ABC ADRIAN BROWN CONSULTANTS, INC.

Final

OU-2 PHASE I WORKPLAN
FOR THE
KN ENERGY GAS COMPRESSOR STATION
CASPER, WYOMING

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1.0 INTRODUCTION

This Workplan sets out the proposed activities associated with the investigation and remediation of the remaining source areas, if any, at the KN Energy Gas Compressor Station, Casper, Wyoming (KN Facility). With the agreement of EPA, the Workplan has been prepared with a view to administrative efficiency. The large amount of information and site history developed and reported in the prior studies of the KN Facility and the Mystery Bridge Road/U.S. Highway 20 Superfund Site (Site) and in the past and current remedial activities have been summarized here, but not reported in detail. The relevant information is provided in the documents listed in Section 11.0 of this Workplan and the monthly reports of site activities submitted on behalf of KN to EPA. The proposed activities set forth in this Workplan are described in sufficient detail to allow evaluation of the reasonableness and effectiveness of the program. Additional details concerning specific procedures are provided in the supporting documents, in particular the OU-1/OU-2 Sampling and Analysis Plan (SAP) (containing the Field Sampling Plan and the Quality Assurance Project Plan) (ABC, 1993a), the Revised Air Sparging Report for the KN Energy Gas Compressor Station, Casper, Wyoming (Air Sparging Report) (ABC, 1993b), the Remedial Action Groundwater Monitoring Plan (GMP) (1993c), and to a lesser extent in the Site Safety Plan (SSP) (ABC, 1992a). This Workplan should be read in conjunction with those documents.

1.1 SITE BACKGROUND

KN has operated the KN Facility since 1965. In 1985, groundwater under and immediately north of the KN Facility was found to contain trace amounts of dissolved hydrocarbons that were suspected to have originated, in part, from the KN Facility (Ecology and Environment, 1987). The constituents of concern at the KN Facility are benzene, ethylbenzene, toluene, and xylene (BETX) for which the maximum contaminant levels (MCLs) are listed in Table 1.

Table 1: Maximum Contaminant Levels for BETX

Constituent	MCL (mg/l)
Benzene	0.005
Ethylbenzene	0.7
Toluene	1
Xylenes	10

Source: EPA Drinking Water Regulations and Health Advisories, December 1992

Since November 1989, KN has undertaken a removal action at the KN Facility, which is part of the Site. EPA divided the Site into two operable units: Operable Unit One (OU-1), which addresses groundwater remediation, and Operable Unit Two (OU-2), which addresses remediation of source areas.

KN's removal action consisted of groundwater pump and treat (PAT) and soil vapor extraction (SVE) systems that remove hydrocarbons via three phases: free floating product, groundwater, and soil vapor. The SVE system extracts vapor phase hydrocarbons from the unsaturated interval between the water table and the ground surface. The PAT system pumps groundwater to the surface where volatile hydrocarbons are removed by air stripping. Floating product, when present, is removed from the groundwater extraction wells when the PAT system is in operation. As part of OU-1, the removal action was selected as the remedy for the KN Facility.

2.0 OBJECTIVES OF OU-2 PHASE I

2.1 OVERALL OBJECTIVES

The overall objective for OU-2 at the KN Facility is to "[e]nsure long-term effectiveness and permanence of OU-1 remediation by eliminating the sources of groundwater contamination at the site, such as contaminated subsurface soils or free product (excluding sources associated with the groundwater plume extending from the LARCO property into the Brookhurst Subdivision), so that the concentration in groundwater of contaminants originating from these sources never exceed Maximum Contaminant Levels (MCLs) or proposed MCLs" (EPA, 1991).

2.2 SPECIFIC OBJECTIVES

The specific objectives for OU-2 are as follows:

1. Evaluate the current remedial action;
2. Confirm current soil conditions;
3. Enhance the ongoing remedial action by implementing a full-scale air sparging system;
4. Update existing applicable or relevant and appropriate requirements (ARARs);
5. After completing air sparging operations, identify any remaining source areas, if any; and
6. Address remaining source areas, if necessary.

3.0 SCOPE OF WORKPLAN

The proposed scope of work for achieving the objectives of OU-2 Phase I is outlined in the following steps:

1. Evaluate the results of the groundwater sampling conducted in March 1993;
2. Collect soil samples from the remaining impacted areas as part of the air sparging program;
3. Implement a full-scale air sparging program;
4. Review and revise the ARARs;
5. Confirm soil conditions at the KN Facility after completion of the air sparging program;
6. Assess success of the existing PAT and SVE systems and air sparging program;
7. Prepare a summary report for OU-2 Phase I; and
8. Perform a feasibility study for the remediation of any remaining source areas, if necessary.

4.0 CONCEPTUAL SITE MODEL

The use of a conceptual site model is necessary to establish a hypothesis for the transport of the BETX constituents in the existing soil/groundwater system. The current conceptual model is illustrated in Figure 1. It is based on two BETX source points: the process area and the former flare pit. The source from the process area migrated vertically into the soil, while the source from the former flare pit was subject to burning, which resulted in a low volatile hydrocarbon fluid that migrated into the soil. The BETX compounds migrated by gravity in the vertical direction to the water table, and spread horizontally in the vadose zone by capillarity. The floating product spread out on the water table becoming elongated down gradient to the northeast. The floating product was smeared vertically in the saturated zone due to fluctuating water levels. When groundwater contacts these materials, BETX components transfer into the groundwater in the dissolved state. This conceptual model will be refined as knowledge is gained throughout the course of the air sparging program and ongoing remediation under OU-1.

5.0 SITE CONDITIONS

5.1 HISTORICAL CONDITIONS

The areal extent of stained soil at the KN Facility as reported in the Engineering Evaluation/Cost Analysis (EE/CA) (ABC, 1989) is shown in Figure 2. The cross section A-A' is shown in Figure 3. The soil staining extends to bedrock in places due to fluctuations in the groundwater table resulting in a vertical smearing of the floating product.

5.2 CURRENT CONDITIONS

Remediation at the KN Facility under OU-1 has been successful. Figure 4a illustrates the amount of benzene removed and groundwater pumped to date. Specifically, in three and one half years of operating the PAT system, 570 million pounds of groundwater have been stripped of approximately 28 pounds of benzene. The calculated 3½-year average benzene concentration of the extracted groundwater is 50 ug/l. Figures 4b and 4c illustrate the asymptotic recovery of benzene from the soil gas and product extracted from the KN Facility. As expected, most of the benzene removal by the SVE system took place in the first 6 to 8 months of operation.

Table 2 summarizes the information on the concentrations in groundwater of the BETX constituents over time in 45 wells on and adjacent to the KN Facility including the results of the March 1993 sampling round.[1] Figure 5 presents the dissolved benzene concentrations in groundwater as measured at the March 1993 sampling. Based on this information, it appears that there remains one limited area on the KN Facility where benzene concentrations in groundwater exceed the applicable MCL. Concentrations of toluene, xylene and ethylbenzene in the groundwater at the KN Facility are all below applicable MCLs.

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[1] The data from the six KNP monitoring wells have been excluded from Table 2 since they were designed as piezometers for water level monitoring. They are, in general, not capable of proper groundwater sampling. In addition, their design does not provide access to the water table, and therefore does provide valid floating product thickness data.

No floating product is currently measurable in any monitoring wells on the KN Facility. Floating product in the monitoring wells is sporadic, and appears to depend on the water level in the aquifer. Floating product in groundwater extraction well KNABC-70 has been consistently measured while the pump is in operation.

The low dissolved oxygen concentrations at water table level as measured in March 1993 indicate that microbial activity is prevalent at the KN Facility. Figure 6 shows the low dissolved oxygen concentrations in the areas of impact and the influence of the reinjection of groundwater saturated with oxygen due to the stripping tower. The data in Table 2 provides the basis for a determination of potential source locations for use in developing a hypothesis for the conceptual site model described in Section 4.0.

