



PACIFIC
ENVIRONMENTAL
GROUP INC.

FACSIMILE TRANSMITTAL

DATE: 2/18/93 PROJ. # _____
 TO: Juliette Shin FAX: 510-569-4757
QCH CS
 FROM: Kelly Brown

IF YOU HAVE ANY PROBLEMS RECEIVING THIS FACSIMILE, PLEASE CALL (408) 441-7500

SHEETS TO FOLLOW COVER PAGE

15

COMMENTS: Juliette
Sorry about the delay for this
information regarding air sparging
articles:
"Air Sparging: A new model for remediation" R.A. Bour
Pollution Engineering 7/1/92
"Air Sparging" K.E. Angell
The National Environmental Journal, Jan/Feb 1992
"Application of In Situ Air Sparging" ... Ground Spring 1992
call if you have any questions.
Kelly

2025 Gateway Place, Suite 440, San Jose, California 95110
 620 Contra Costa Blvd., Suite 209, Pleasant Hill, California 94523

(408) 441-7500
 (510) 825-0855

FAX (408) 441-7539
 FAX (510) 825-0882



PACIFIC
ENVIRONMENTAL
GROUP, INC.

AIR SPARGING - CASE STUDY

Site Conditions

- o Soil types at the site consist primarily of coarse-grained deposits to an approximate depth of 21 to 23 feet below ground surface (bgs), underlain by clay. Fill material consisting of clean sand and gravel and construction debris occurs from the ground surface to an approximate depth of 18 to 22-1/2 feet in the areas of the former tanks.

Well Installation Procedures

- o The borings for the dual completion air sparging and soil vapor extraction wells were drilled using 10-inch diameter hollow-stem auger drilling equipment. The soil borings were converted to dual completion air sparging and soil vapor extraction wells by the installation of two, 2-inch diameter Schedule 40 PVC casings. One casing comprises the air sparging well, and one casing comprises the soil vapor extraction well. The air sparging wells were constructed by placing from the bottom of the boring, a 1 foot length of either 0.020- or 0.040-inch factory-slotted screen. Coarse aquarium sand is placed in the annular space and extended across the screened interval, extending approximately 1 foot above the top of the screens. A bentonite and portland cement seal impregnated with a catalyst extends from the top of the sand pack to the approximate groundwater surface. The catalyst is used for quickening the setting time of the portland cement seal. The screen for the soil vapor extraction wells consist of 0.040-inch factory-slotted screen, extending from the top of the seal for the air sparging well, to a depth of approximately 6 feet bgs. Coarse aquarium sand is placed in the annular space across the entire screened interval, and extends approximately 1 foot above the top of the screen. A bentonite and portland cement seal extends from the sand pack for the vapor extraction well to the ground surface.

- o The borings for the air sparging wells were drilled using 8-inch diameter hollow-stem auger drilling equipment. The air sparging wells were constructed by placing from the bottom of the boring, a 1 foot length of either 0.020- or 0.040-inch factory-slotted screen. Coarse aquarium sand is placed in the annular space and extended across the screened interval, extending approximately 1 foot above the top of the screens. A bentonite and portland cement seal extends from the top of the sand pack to the ground surface.

Well placement is shown in Figure 1. Well construction details are attached as Figures 2 and 3.

System Requirements

- o Groundwater extraction while sparging is necessary to contain separate-phase or dissolved contaminant plumes, and to stop possible off-site migration.
- o Soil vapor extraction while sparging is needed to capture vapors generated from sparging and to minimize their release to the atmosphere.

Quarterly Analytical Results

- o Pre-start up groundwater analytical results from site wells indicated that TPH-g and benzene concentrations ranged from non-detected to 14,000 and non-detected to 930 ppb, respectively. Results are from data obtained approximately 2 months prior to system start up. A pre-start up dissolved gasoline and benzene concentration map is attached as Figure 4.
- o Post-start up groundwater analytical results from site wells indicate that TPH-g and benzene concentration in groundwater have dropped to non-detectable levels for all site wells except Well A-2 which had 1.3 ppb of benzene. Results are from data obtained approximately 1 month after system start up. A post-start up dissolved gasoline and benzene concentration map is attached as Figure 5. A table of historical groundwater analytical results is attached.

