JACK WALSTAD OIL COMPANY, INC.

LOVINGTON FACILITY

2nd Interim Hydrogeologic Investigation Report

for
Jack Walstad Oil Co., Inc.
and
New Mexico Environment Department

by
Billings & Associates, Inc.
September, 1992

BILLINGS & ASSOCIATES, INC. • 3816 Academy Pkwy. North-N.E. • Albuquerque, NM 87109 • (505) 345-1116

Table of Contents

List of Figures

List of Appendices

Appendix	Description
A	Organic Water Quality Data
B	Soil Headspace and Lab Data
C	Water Table Elevation and Free Product Data
D	Boring Logs
E	Well Completion Logs
F	Laboratory Water Quality Data

Text

1.0
Introduction

Billings & Associates, Inc. (BAI) has been contracted by Jack Walstad Oil, Co. (Walstad Oil) of Hobbs, NM to develop a hydrogeologic investigation report to fulfill obligations under §1210C of the NM Environment Department (NMED) UST Corrective Action Regulations (USTR). The original scope of work was limited to on-site activities. An interim report was submitted to the NMED in June 1992 describing those on-site operations and the relevant data obtained to that point. Contamination had been observed at that time which indicated legal access to off-site areas was required to fully define the extent and possible sources of such contamination. This report describes the additional activites (both on and off-site) performed to date. Though this report will reiterate and update information contained in the original interim report; the two documents should be considered together as parts of a complete investigation pursuant to USTR §1210C.

2.0
Background

The site under investigation is a closed Phillips 66 station at the Northwest corner of Main Street and US Highway 82 (NM 83) in Lovington, New Mexico. Previous to BAI involvement, work had been done at the facility by AEI Tank, Inc. of Clovis, NM beginning July 30, 1991. A report of those activities was presented by AEI to Walstad Oil and the NMED in April of 1992. A brief synopsis of the prior work performed by AEI is as follows: A set of shallow bores (<15 feet) were advanced around the site on July 30 - 31, 1991 which revealed soil contamination in excess of state action levels. Beginning in early November, 1991 four or five (report unclear) underground storage tanks were removed which previously stored unleaded gasolines of various grades and

diesel. The associated piping and dispensers were then removed and an over-excavation process proceeded apparently in response to the presence of contaminated soils. In December, 1991, a single soil boring was advanced somewhere on the site to a depth of 40 feet. Soil samples obtained during the boring operation were analyzed in excess of action levels. On February 5, 1992, a single monitoring well was installed and a water sample was obtained which was contaminated above state standards. On March 13, 1992, two more wells were installed. Ground water from those wells was also found to exceed standards.

Beginning on June 8, 1992, BAI began work at the site to obtain sufficient information for the filing of a hydrogeologic investigation report. A map showing basic on-site features is provided as Figure 1. Free phase hydrocarbon product with a thickness in excess of 30 inches was observed in each of the existing monitoring wells (W's-1, 2, and 3). A set of six soil borings (B-4 thru 9) was advanced at on-site locations to a maximum depth of approximately 40 feet using an auger-type drilling rig. Split spoon samples were taken for headspace and laboratory analysis from various depths in each of the borings. A sandstone layer encountered at a depth of 40 feet was impenetrable by the auger rig, precluding the installation of ground water monitoring wells at that time. Soils contaminated above the state action level of 100 ppm were observed. The soil contamination diminished below the action level in all borings except B-7 (in the area of the south dispensers) at depths shallower than 40 feet.

As a result of the auger's inability to penetrate the deep sandstone layer, a variance was obtained from Steve Wild of the NMED on June 19, 1992 to use an air rotary drilling rig for the installation of necessary monitoring wells. Three on-site monitoring wells (W's-4, 5, and 6) were installed on June 23, 1992. Subsequent sampling and lab

analysis of ground water from each of those wells revealed the presence of benzene in excess of state standards in all three samples. The concentration of toluene in water from W-6 was also found in excess of standard. The organic water quality data are in Appendix A.

Beginning on August 27, 1992 free product recovery operations were initiated in the three existing wells which had evidence of product. In addition, eight additional monitoring wells were installed in the area on August 27 and 28, 1992 in an attempt to define the horizontal and vertical extent of ground water contamination. Figure 2 shows the location of all site-associated monitoring wells installed to date.