Table 2: BETX Concentrations in KN and Select Groundwater Monitor Wells (ug/l)

Well Name	Current Date	Benzene			Ethylbenzene			Toluene			Xylenes		
		Current	Minimum	Maximum	Current	Minimum	Maximum	Current	Minimum	Maximum	Current	Minimum	Maximum
MCL		5			700			1,000			10,000		
EPA-1-08	03-Feb-92	<1.00	<1.00	4.00j	<5.00	<1.00	2.00J	<5.00	<1.00	100.00	<5.00	<1.00	<5.00
EPA-1-09	26-Mar-93	4.00	<0.80	7.00	22	<1.00	22.00	<0.78	<0.78	96.00	<23.00	<1.00	<23.00
EPA-1-10	26-Mar-93	<0.80	<0.80	40.00	40.00	<1.00	40.00	<0.78J	<0.78	98.00	11.00	<1.00	27.00
EPA-1-11	01-Nov-90	<1.00	<1.00	<5.00	<5.00	<1.00	<5.00	<5.00	<1.00	<6.00	<5.00	<1.00	<5.00
EPA-2-11	26-Mar-93	<0.80	<0.80	70.00	6.00	<1.00	190.00	<0.78	<0.78	101.00	9.00	<3.00	1300.00
EPA-2-14	26-Mar-93	<0.80	<0.80	2.00	6.00	<1.00	6.00	<0.78	<0.78	105.00	<3.00	<1.00	<3.00
KNABC-01	25-Mar-93	<0.80	<0.80	<1.00	<0.60	<0.60	<5.00	<0.78	<0.78	<5.00	<1.54	<1.00	<5.00
KNABC-02	24-Mar-93	<0.80	<0.80	0.41	<0.60	<0.60	<5.00	<0.78	<0.78	1.04	<1.54	<0.01	<5.00
KNABC-03	24-Mar-93	<0.80	<0.80	<1.00	<0.60	<0.60	<5.00	<0.78	<0.78	<5.00	<1.54	<1.00	<5.00
KNABC-05	25-Mar-93	3.00	<0.80	330.00	38.00	<5.00	160.00	<0.78	<0.78	53.00	25.00	<5.00	1940.00
KNABC-06	25-Mar-93	1.00	<1.00	1.00	3.00	<1.00	<3.00	<0.78	<0.78	<5.00	3.00	<5.00	<7.00
KNABC-07	24-Mar-93	<0.80	<0.80	<5.00	<0.60	<0.60	<5.00	<0.78	<0.78	9.00	<1.54	<1.00	7.00
KNABC-09	25-Mar-93	<0.80	<0.80	<5.00	2.00	<1.00	<2.00	<0.78	<0.78	9.00	4.00	<1.00	10.00
KNABC-10	25-Mar-93	<0.80	<0.80	<5.00	<0.60	<0.60	<5.00	<0.78	<0.78	9.00	<1.54	<1.00	34.00
KNABC-11	25-Mar-93	5.00	<1.00	33.00	120.00	<1.00	120.00	<0.78	<0.78	83.00	54.00	<5.00	1300.00
KNABC-12	25-Mar-93	3.00	<0.50	3.00	5.00	<1.00	5.00	<0.78	<0.50	104.00	10.00	<0.50	110.00
KNABC-15	24-Mar-93	<0.80	<0.80	0.46	<0.60	<0.01	<5.00	<0.78	<0.78	0.75	<1.54	<0.01	<5.00
KNABC-16	24-Mar-93	<0.80	<0.80	<1.00	<0.60	<0.60	<5.00	<0.78	<0.78	2.81	<1.54	<1.00	<5.00
KNABC-17	25-Mar-93	4.00	<1.00	<100.00	31.00	<5.00	31.00	<0.78	<0.78	<100.00	12.00	<5.00	360.00

j : Estimated value
M : Original parameter note modified
J : Analyzed below contract LOD
SP : Compound was a spike

Well Name	Current Date	Benzene			Ethylbenzene			Toluene			Xylenes		
		Current	Minimum	Maximum	Current	Minimum	Maximum	Current	Minimum	Maximum	Current	Minimum	Maximum
MCL		5			700			1,000			10,000		
KNABC-18	24-Mar-93	<0.80	<0.80	<1.00	<0.60	<0.60	<5.00	<0.78	<0.78	1.33	<1.54	<1.00	14.00
KNABC-19	24-Mar-93	<0.80	<0.80	<1.00	<0.60	<0.60	<5.00	<0.78	<0.78	6.00	<1.54	<1.00	72.00
KNABC-20	25-Mar-93	0.80	<0.80	3.91	70.00	<5.00	110.00	<0.78	<0.78	2.67	62.00	<5.00	411.02
KNABC-21	24-Mar-93	<0.80	<0.80	<1.00	<0.60	<0.60	<5.00	<0.78	<0.78	<5.00	<1.54	<1.00	<5.00
KNABC-22	30-Oct-90	<1.00	<0.50	<1.00	<5.00	<0.50	<5.00	<5.00	<0.50	<5.00	<5.00	<0.50	<5.00
KNABC-23	24-Mar-93	<0.80	<0.80	<1.00	<0.60	<0.60	<5.00	<0.78	<0.78	<5.00	<1.54	<1.54	<5.00
KNABC-24	01-Nov-90	<1.00	<0.50	<5.0J,M	<5.00	<0.50	40.00	<5.00	<0.50	105.00	<5.00	<0.50	47.00
KNABC-25	25-Mar-93	<0.80	<0.50	200.00	<0.60	<0.50	170.00	<0.78	<0.50	<10.00	<1.54	<0.50	270.00
KNABC-26	25-Nov-92	<0.80	<0.80	220.00	7.00	<5.00	1600.00	<0.78	<0.78	520.00	3.00	3.00	6900.00
KNABC-27	25-Mar-93	5.00	<5.00	25.00	240.00	<5.00	240.00	<0.78	<0.78	52.00	300.00	42.00	300.00
KNABC-34	4-Oct-92	7.00	<1.00	54.00	13.00	<5.00	86.00	<0.78	<0.50	12.00	18.00	<5.00	270.00
KNABC-35	31-Mar-92	97.00	3.00	7370.00	45.00	<5.00	1535.00	16.00	<5.00	400.00	190.00	<5.00	2415.00
KNABC-36	28-Jul-92	2.00	<1.00	155.00	13.00	<5.00	164.00	<0.78	<0.78	25.00	13.00	13.00	820.00
KNABC-50	19-Oct-92	4.00	1.00	29.00	48.00	<50.00	177.00	4.008	<0.78	284.00	13.00	6.00	943.00
KNABC-70	13-Apr-93	6.00	3.00	15.00	6.00	3.00	16.00	<0.78	<0.78	6.00	31.00	9.00	64.00
KNABC-71	13-Apr-93	<0.80	<0.80	<0.80	4.00	4.00	4.00	<0.78	<0.78	<0.78	4.00	4.00	4.00
KNABC-72	13-Apr-93	22.00	13.00	200.00	79.00	30.00	92.00	<0.78	<0.78	1.00	210.00	77.00	210.00
KNABC-73	13-Apr-93	22.00	5.00	82.00	45.00	36.00	140.00	<0.78	<0.78	2.00	83.00	68.00	190.00
KNGW-01	24-Mar-93	<0.80	<0.80	<1.00	<0.60	<0.60	<5.00	<0.78	<0.78	<5.00	<1.54	<1.54	<5.00
KNGW-02	26-Mar-93	40.00	<1.00	40.00	110.00	<5.00	110.00	<0.78	<0.78	38.00	160.00	<5.00	160.00
KNGW-03	26-Mar-93	4.00	<1.00	<4.00	36.00	<5.00	36.00	<0.78	<0.78	5.00	39.00	<5.00	170.00

j : Estimated value
M : Original parameter note modified
J : Analyzed below contract LOD
SP : Compound was a spike