Soil Vapor Extraction Analytical and Air Sparging Results

- o Figures 6 and 7 show the historical trend in groundwater and soil vapor concentrations. Although not conclusive these preliminary results are encouraging.

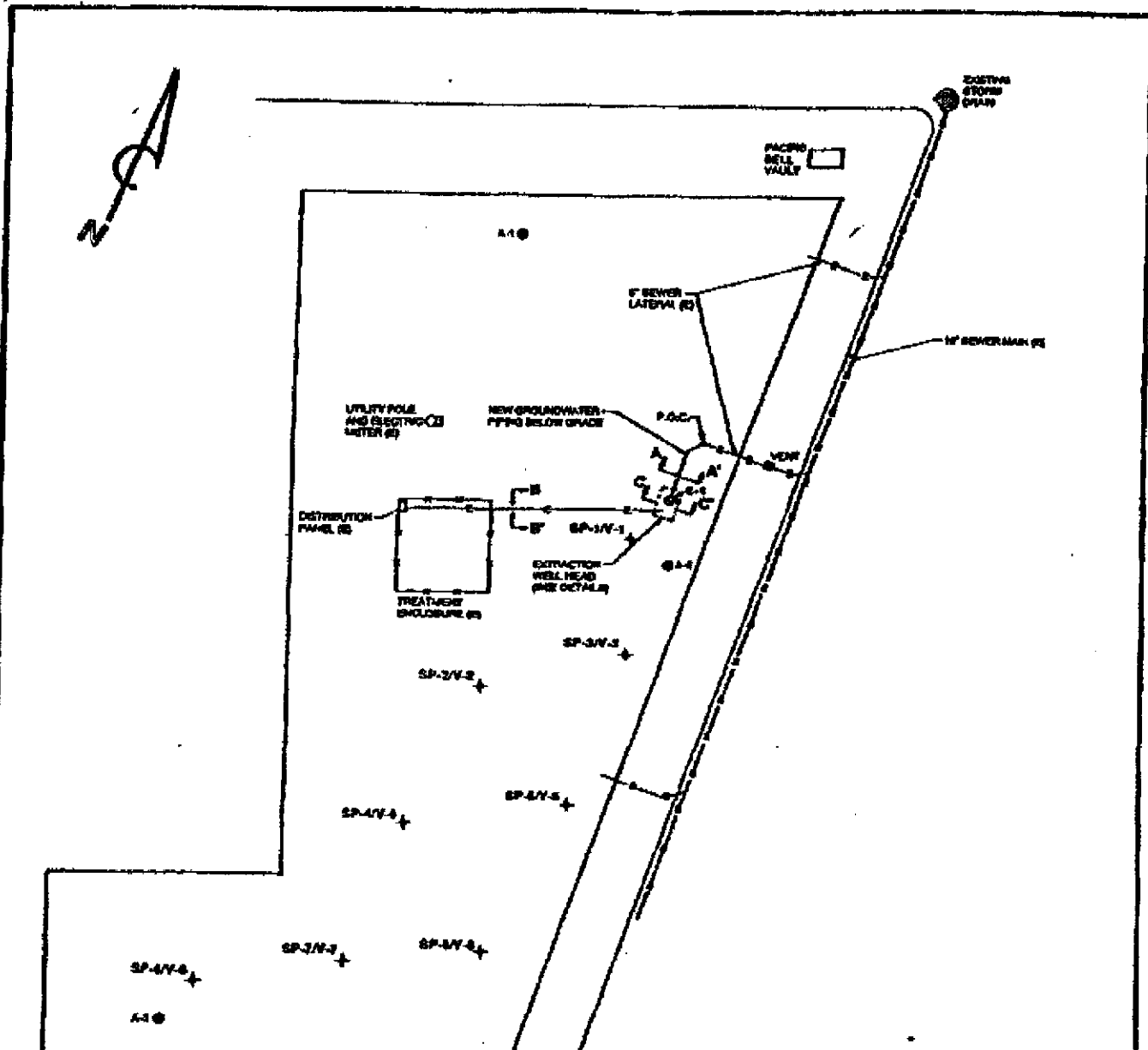
Table 1
Groundwater Extraction Facility
Analytical Results