3.0
Soil Contamination

Based on the previous split spoon sampling using the auger rig, the data indicates that soil contamination with petroleum hydrocarbons exists primarily in the southeast corner of the Walstad Oil property. Data from the analysis of soils using field headspace and laboratory methods can be found in Appendix B. Headspace data obtained by AEI Tank in late 1991 and early 1992 revealed soil contamination above the water table (approximately 60 feet below ground level) in excess of the state action level in the location of W-1 and W-2. The value of 289 ppm-v for soils at 50 feet below ground surface in W-3 could presumably be due to the presence of free product upon the water below, as the 40 foot sample had a headspace measurement of only 46 ppm-v.

Soil data obtained by BAI in June, 1992 discovered petroleum hydrocarbon contamination at depths of 25 feet or less in excess of the action level in the former tank excavation areas (B-4 and B-5). Though a headspace response by a photoionization detector (PID) to an unknown compound was noted in samples immediately north of the area of discovered free product (B-6) and the far northwest corner of the property (B-9), laboratory analysis of the soil did not reveal the presence of petroleum hydrocarbons. The southwest portion of the property in the area of B-8 had no evidence of contamination at shallow depth. Amongst the south dispensers and immediately west of those wells containing free product, boring B-7 did reveal continuous soil contamination from near-surface to within 25 feet of the water table.

Subsequent use of the air rotary drill rig for the installation of monitoring wells precluded the gathering of valid soil samples. Olfactory and PID screening of drilling returns during air rotary operations only revealed the presence of hydrocarbon contamination at well locations W-8 and V-1 (which is situated in an area of known free phase hydrocarbon product upon the water table). Quantitative use of such information is of very limited value due to the ability of the drilling method to rapidly volatilize contamination within the bore

4.0
Free Product Recovery

As previously mentioned, a set of three monitoring wells was previously installed during early 1992 by AEI. Some brief period after installation (perhaps the same day), 1/16 to 1/8" of free phase hydrocarbon product was noted in some or all the wells. Each of the wells was sampled for water quality analysis in the same time period, but to

BAI's knowledge the extent of product was not again checked until June 8, 1992. At that time BAI personnel checked for the presence of product in each of the wells using a clear bailer. In each well the thickness of product was observed to be greater that 30 inches (the usable length of the bailer). The product thickness was again checked by BAI on June 24, 1992 and August 27, 1992 with similar results.

The presence of free product was not noted in on-site monitoring wells Ws-4, 5, and 6 on either June 24, 1992 twenty four hours after they were installed, or when they were again sampled on August 28, 1992. Neither was product noted in any of the eight additional wells installed August 27 and 28, 1992 when they were sampled on August 28-29, 1992.

Free product recovery operations from wells W-1, 2, and 3 was initiated by BAI on August 27, 1992. Product recovery was passively facilitated via BAI's Product Recovery Filter system (PRF™) to minimize the collection of contaminated groundwater as well as not to create a drawdown cone which could have the effect of causing further horizontal spread of product if direct pumping were suddenly ceased.

The PRF™ system basically consists of a hydrophobic filter module which is placed across the product/water interface. Beneath the filter is fitted a collection reservoir containing a small electric pump by which the passively gathered product can be conveyed to the surface and properly disposed.

Using the described system on August 27 approximately 8 gallons of product were removed from W-1, 6.5 gallons from W-2, and 7 gallons from W-3. The initial removal operation left less than 1/4" of floating product in each of the wells. The wells were then allowed to recover overnight to determine the response in product thickness. The following morning (August 28) W-1 had recovered to a thickness in excess of 30", W-2 to a thickness of 5.5", and W-3 to a thickness of 4". Product removal via the

PRF™ units was again initiated. A total of 3 gallons of product was removed from well W-1 before the product thickness measured in the well again dropped below 1/4".

By the morning of August 29, 1992 approximately 26 gallons of free phase hydrocarbon product had been recovered from the three wells. Recovery efforts remain on-going.

It is widely known that product thickness in a well is only relatively indicative of actual thickness within the surrounding formation, with the apparent thickness in a well being several times greater than the true formation thickness. The recovered volumes of product relative to initial thickness and the recovery rate after product removal perhaps indicate that the difference between apparent and actual product thickness may be large.

5.0
Hydrogeology

The ground-water system in question exists in medium to fine grained, silty sands beneath a sandstone of variable thickness. Depth to water in the immediate area is between 56 and 57 feet below ground surface. This system is likely part of the greater Ogallala Aquifer. The sandstone is overlain by fine sands of variable thickness beneath a thick caliche layer to surface of varying hardness and permeability.