Well Name	Current Date	Benzene			Ethylbenzene			Toluene			Xylenes		
		Current	Minimum	Maximum	Current	Minimum	Maximum	Current	Minimum	Maximum	Current	Minimum	Maximum
MCL		5			700			1,000			10,000		
KNMW-04	25-Mar-93	<0.80	<0.80	<5.00	<0.60	<0.60	<5.00	<0.78	<0.78	<5.00	<1.54	<1.54	<5.00
KNMW-05	25-Mar-93	<0.80	<0.80	<500.00	<0.60	<0.60	210.0J	<0.78	<0.78	<500.00	<1.54	<1.54	1800.00
KNMW-06	26-Mar-93	18.00	<1.00	4200.0SP	6.00	<1.00	6.00	<0.78	<0.78	5000.0SP	16.00	<3.00	920.00
KNMW-07	26-Mar-93	<0.80	<0.80	<250.00	4.00	<1.00	140.0j	<0.78	<0.78	90.00	7.00	<3.00	1100.00
OBG-07	26-Mar-93	<0.80	<0.80	<5.00	<0.60	<0.60	<5.00	<0.78	<0.78	<5.00	<1.54	<1.00	<5.00

j : Estimated value
M : Original parameter note modified
J : Analyzed below contract LOD
SP : Compound was a spike

6.0 FIELD PROGRAM

6.1 AIR SPARGING

KN has proposed accelerating the remedial effort at the KN Facility, particularly with regard to the soil at the water table fluctuation zone, by using in-situ air sparging (ABC, 1993b). Air sparging is the injection of air below the water table, which then rises up through the soil and groundwater stripping the volatile components (including BETX) from any residual hydrocarbons and ultimately emerging into the vadose zone. The air in the vadose zone is then collected using the existing SVE system, as modified, and transmitted into the permitted vapor discharge system currently onsite.

6.1.1 AIR SPARGE TEST

To evaluate the feasibility of the air sparging technology at the KN Facility, a prototype air sparge test well was installed and operated under controlled conditions. Results from the test indicate that there was a measurable effect on the volatile components remaining in the groundwater system. In addition, the dissolved oxygen content of the groundwater increased due to the air injection making more oxygen available for bacterial colonies. The air sparge test conditions, parameters and results are presented in the Revised Air Sparging Report (ABC, 1993b).

6.1.2 FULL-SCALE AIR SPARGING

A full-scale air sparging design for the KN Facility is presented in the Revised Air Sparging Report (ABC, 1993b). The design contemplates operating approximately 15 cells of air sparge wells. Each cell will be comprised of between 3 to 5 air sparge wells spaced approximately 50 feet apart. A total of approximately 56 wells will be operated over a one year period. One to two cells may be operated at any given time depending upon the cell configuration, equipment capabilities, and current aquifer conditions. Details of installation, operation, and results of the program will be reported in the monthly reports to EPA, as well as being reported in the Phase I Summary Report.

6.1.2.1 Sparging Locations

KN proposes in this Workplan to locate the first sparge cell in the northeast corner of the KN Facility. In this manner, optimization of the air sparging system will be facilitated by observing the effects on the last zone where benzene in the groundwater exceeds the applicable MCL. At the outset, groundwater extraction wells will be operated during the air sparging program. In the event that it appears that operation of the groundwater extraction wells is counteracting the air sparging effect, EPA will be notified and alternatives will be explored.

6.1.2.2 Soil Vapor Extraction System

The SVE system will be operated during the air sparging program with the exception of brief time intervals when soil gas monitoring is taking place. At the completion of the air sparging program, the SVE system will continue to operate for a period of 4 weeks after which the SVE system will be shut down and sampled for the BETX constituents (Standard Operating Procedure AIR022 - SAP). If the sampling results reveal that a rebound of hydrocarbon concentrations has occurred in the soil gas, EPA will be notified and alternatives will be explored.

6.1.2.3 Operational Monitoring

Operational monitoring of the air sparging system will be performed according to the program set forth in the Revised Air Sparging Report (ABC, 1993b).

6.2 SOIL CONDITION

6.2.1 SOIL SAMPLING

As described in more detail in the Revised Air Sparging Report, five soil samples will be collected from the KN Facility. One from each of the locations shown in Figure 7. The drilling technique will be split-spoon sampling every five feet from ground surface to bedrock using a hollowstem auger (Standard Operating Procedure SLS023 - SAP). The sample with the highest reading using a Photo-Ionization Detector (PID) will be sent to the lab to be analyzed for BETX using EPA Method 8260 with selective ion monitoring (SIM).

At the conclusion of the air sparging program, each of the original soil sampling boreholes will be twinned a distance of no greater than 10 feet at the same depth. Soil samples will be collected in the same manner as the pre-sparging samples and analyzed for the same parameters using the same method.

6.2.2 LABORATORY ANALYSIS TECHNIQUES

Using current laboratory analysis techniques (EPA Method 8020), the practical quantitation limit (PQL) for BETX components in soil samples with relatively high hydrocarbon concentrations is 250 ppb. To identify BETX concentrations in soil at ranges that will be useful to determine soil conditions at the KN Facility, it appears necessary to demonstrate a method with detection limits for BETX in soil in the range of 10 ppb.

To achieve lower detection limits, ABC proposes to use EPA Method 8260 modified to include SIM (see Appendix A - SAP), if necessary. In previous soil analyses, the use of EPA Method 8260 modified to include SIM has been reported to achieve detection limits for benzene in the 5 ppb range[2].

7.0 UPDATING ARARs

Concurrent with the above actions, the existing ARARs set forth in the Record of Decision for OU-1 will be revised, based on evaluation of the appropriateness and completeness of these ARARs for OU-2.

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[2] Personal communication with John Huntington, Ph.D., Phoenix Analytical Laboratories, Inc., January 15, 1992.

8.0 PHASE I REPORT

Following the completion of the activities described in this Workplan, the Phase I Summary Report will be finalized (it will be in preparation during the entire project). This report will contain a description of the entire set of activities described above and their results. The report will include:

1. a conceptual site model of the relationship between potential source areas and groundwater;
2. a description of the nature, extent and volume of potential source areas;
3. the status of KN's SVE, PAT, and air sparging systems;
4. sample results and interpretations of sampling events performed during Phase I;
5. a preliminary list of remedial alternatives; and
6. a remedial alternatives analysis, if cleanup will not be achieved using the SVE, PAT and air sparging systems.

9.0 PHASE II ACTIVITIES AND IMPLEMENTATION

As part of the OU-2 Phase I activities, an evaluation of the groundwater, soil quality and existence of floating product at the KN Facility will be performed. In the event it is determined by EPA that the PAT, SVE, and air sparging systems will not be adequate to achieve the overall remedial objectives for the KN Facility, an evaluation of additional remedial activities will be undertaken as Phase II. The specific tasks involved in Phase II will be described in an OU-2 Phase II Workplan.

10.0 SCHEDULE OF ACTIVITIES

The schedule for OU-2 activities is shown in Appendix A.

11.0 REFERENCES

ABC, 1989, Engineering Evaluation/Cost Analysis For Response Actions At The Casper Compressor Station, Casper, Wyoming, Adrian Brown Consultants, Inc., Denver, Colorado, March 1989.

ABC, 1991, Phase I Remedial Design Sampling and Analysis Plan for the KN Energy Gas Compressor Station, Casper, Wyoming, Adrian Brown Consultants, Inc., Denver, Colorado, December 1991.