Sample Date	Gasoline (ppb)	Benzene (ppb)	Toluene (ppb)	Ethylbenzene (ppb)	Xylenes (ppb)
Extraction Well E-1					
10/28/91	1,800	130	140	13	89
11/20/91	3,200	260	240	13	240
12/30/91	6,800	240	180	<6.0	920
01/29/92	2,600	170	74	13	350
02/27/92	710	190	15	33	50
03/11/92	1,200	160	20	17	88
03/17/92	180	0.42	0.63	<0.30	16
04/29/92	1,400	53	34	52	210
05/07/92	56	4.5	0.49	0.61	4.6
05/13/92	<30	3.2	<0.30	<0.30	<0.30
05/28/92	79	17	1.4	2.5	6.5
06/04/92	79	13	1.5	1.4	5.1
06/11/92	49	7.8	1.1	1.4	3.4
06/17/92	60	10	1.2	1.1	3.4
06/30/92	<50	11	0.73	1.4	2.3
ppb = Parts per billion					
< = Analyte was not detected above the stated detection limit.					

Table 3 (continued)
 Quarterly Groundwater Monitoring Results
 Total Petroleum Hydrocarbons

Well Number	Sample Date	Gasoline (ppb)	Benzene (ppb)	Toluene (ppb)	Ethylbenzene (ppb)	Xylenes (ppb)
E-1	09/26/90	210	13	11	5	17
	03/27/91	<30	2.2	0.42	0.75	0.38
	06/21/91	59	11	0.33	5.2	0.62
	09/17/91	NS	NS	NS	NS	NS
	12/30/91	6,800	240	180	<6.0	920
	03/13/92	NS	NS	NS	NS	NS
	04/06/92	NS	NS	NS	NS	NS
	06/04/92	NS	NS	NS	NS	NS
	07/06/92	NS	NS	NS	NS	NS

ppb = Parts per billion
 NA = Not available
 ND = Not detected
 NS = Not sampled
 < = Denotes minimum laboratory detection limit.
 * = Contaminated groundwater sampling equipment used for sampling.



