled half full) and covered with aluminum foil prior to capping. H-Nu measurements were made after the jar samples sat for 15 to 20 minutes by pushing the probe through the foil cover. The H-Nu measurements were made using a 10.2 eV probe. The H-Nu was calibrated using a manufacturer supplied standard gas (isobutylene, equivalent to 34 ppm benzene) prior to making the measurements.

Key to Exploration Logs

Sample Descriptions

Classification of soils in this report is based on visual field and laboratory observations which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field nor laboratory testing unless presented herein. Visual-manual classification methods of ASTM D 2488 were used as an identification guide.

Soil descriptions consist of the following:
Density/consistency, moisture, color, minor constituents, MAJOR CONSTITUENT, additional remarks.

Density/Consistency

Soil density/consistency in borings is related primarily to the Standard Penetration Resistance. Soil density/consistency in test pits is estimated based on visual observation and is presented parenthetically on the test pit logs.

SAND or GRAVEL Density	Standard Penetration Resistance in Blows/Foot	SILT or CLAY Consistency	Standard Penetration Resistance in Blows/Foot	Approximate Shear Strength in TSF
Very loose	0 - 4	Very soft	0 - 2	<0.125
Loose	4 - 10	Soft	2 - 4	0.125 - 0.25
Medium dense	10 - 30	Medium stiff	4 - 8	0.25 - 0.5
Dense	30 - 50	Stiff	8 - 15	0.5 - 1.0
Very dense	>50	Very stiff	15 - 30	1.0 - 2.0
		Hard	>30	>2.0

Moisture

Dry	Little perceptible moisture
Damp	Some perceptible moisture, probably below optimum
Moist	Probably near optimum moisture content
Wet	Much perceptible moisture, probably above optimum

Minor Constituents

	Estimated Percentage
Not identified in description	0 - 5
Slightly (clayey, silty, etc.)	5 - 12
Clayey, silty, sandy, gravelly	12 - 30
Very (clayey, silty, etc.)	30 - 50

Legends

Sampling

BORING SAMPLES

- Split Spoon
- Shelby Tube
- Cuttings
- Core Run
- * No Sample Recovery
- P Tube Pushed, Not Driven

Test Symbols

GS	Grain Size Classification
CN	Consolidation
TUU	Triaxial Unconsolidated Undrained
TCU	Triaxial Consolidated Undrained
TCD	Triaxial Consolidated Drained
QU	Unconfined Compression
DS	Direct Shear
K	Permeability
PP	Pocket Penetrometer, Approximate Compressive Strength in TSF
TV	Torvane, Approximate Shear Strength in TSF
CBR	California Bearing Ratio
MD	Moisture Density Relationship
AL	Atterberg Limits