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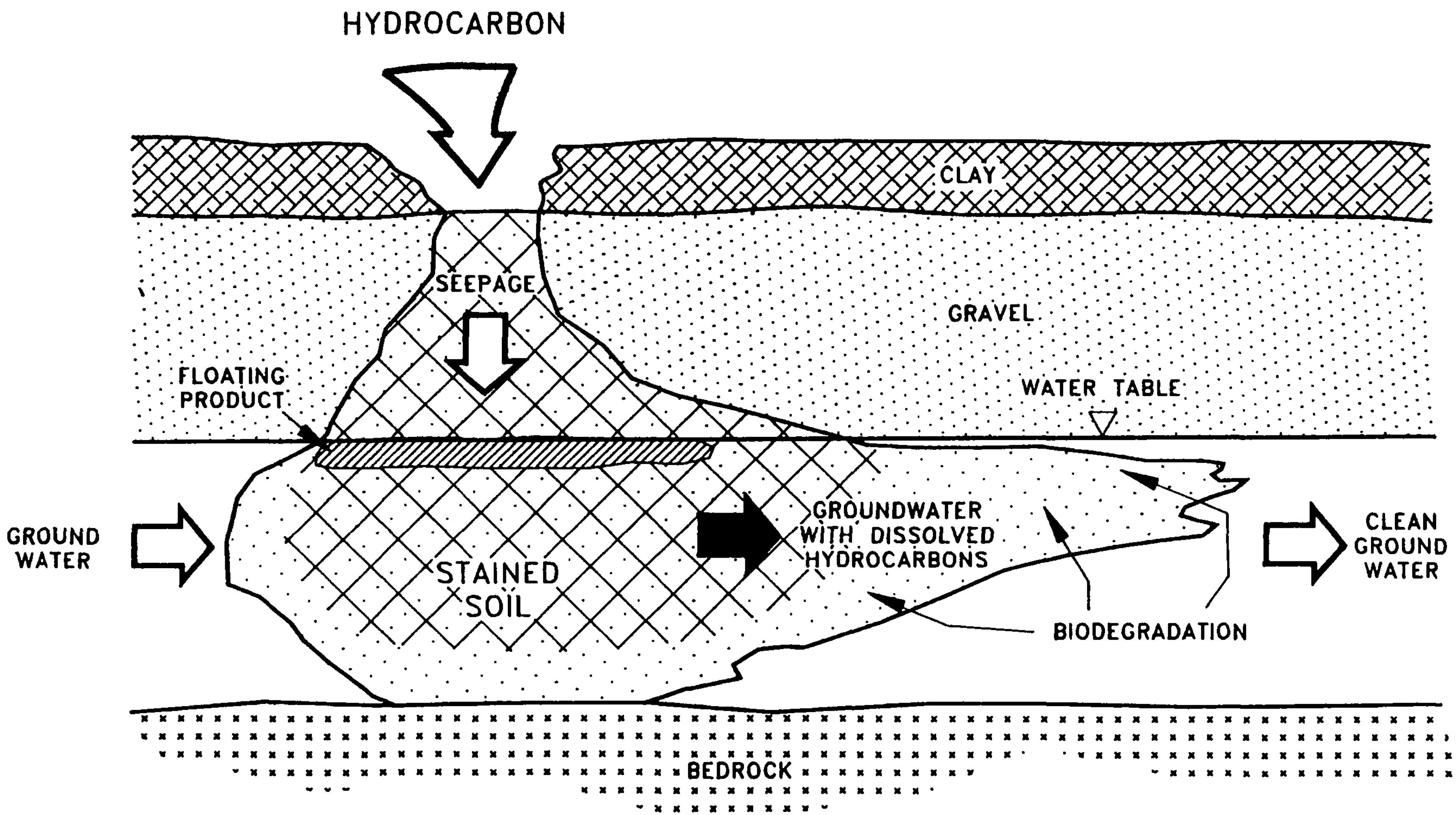
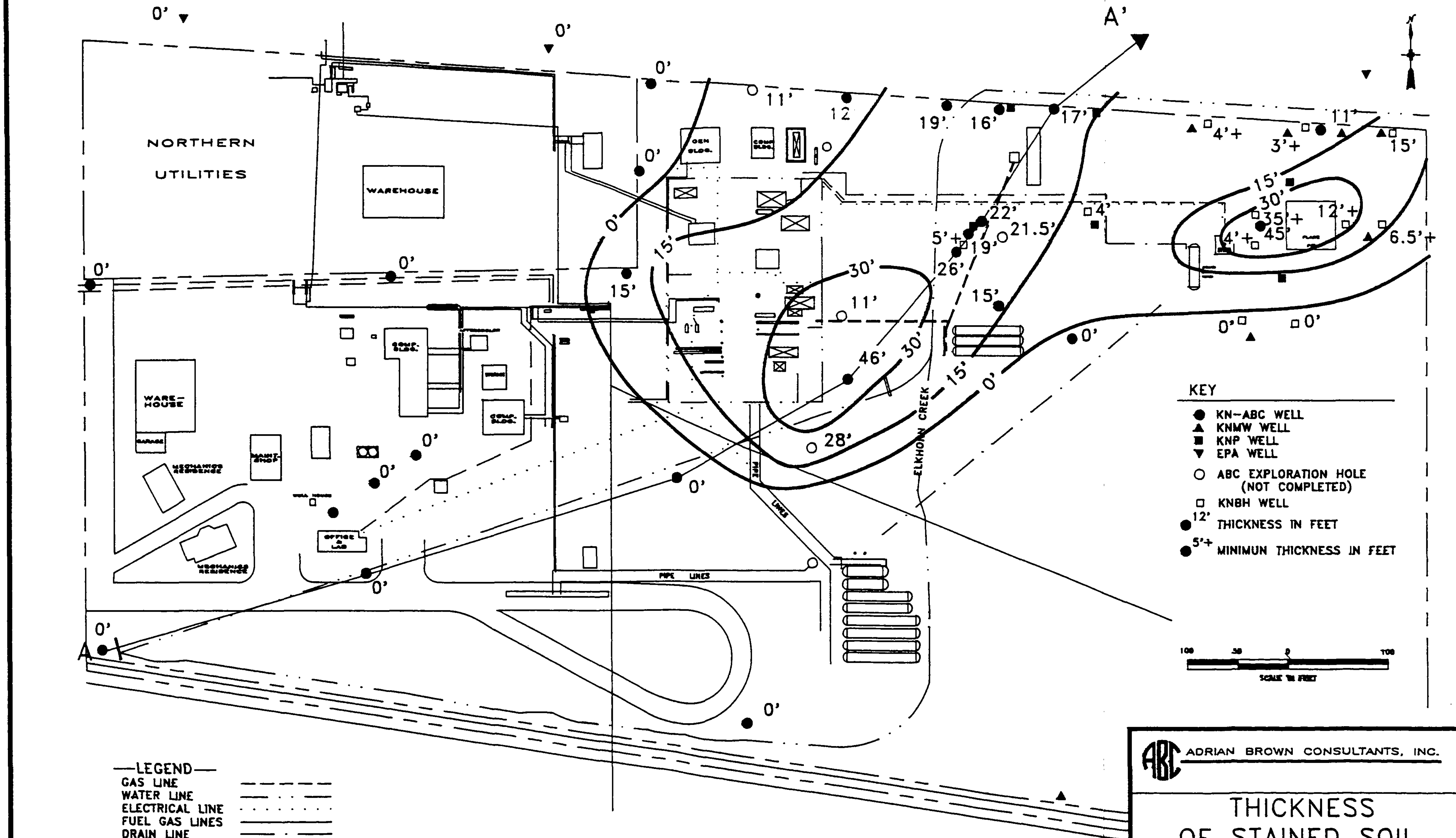