LEGEND

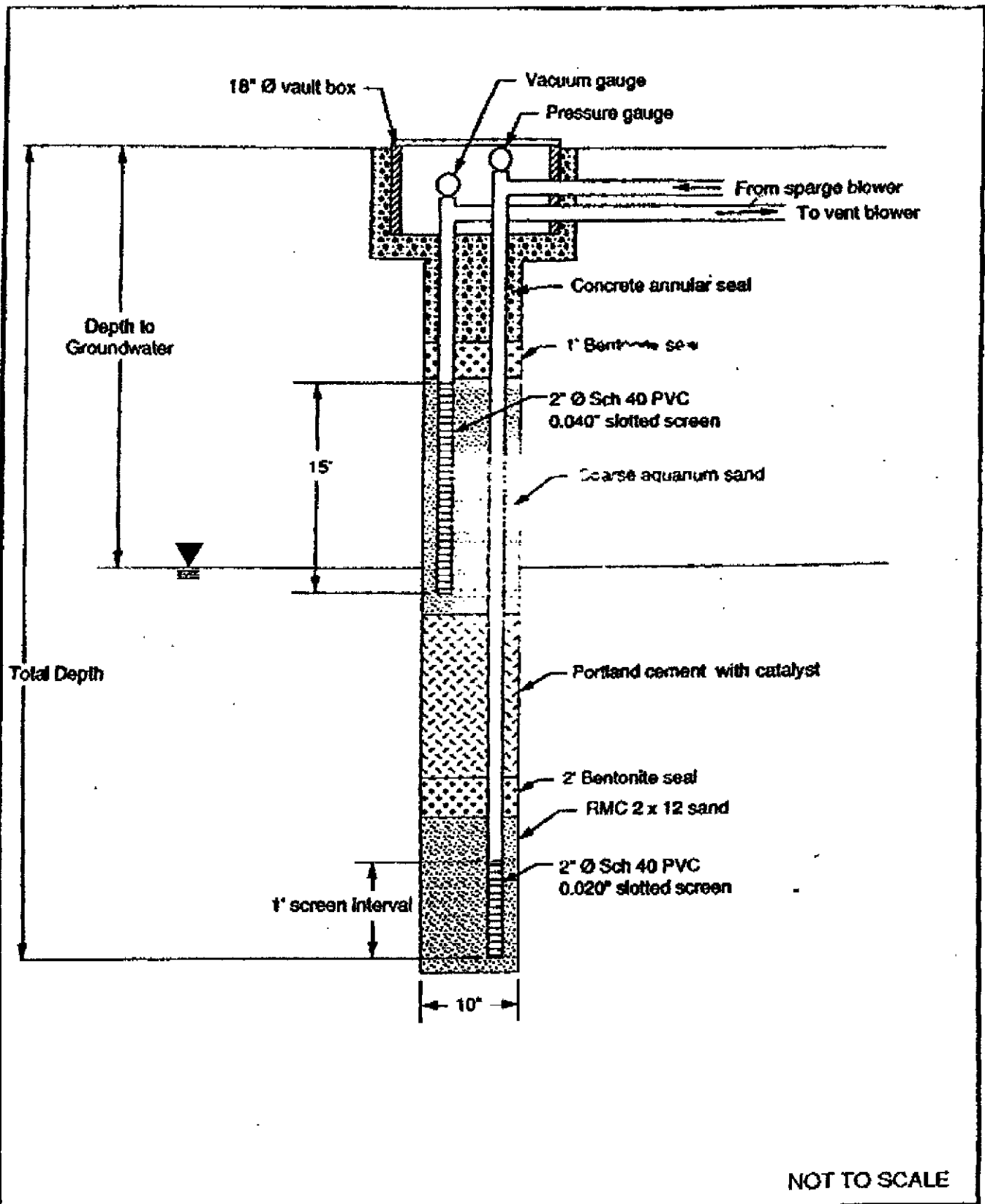
- A-1 ● EXISTING GROUNDWATER MONITORING WELL LOCATION AND DESIGNATION
- E-1 ● EXISTING EXTRACTION WELL LOCATION AND DESIGNATION
- SP-1V-1 ✚ DUAL COMPLETION WELL, SPARGING WELL AND VAPOR EXTRACTION WELL LOCATION AND DESIGNATION
- P.O.C. POINT OF CONNECTION, NEW TO EXISTING
- CHAIN LINK FENCE (E)
- S— SANITARY SEWER LATERAL
- E— UNDERGROUND ELECTRICAL 3/4" 601 40 PVC
- (E) EXISTING