Water Content in Percent
- Liquid Limit
- Natural
- Plastic Limit

Ground Water Observations

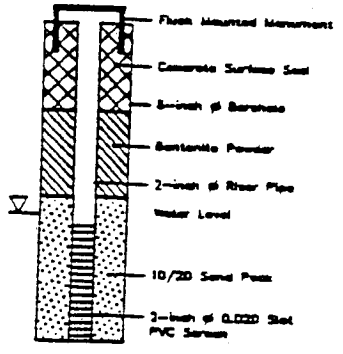

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Figure A-1

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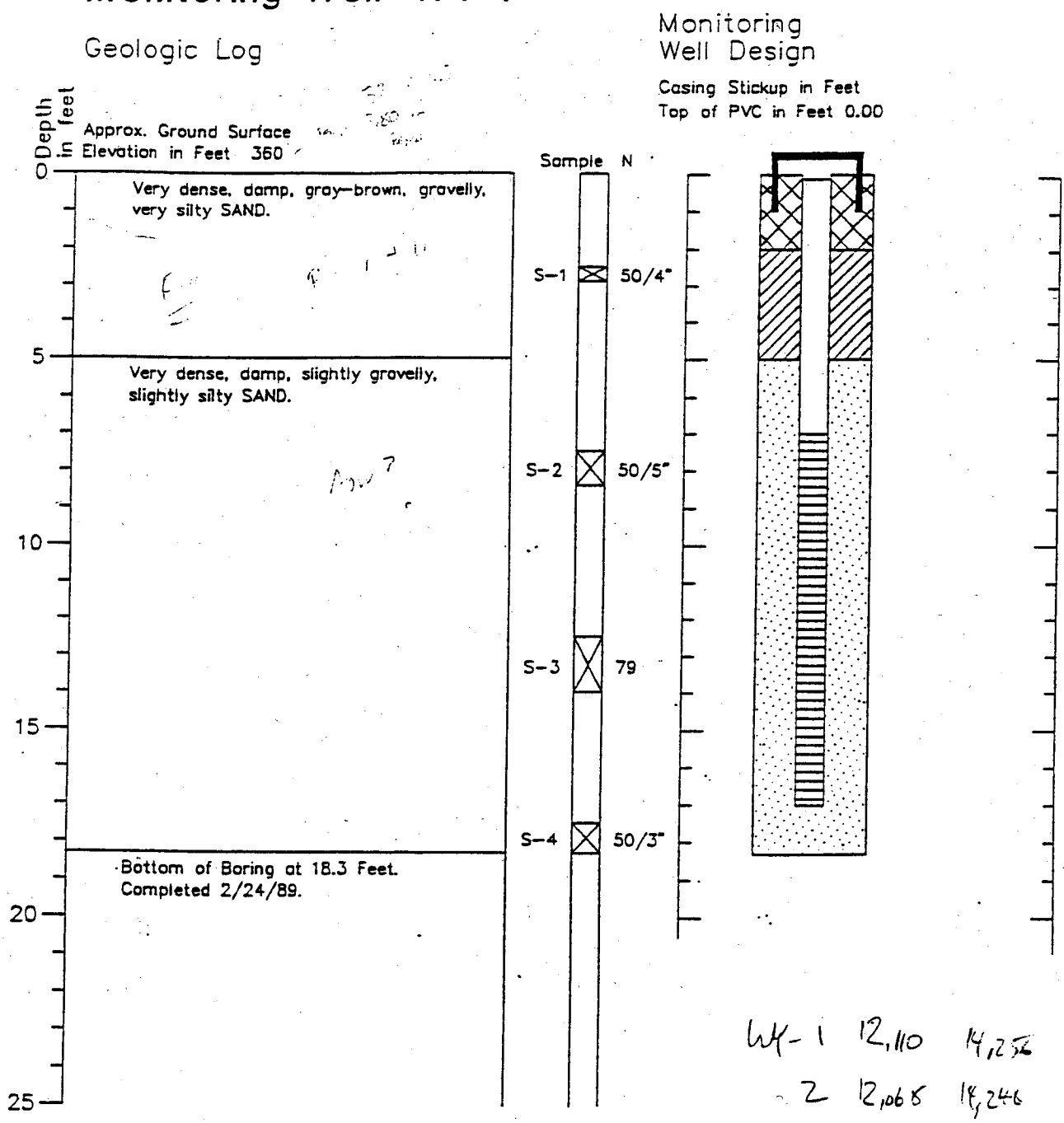
Boring Log and Construction Data for Monitoring Well WY-1



WY-1 12,110 14,252
2 12,068 14,246
3 12,142 14,095

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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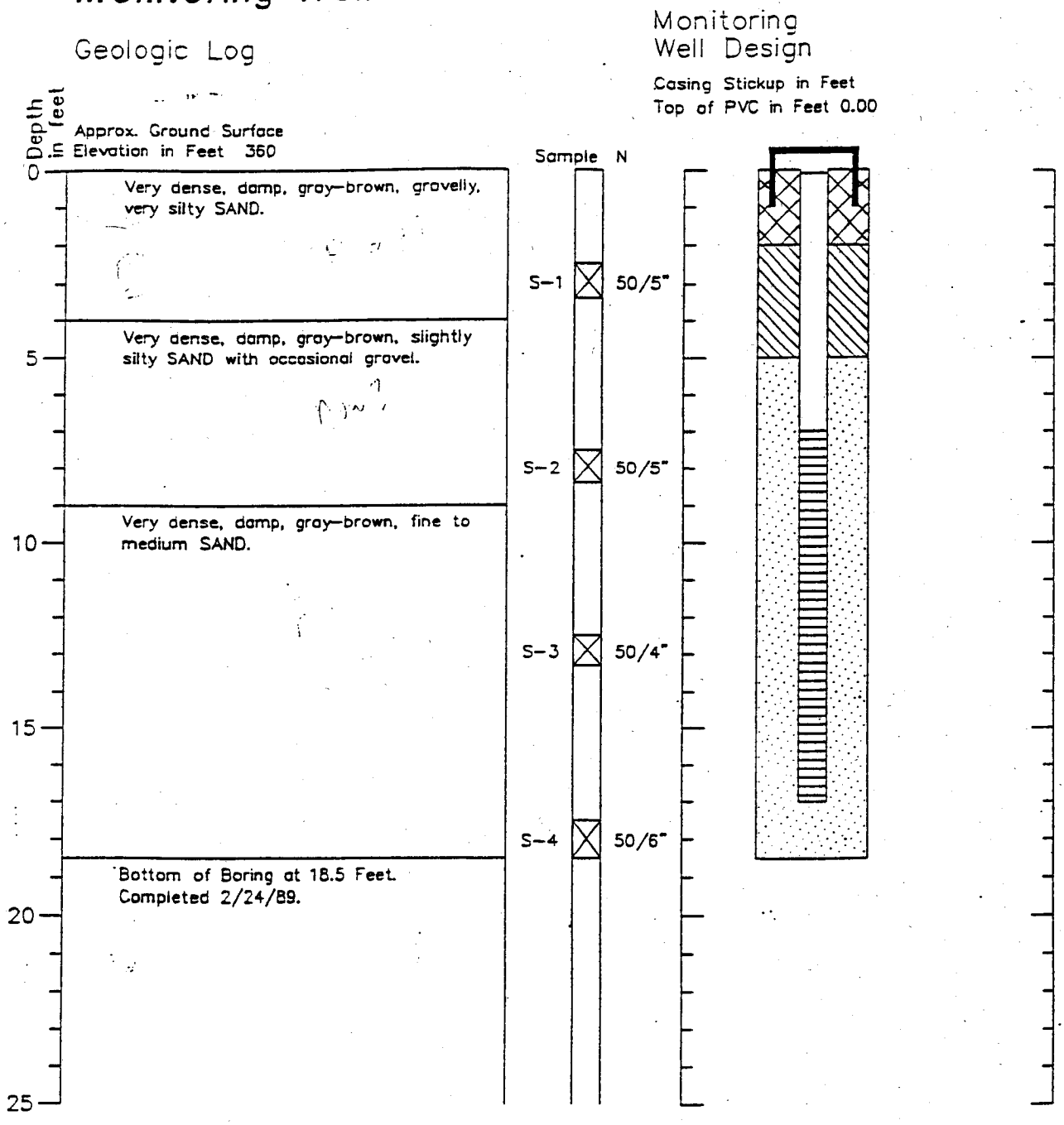
Boring Log and Construction Data for Monitoring Well WY-2