ADRIAN BROWN CONSULTANTS, INC. **KN Energy**		**CURRENT CONCEPTUAL MODEL OF TRANSPORT OF BETX** Figure 1



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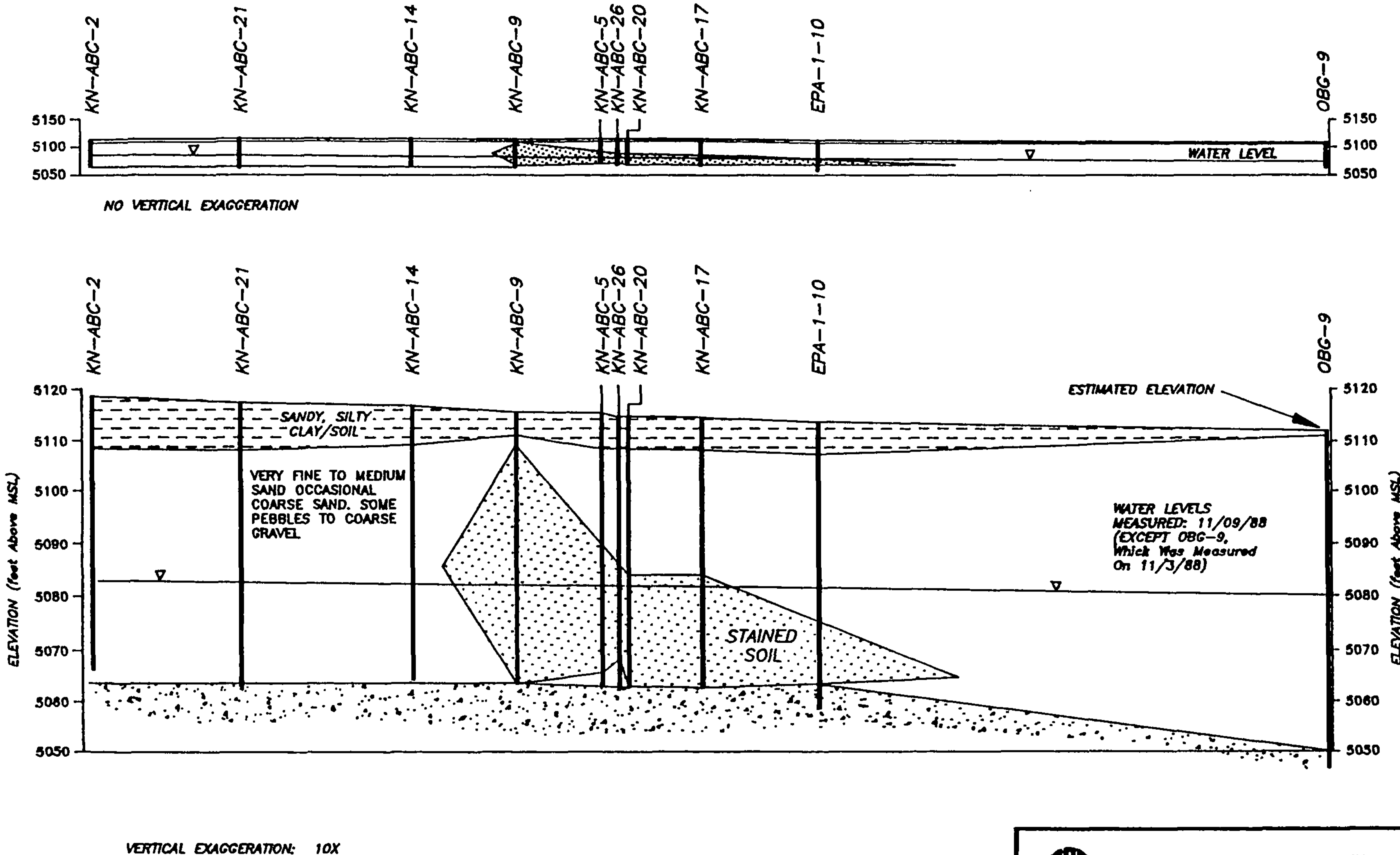
THICKNESS
OF STAINED SOIL,
KN FACILITY

Figure 2

THICK.DWG



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CROSS-SECTION A-A'

1125J/930628

Figure 3

Source: EE/CA (ABC, 1989)

(CROSS-SECTION LOCATION ON Figure 2)

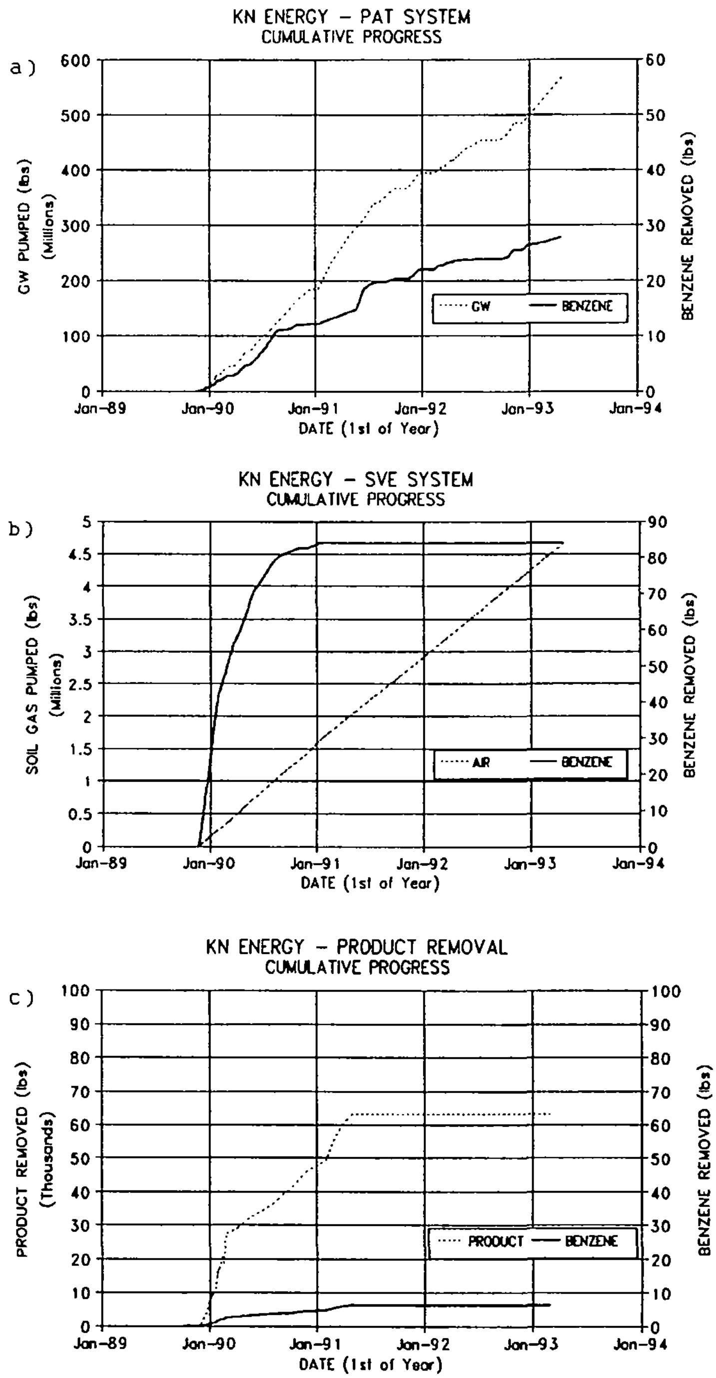
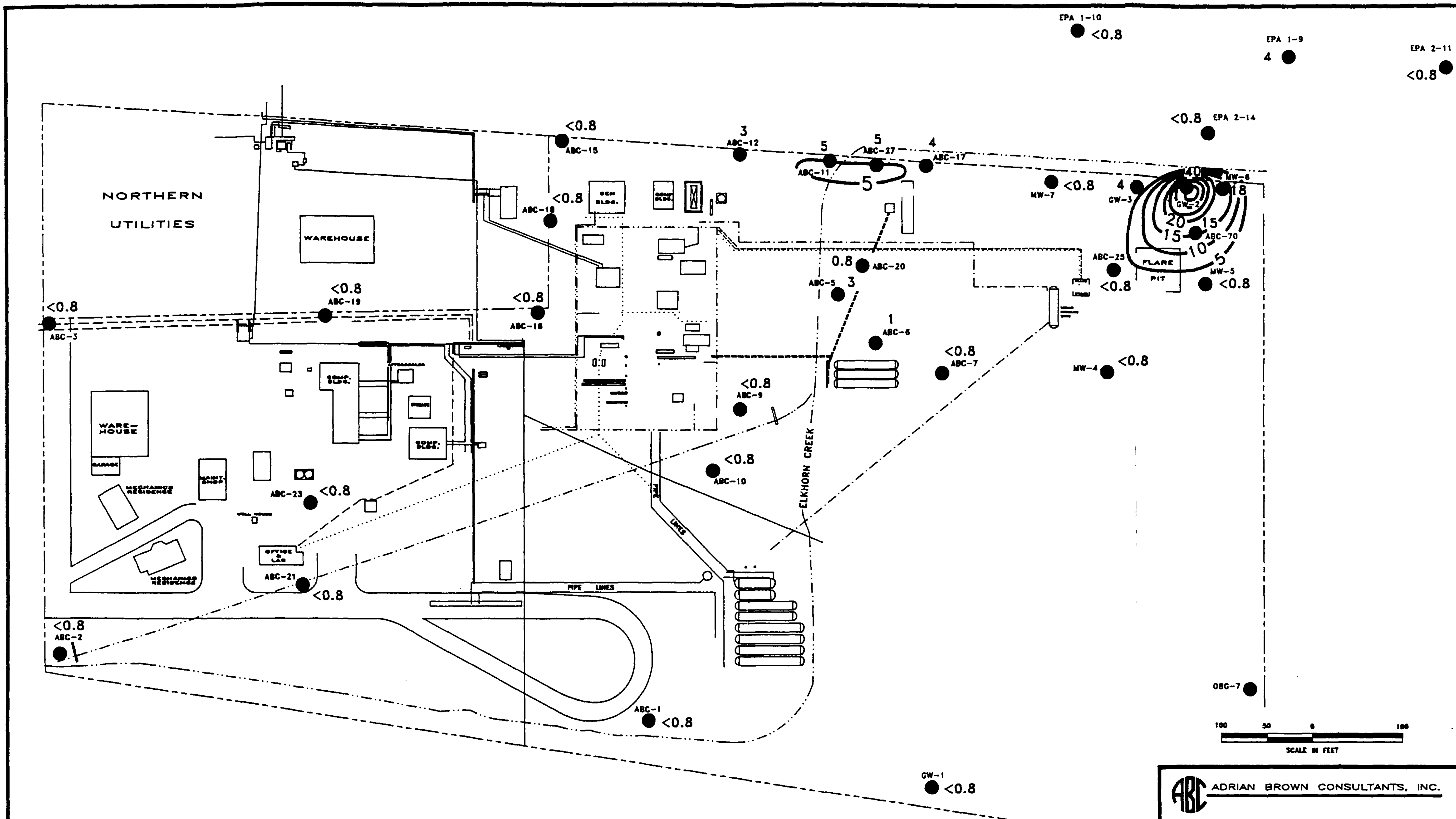