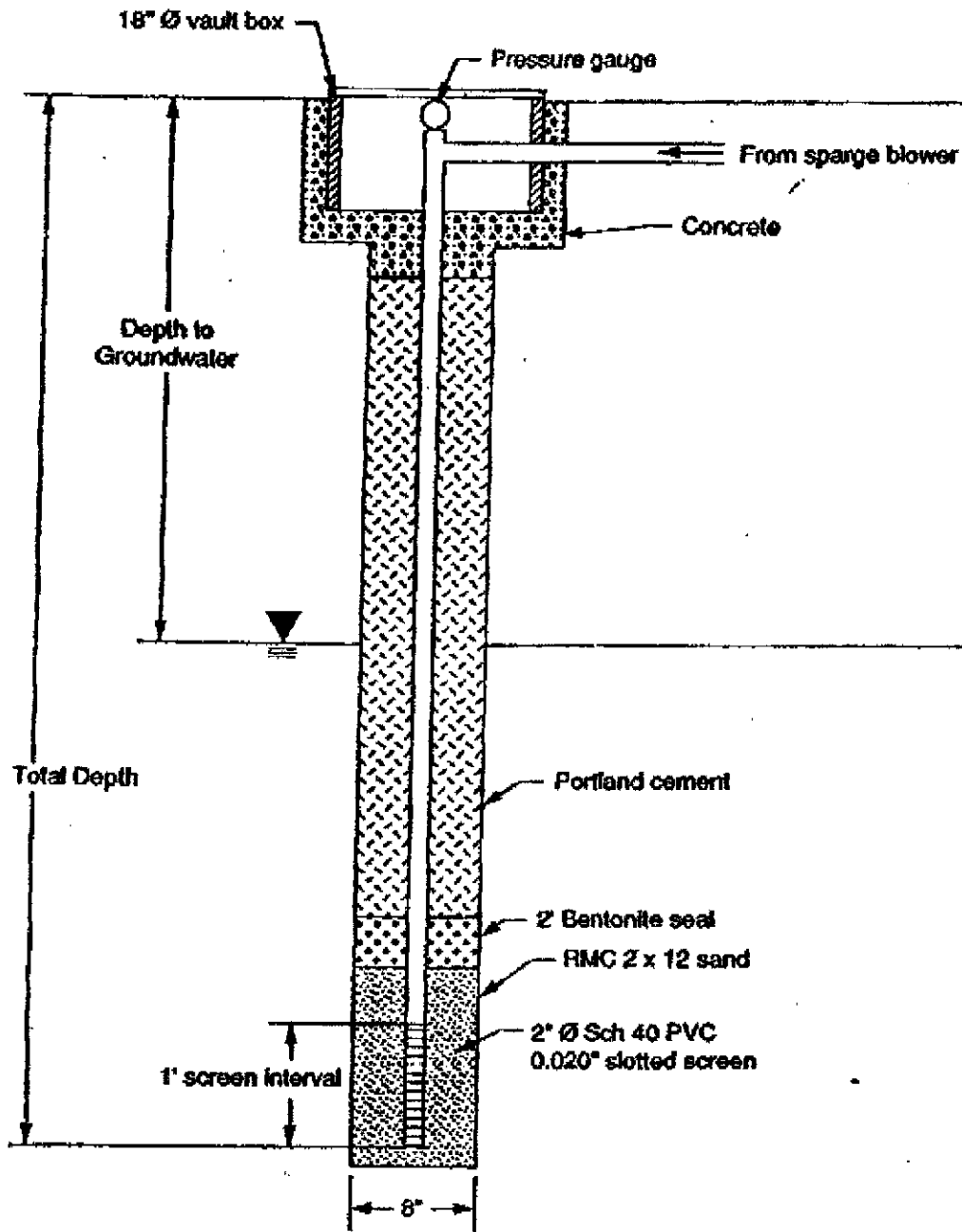
PACIFIC ENVIRONMENTAL GROUP INC.

AIR SPARGING WELL LOCATION MAP

FIGURE 1



 <p>PACIFIC ENVIRONMENTAL GROUP, INC.</p>	<p>PROPOSED DUAL COMPLETION AIR SPARGING AND VAPOR EXTRACTION WELL CONSTRUCTION DETAIL</p>	<p>FIGURE: 2</p>
--	--	------------------