1. Refer to Figure A–1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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J-2359 2/89

Figure A-3

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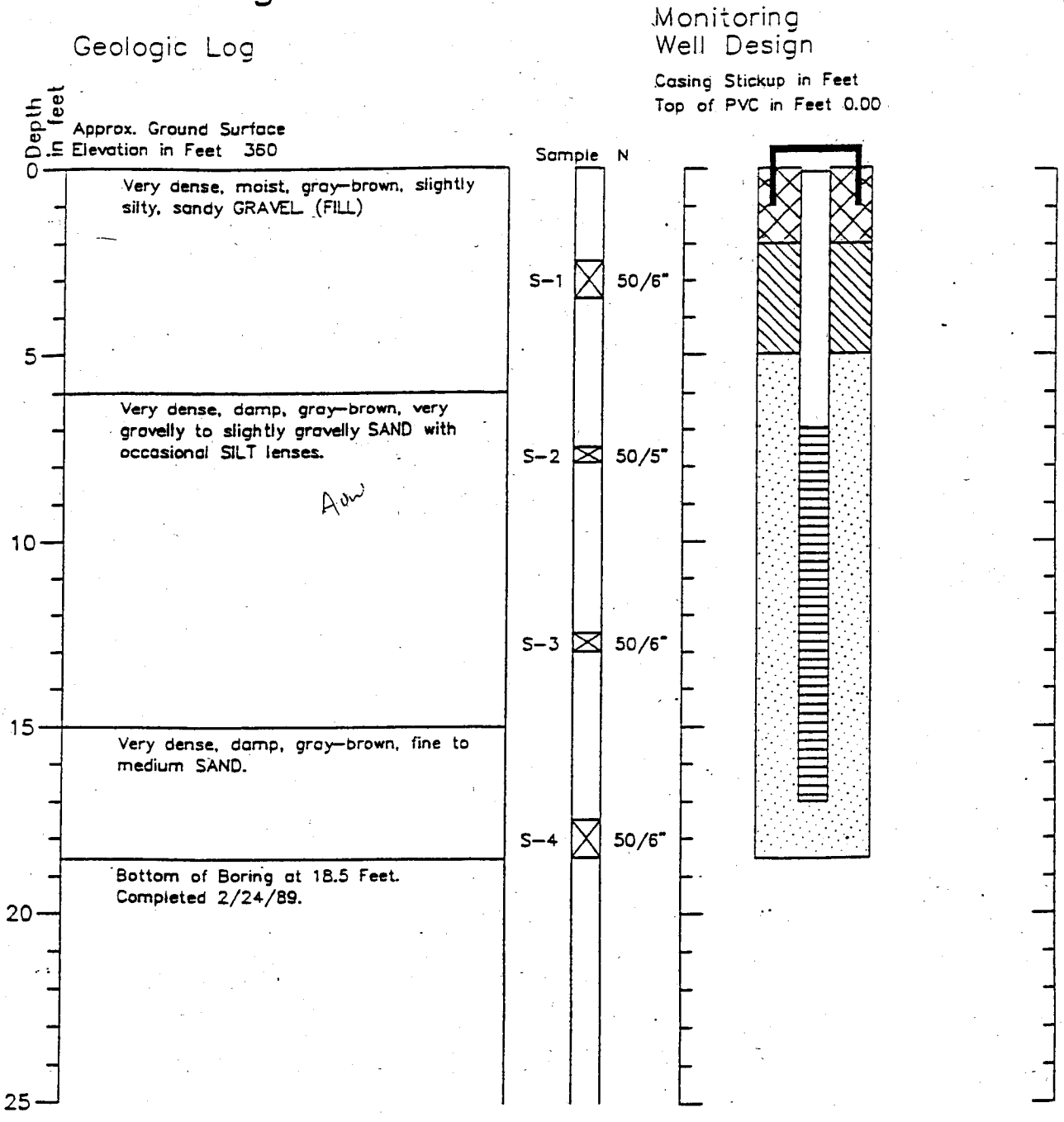
Boring Log and Construction Data for Monitoring Well WY-3