Figure 4 KN Energy System Progress (as of 5/93)



—LEGEND—

GAS LINE	- - - - -
ELKHORN CREEK	-·-·-·-
ELECTRICAL LINE	········
FUEL GAS LINES	———
DRAIN LINE	-·-·-

KEY

● SAMPLING POINTS

ABC-21 ● MONITOR WELL SAMPLE LOCATIONS

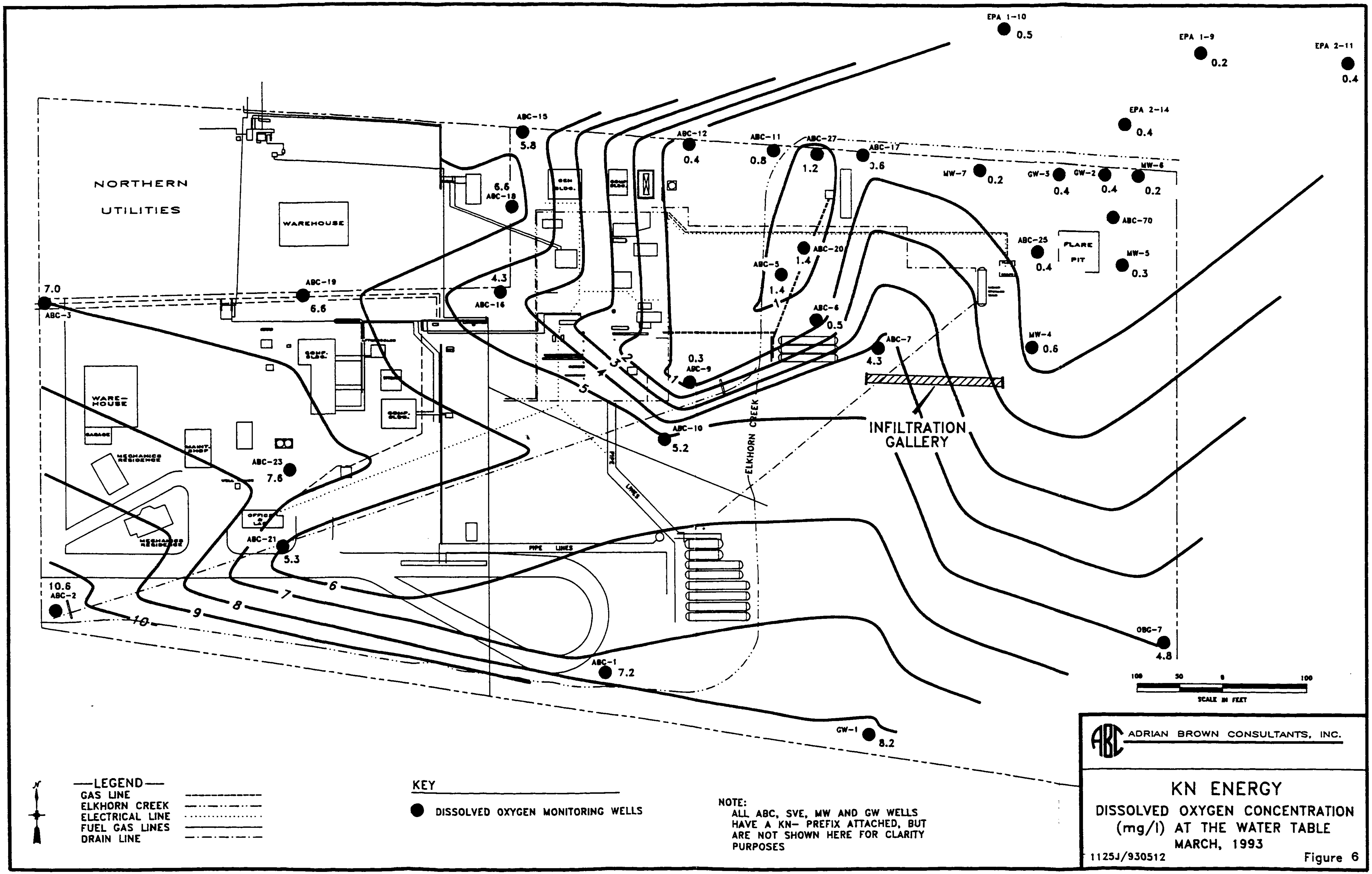
NOTE:
ALL ABC, SVE, MW AND GW WELLS HAVE A KN- PREFIX ATTACHED, BUT ARE NOT SHOWN HERE FOR CLARITY PURPOSES