The top of casing elevations of wells W-1 through W-6 was surveyed on June 24, 1992. The top of casing elevations of wells V-1, W-7 through W-13 was surveyed on August 27 & 28, 1992. Static depths to water were measured in those wells not containing free product prior to sampling. Well elevation, depth to water, and relative

water table elevation information can be found in Appendix C. A map depicting the potentiometric surface is presented as Figure 3. The observed potentiometric gradient based on the June 24 data trended southeast at an average rate of 0.0029 ft/ft. When one analyzes the potentiometric surface from the August 28-29 data as presented in Figure 3 the observed gradient continues its southeastern trend with an average rate of 0.0033 ft/ft. There is only a 12% difference between the gradient data derived from the two sets of measurements.

This most recent potentiometric data includes the depth to water measurement of deep well V-1, located in the area of large apparent free product thickness in the nearby wells whose screened intervals span the water table. The gradient as represented in Figure 3 appears to be rather constant across the area bounded by the perimeter monitoring wells.

As previously reported in the interim report, aquifer characteristics beneath the site were quanitified by performing slug injection testing on monitoring well W-5 on June 24, 1992. A fresh water slug sufficient to instantaneously raise the water level several feet above its static level was gravity injected. A down-hole pressure transducer recorded the water level response. A total of three injection events were performed consecutively on the well. The gathered data were later analyzed according to the "Cooper" method (Cooper, Bredehoeft, and Papadopoulos; WWR, 1967; Vol. 3, No. 1). Using such means the average value of transmissivity for the upper portion of the aquifer was estimated at 8 ft^2/day. The average storativity was determined to be 0.02. The hydraulic conductivity of the aquifer in the immediate vicinity of the monitoring well was estimated to be 1 ft/day (4×10^{-4} cm/sec).

Based on the most recent gradient data, an estimate of general ground-water flow velocity (v) can be made utilizing a derivation of the Darcy equation. Using an average hydraulic gradient (i) of 0.0033 ft/ft, an effective porosity (n) of 20%, and an average hydraulic conductivity (k) of 1 ft/day, the groundwater velocity is estimated to be:

$$v = [k \times i]/n = 0.165 \text{ ft/day} = 60 \text{ ft/year}$$

6.0
Organic Water Quality

Due to the inability of a standard auger to penetrate the sandstone layer encountered at an approximate depth of 40 feet across the site, a air-rotary drilling rig was again used to emplace the additional wells. Boring logs and pertinent well information can be found in Appendices D and E.

Each of the new wells was developed shortly after completion by pumping and bailing until formation fines were no longer observed in the water. The wells were then allowed to stabilize for at least 24 hours before sampling. Water quality sampling was performed on the entire suite of monitoring wells associated with the site which did not have an indicated presence of free phase product. A minimum of three bore volumes of ground water was removed from each well using disposable bailers immediately prior to sampling. Each sample was slowly obtained from the bottom of the bailers into two clean 40 ml volatile organic analysis bottles provided by the laboratory. Prior to filling, each bottle was spiked with two drops of a 4 molar solution of mercuric chloride ($HgCl_2$) in distilled water as a preservative. The bottles were then capped with a septum top and carefully checked for the presence of any air bubbles. They were then

labeled and refrigerated until they reached the lab with appropriate chain of custody.

The water samples were analyzed for benzene, toluene, ethylbenzene, total xylenes (BTEX), and methyl tertiary butyl ether (MTBE, a gasoline oxygenating additive) by Hall Environmental Analysis Lab in Albuquerque. A tabular compliation of this organic water quality data is presented as Appendix A. Copies of the actual laboratory water analysis reports can be found in Appendix F.

Concentrations of all BTEX constiuents in the previously installed monitoring wells (Ws-4, 5, and 6) have increased since the June sampling. Sample from the two new upgradient wells (Ws-7 and 13) had no detectable BTEX or MTBE. In fact, only ground water from W-5 contained a detectable level of MTBE (3.3 ppb). Benzene levels detected in samples from Ws-4, 5, 6, 8, 9, 10, 11, and 12 were all above the state water quality standard of 10 ppb. The benzene concentration in ground water from each of the sampled wells is presented in Figure 4. Concentrations of toluene and total xylenes in excess of the state standard (750 ppb and 620 ppb, respectively) were observed in samples from W-6 and W-8. Though the presence of ethlybenzene was noted in all but two of the samples, none were above the state standard of 750 ppb.

The most probable location for the installation of the deep-screened well for the determination of the vertical extent of groundwater contamination has been in the southeast portion of the property where the free product exists, and thus by inference the highest dissolved-phase contamination. BAI has had a strong concern that the magnitude of product in that area would pose a difficulty in the drilling and completion of a deep well through the product and still being able to acquire a representative sample

some depth into the saturated aquifer. Nonetheless, deep-screened well V-1 was installed on August 28, 1992 as located in Figure 1. Product removal efforts had been going on in the area for almost 48 hours prior to the well being drilled.