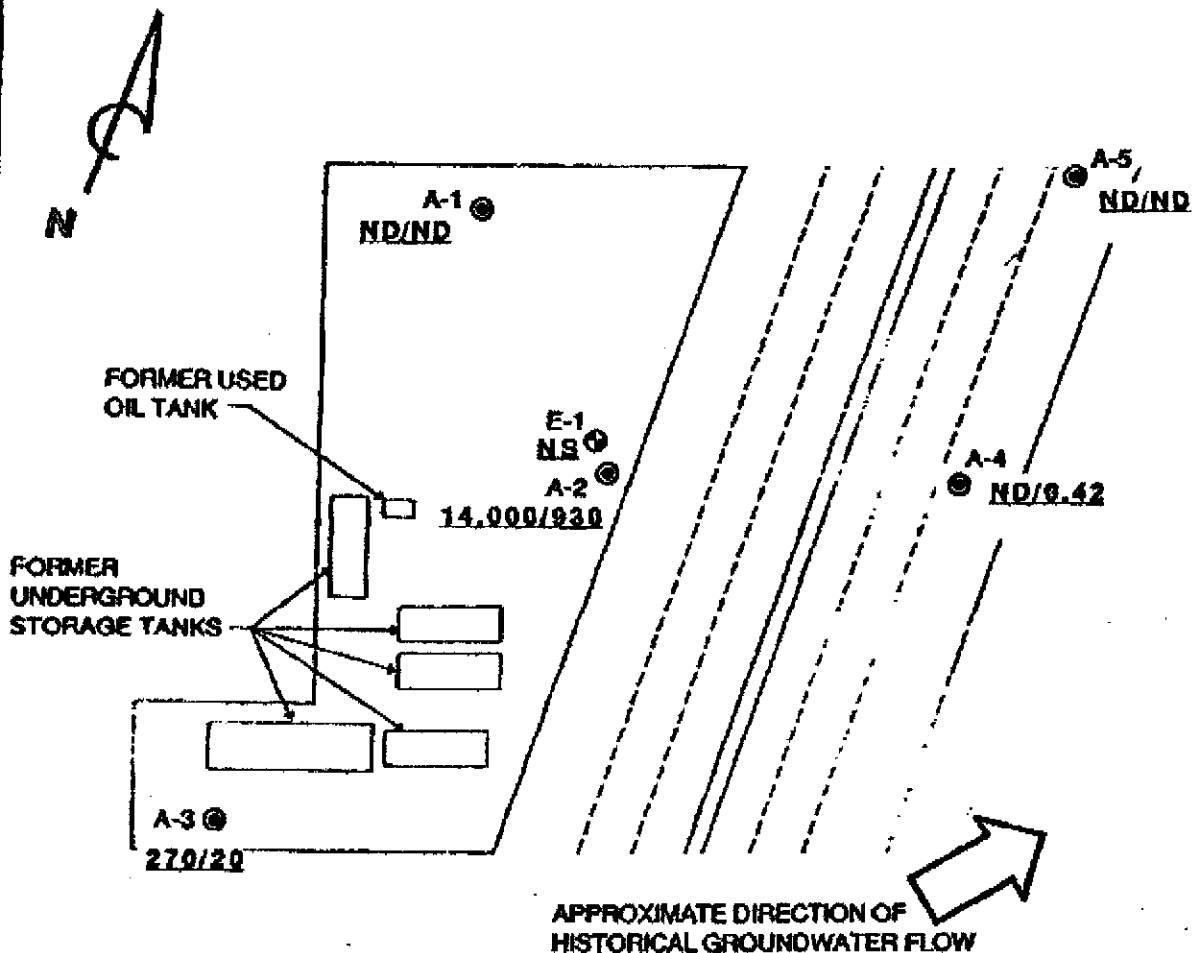
NOT TO SCALE



PACIFIC
ENVIRONMENTAL
GROUP, INC.

PROPOSED AIR SPARGING WELL CONSTRUCTION DETAIL

FIGURE:
3



LEGEND

- A-1 ● GROUNDWATER MONITORING WELL LOCATION AND DESIGNATION
- E-1 ● GROUNDWATER EXTRACTION WELL LOCATION AND DESIGNATION
- 270/20 DISSOLVED GASOLINE/BENZENE CONCENTRATION IN PARTS PER BILLION, 4-8-92
- ND** NON-DETECTABLE LEVELS
- NS** WELL NOT SAMPLED