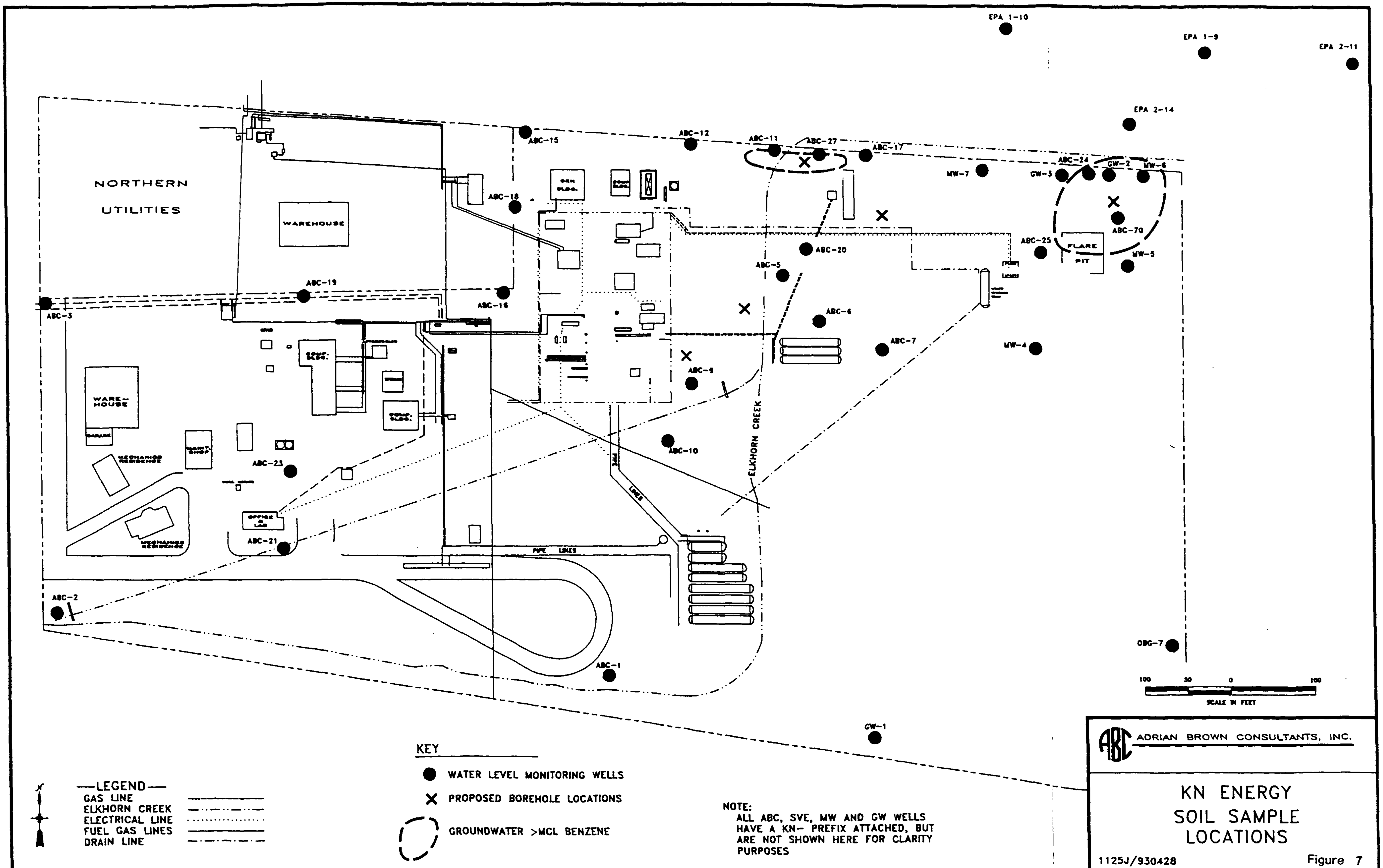
ADRIAN BROWN CONSULTANTS, INC.

KN ENERGY
BENZENE CONCENTRATIONS
(ug/l)
MARCH 24-26, 1993

1125A/930412

Figure 5


NORTHERN
UTILITIES
WAREHOUSE
WARE-HOUSE
GARAGE
MECHANICS RESIDENCE
MAINT. SHOP
COMP. BLDG.
GEN BLDG.
FLARE PIT
PIPE LINES
LINES
ELKHORN CREEK
INFILTRATION
GALLERY
EPA 1-10 0.5
EPA 1-9 0.2
EPA 2-11 0.4
EPA 2-14 0.4
ABC-15 5.8
ABC-12 0.4
ABC-11 0.8
ABC-27 1.2
ABC-17 0.6
MW-7 0.2
GW-3 0.4
GW-2 0.4
MW-6 0.2
ABC-70
ABC-25 0.4
MW-5 0.3
6.6 ABC-18
ABC-20 1.4
ABC-5 1.4
7.0 ABC-3
ABC-19 6.6
4.3 ABC-16
ABC-6 0.5
ABC-7 4.3
MW-4 0.6
0.3 ABC-9
ABC-10 5.2
ABC-23 7.6
ABC-21 5.3
10.6 ABC-2
ABC-1 7.2
GW-1 8.2
OBG-7 4.8
1
2
3
4
5
6
7
8
9
10
100 50 0 100
SCALE IN FEET
ADRIAN BROWN CONSULTANTS, INC.
KN ENERGY
DISSOLVED OXYGEN CONCENTRATION
(mg/l) AT THE WATER TABLE
MARCH, 1993
1125J/930512
Figure 6
LEGEND
GAS LINE
ELKHORN CREEK
ELECTRICAL LINE
FUEL GAS LINES
DRAIN LINE
KEY
DISSOLVED OXYGEN MONITORING WELLS
NOTE:
ALL ABC, SVE, MW AND GW WELLS
HAVE A KN- PREFIX ATTACHED, BUT
ARE NOT SHOWN HERE FOR CLARITY
PURPOSES