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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J-2359 2/89

Figure A-4

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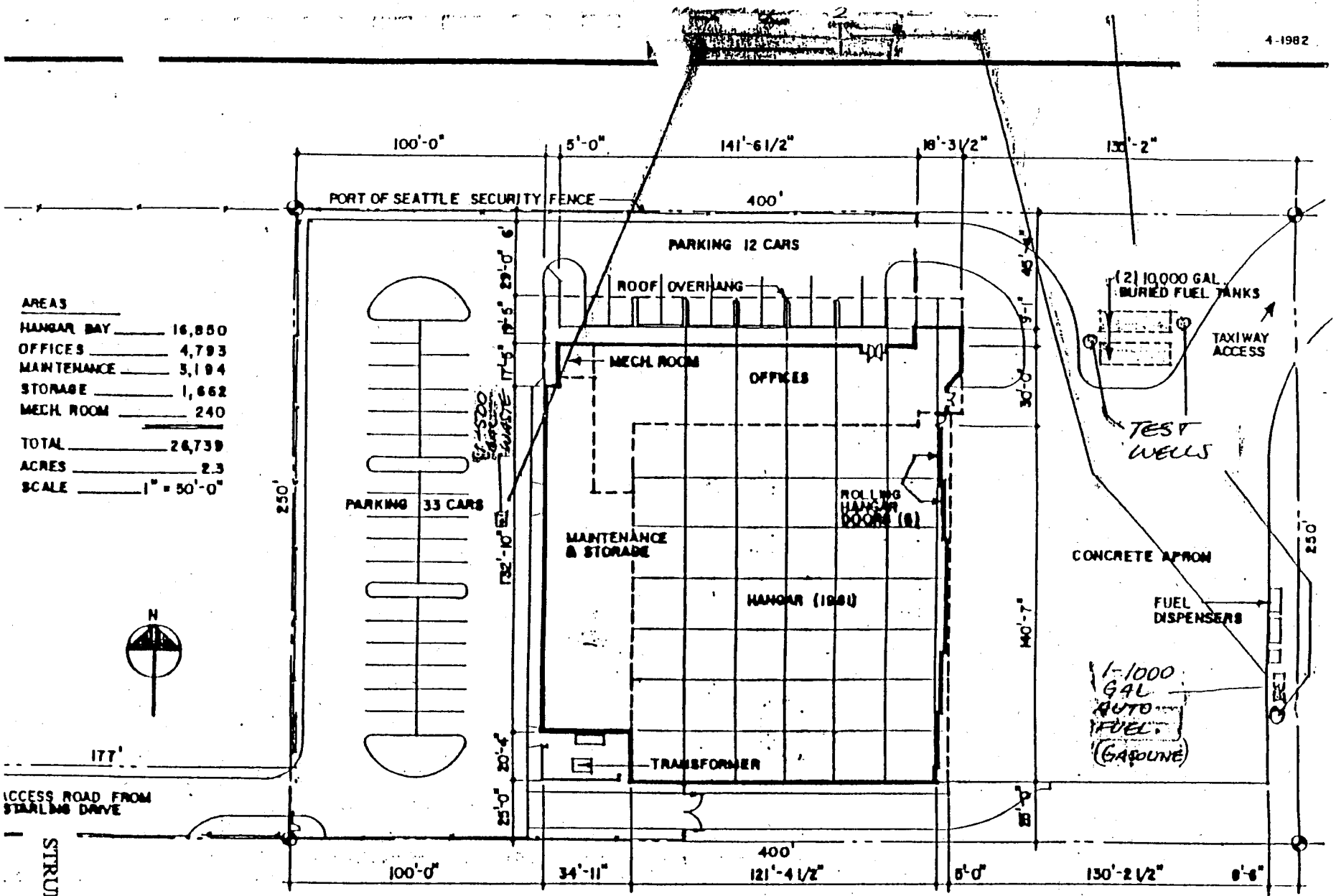

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