SCALE



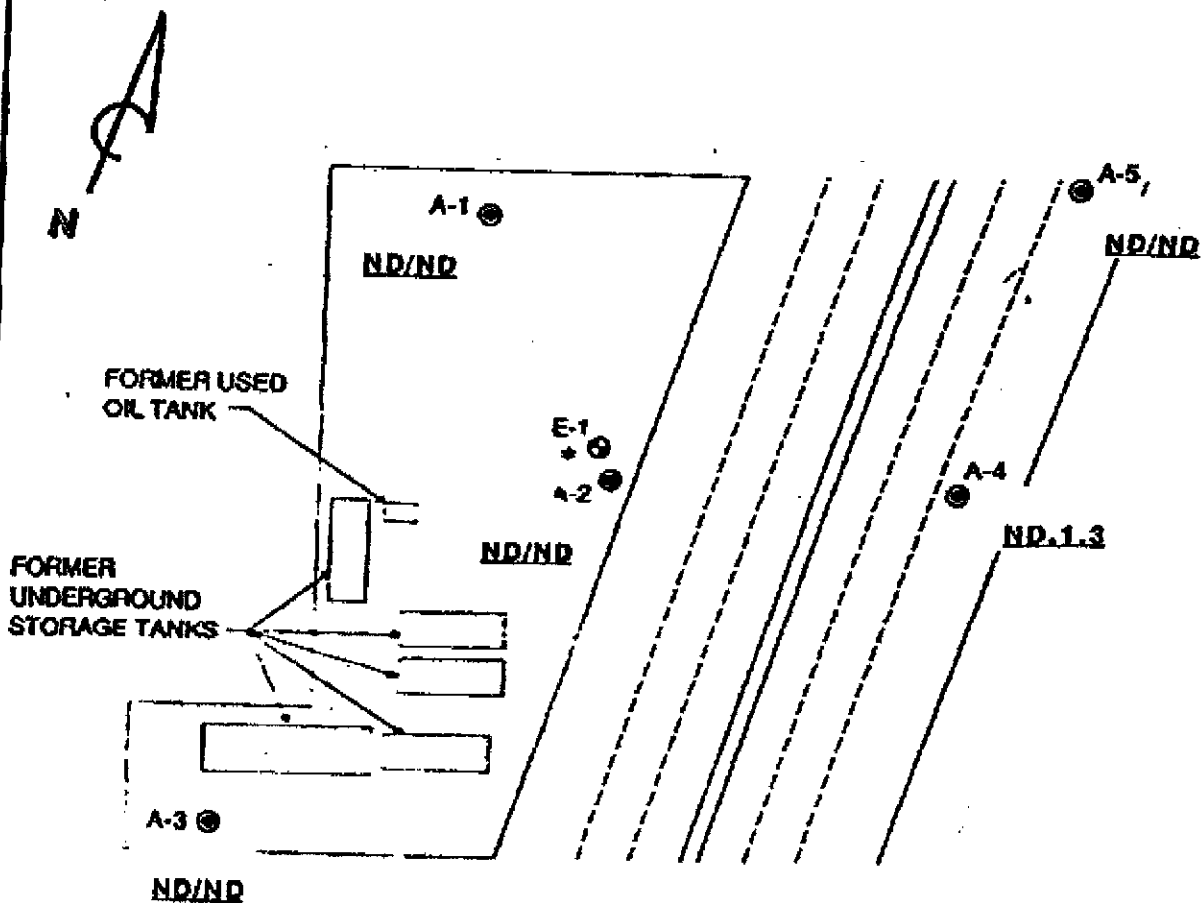
PACIFIC ENVIRONMENTAL GROUP, INC.

BEFORE SPARGING

DISSOLVED GASOLINE AND BENZENE CONCENTRATION MAP

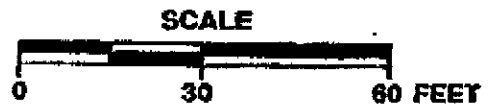
FIGURE:

4



LEGEND

- A-1 ● GROUNDWATER MONITORING WELL LOCATION AND DESIGNATION
- E-1 ● GROUNDWATER EXTRACTION WELL LOCATION AND DESIGNATION
- ND/1.3 DISSOLVED GASOLINE/BENZENE CONCENTRATION IN PARTS PER BILLION, 7-6-92
- ND NON-DETECTABLE LEVELS
- * NOT SAMPLED