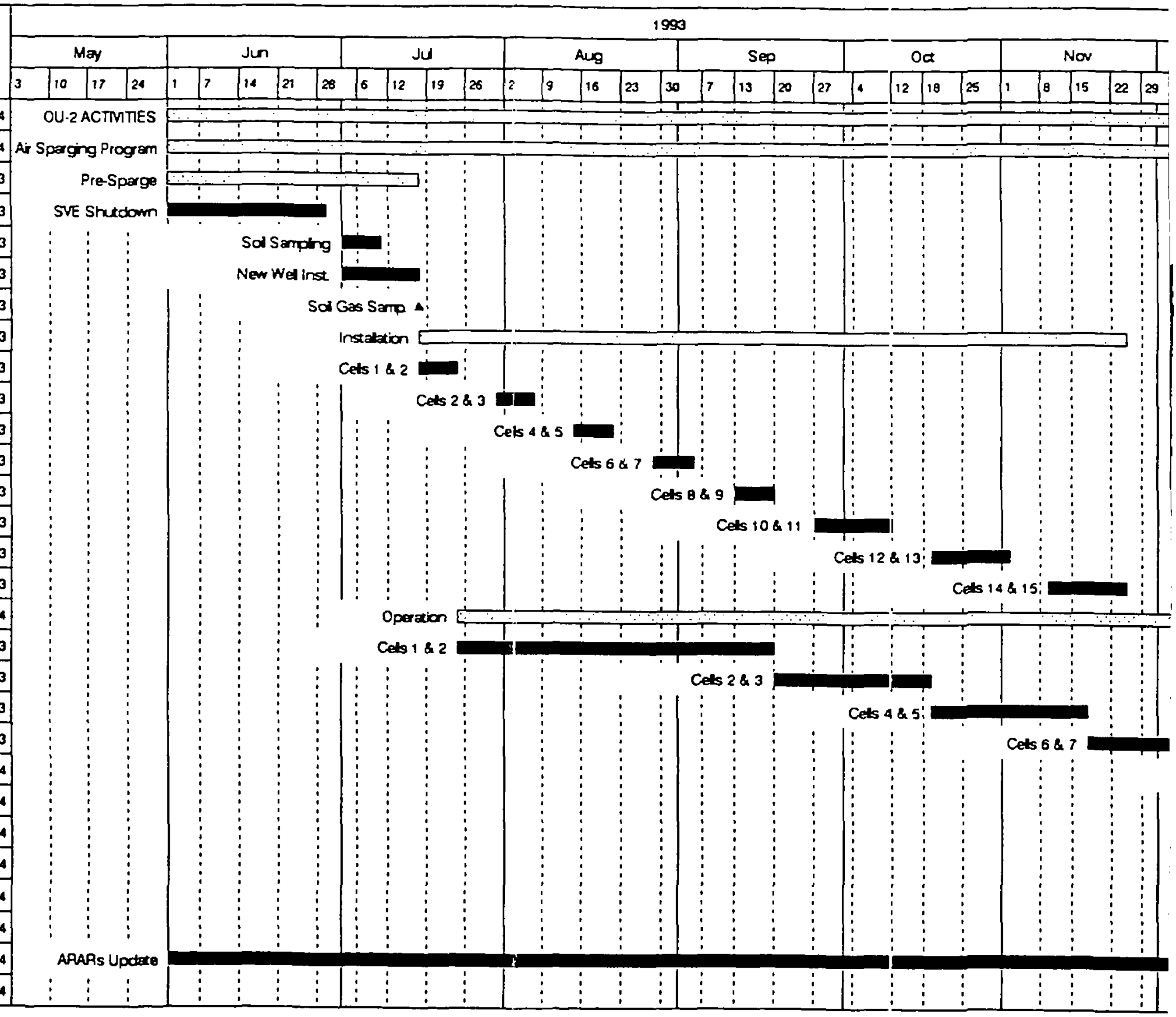

NORTHERN
UTILITIES
WAREHOUSE
WARE-HOUSE
EPA 1-10
EPA 1-9
EPA 2-11
EPA 2-14
ABC-15
ABC-12
ABC-11
ABC-27
ABC-17
ABC-24
GW-2
MW-6
MW-7
GW-3
ABC-18
ABC-70
ABC-25
FLARE PIT
MW-5
ABC-20
ABC-5
ABC-19
ABC-16
ABC-3
ABC-6
ABC-7
MW-4
ABC-9
ABC-10
ABC-23
ELKHORN CREEK
PIPE LINES
ABC-21
ABC-2
ABC-1
OBG-7
GW-1
100 50 0 100
SCALE IN FEET
—LEGEND—
GAS LINE
ELKHORN CREEK
ELECTRICAL LINE
FUEL GAS LINES
DRAIN LINE
KEY
WATER LEVEL MONITORING WELLS
PROPOSED BOREHOLE LOCATIONS
GROUNDWATER >MCL BENZENE
NOTE:
ALL ABC, SVE, MW AND GW WELLS HAVE A KN- PREFIX ATTACHED, BUT ARE NOT SHOWN HERE FOR CLARITY PURPOSES
ADRIAN BROWN CONSULTANTS, INC.
KN ENERGY
SOIL SAMPLE
LOCATIONS
1125J/930428
Figure 7

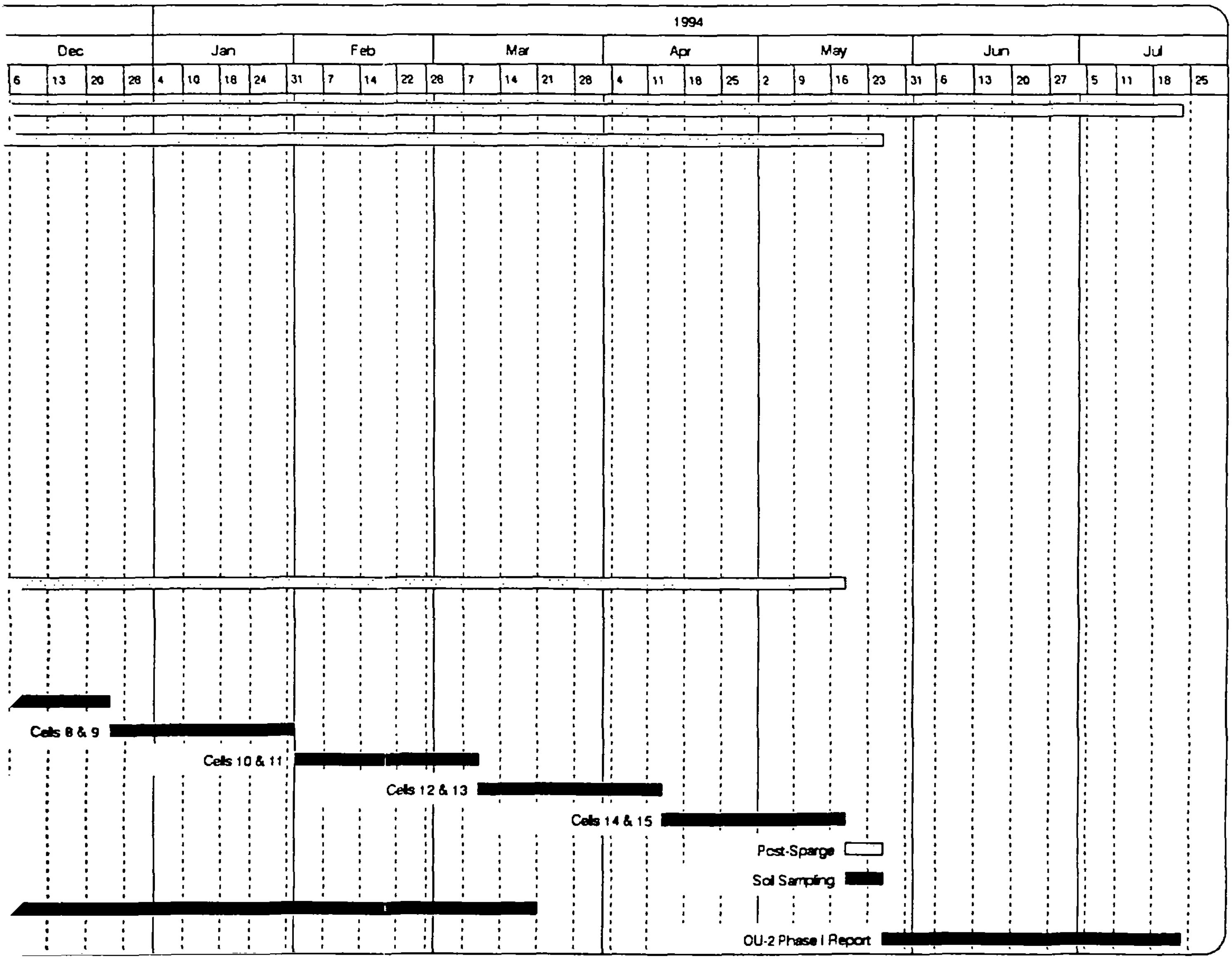
KN ENERGY

OU-2 SCHEDULE OF ACTIVITIES

JUNE 28, 1993

Task Name	Start Date	Duratn (Wks)	End Date
OU-2 ACTIVITIES	1-Jun-93	57.4	22-Jul-94
Air Sparging Program	1-Jun-93	49.4	25-May-94
Pre-Sparge	1-Jun-93	6.4	16-Jul-93
SVE Shutdown	1-Jun-93	4	29-Jun-93
Soil Sampling	1-Jul-93	1	9-Jul-93
New Well Inst.	1-Jul-93	2	16-Jul-93
Soil Gas Samp	16-Jul-93	0	16-Jul-93
Installation	16-Jul-93	18	24-Nov-93
Cells 1 & 2	16-Jul-93	1	23-Jul-93
Cells 2 & 3	30-Jul-93	1	6-Aug-93
Cells 4 & 5	13-Aug-93	1	20-Aug-93
Cells 6 & 7	27-Aug-93	1	3-Sep-93
Cells 8 & 9	13-Sep-93	1	20-Sep-93
Cells 10 & 11	27-Sep-93	2	12-Oct-93
Cells 12 & 13	19-Oct-93	2	2-Nov-93
Cells 14 & 15	9-Nov-93	2	24-Nov-93
Operation	23-Jul-93	41	18-May-94
Cells 1 & 2	23-Jul-93	8	20-Sep-93
Cells 2 & 3	20-Sep-93	4	19-Oct-93
Cells 4 & 5	19-Oct-93	4	17-Nov-93
Cells 6 & 7	17-Nov-93	5	23-Dec-93
Cells 8 & 9	23-Dec-93	5	1-Feb-94
Cells 10 & 11	1-Feb-94	5	9-Mar-94
Cells 12 & 13	9-Mar-94	5	13-Apr-94
Cells 14 & 15	13-Apr-94	5	18-May-94
Post-Sparge	18-May-94	1	25-May-94
Soil Sampling	18-May-94	1	25-May-94
ARARs Update	1-Jun-93	40	21-Mar-94
OU-2 Phase I Report	25-May-94	8	22-Jul-94




1994
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
6 13 20 28 4 10 18 24 31 7 14 22 28 7 14 21 28 4 11 18 25 2 9 16 23 31 6 13 20 27 5 11 18 25
Cells 8 & 9
Cells 10 & 11
Cells 12 & 13
Cells 14 & 15
Post-Sparge
Soil Sampling
OU-2 Phase I Report