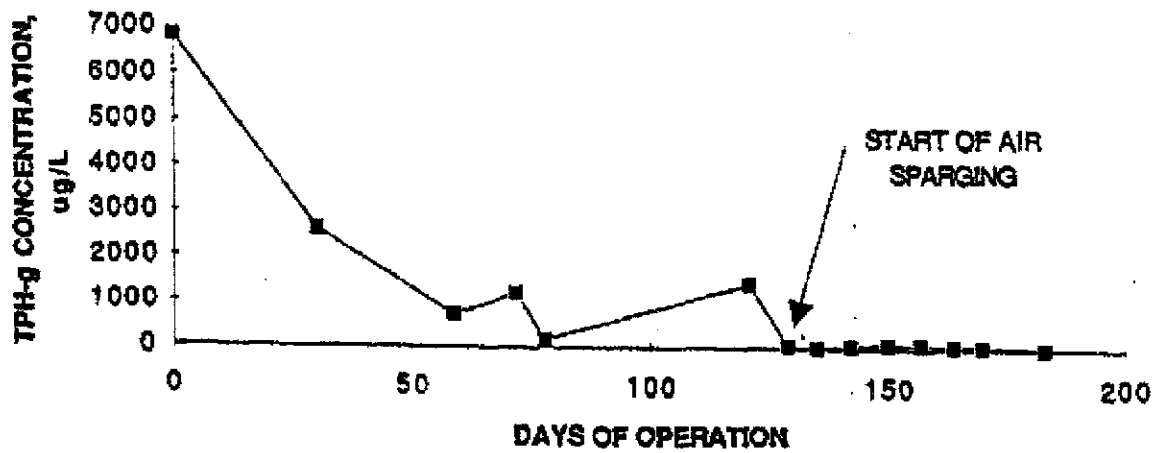


PACIFIC ENVIRONMENTAL GROUP, INC.

60 DAYS AFTER SPARGING
DISSOLVED GASOLINE AND BENZENE CONCENTRATION MAP

FIGURE:
5

GROUNDWATER TREATMENT SYSTEM

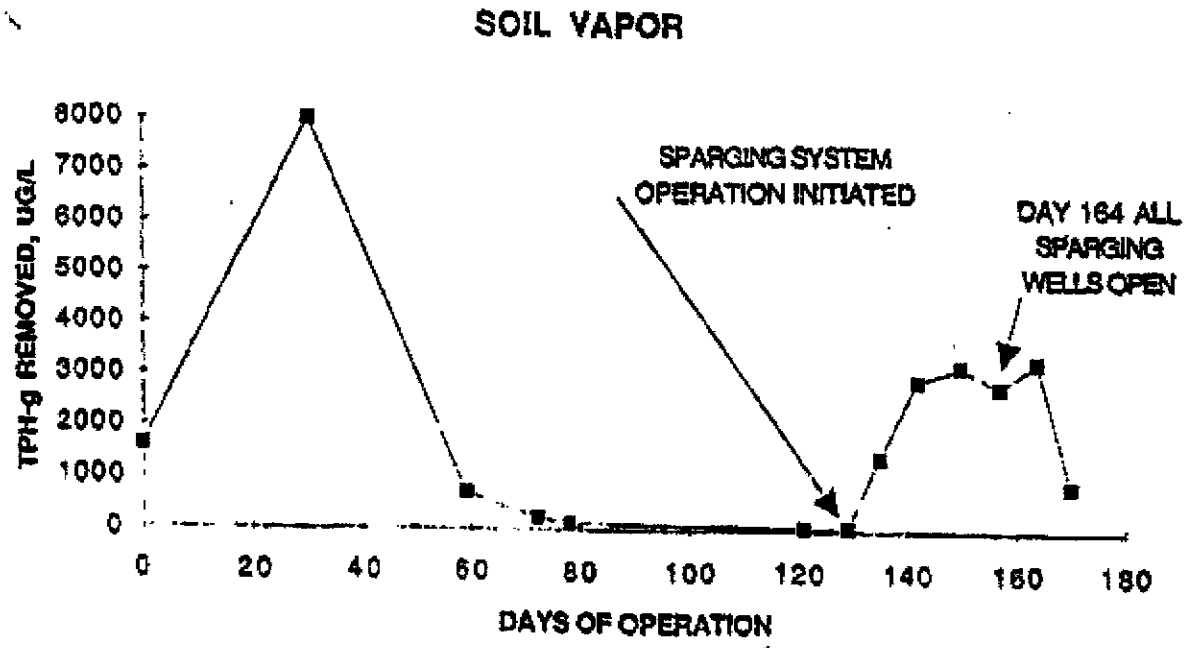


PACIFIC
ENVIRONMENTAL
GROUP INC.

GROUNDWATER EXTRACTION SYSTEM CONCENTRATION TRENDS

FIGURE:

6



PACIFIC ENVIRONMENTAL GROUP INC.

SOIL VAPOR EXTRACTION SYSTEM CONCENTRATION TRENDS

FIGURE:
7