The analyzed water sample from V-1 revealed the presence of all BTEX constituents at a depth in excess of 18 feet below the water table. The levels of benzene and total xylenes were found to be in excess of the state standards.

7.0
Summary

- A series of eight additional ground water monitoring wells have been installed to help delineate the horizontal and vertical extent of dissolved phase contamination

- Free-phase hydrocarbon product on the water table remains beneath the site. Product recovery operations were initiated on August 27, 1992 and continues at present. As of August 29, 1992 approximately 26 gallons of product had been recovered.

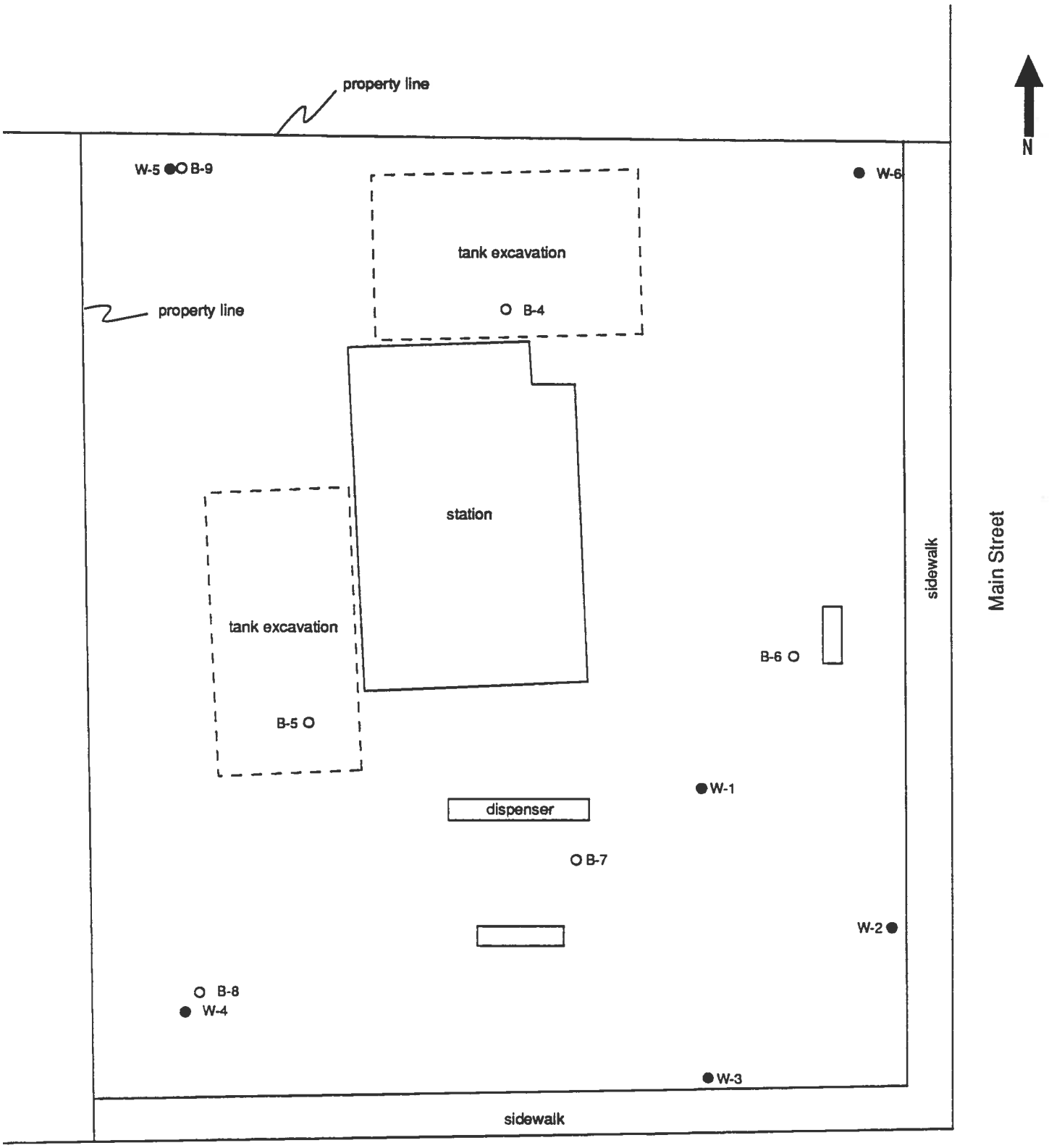
- Ground-water from all but two monitoring wells is contaminated above state standards. Each of the uncontaminated wells is in a nominal upgradient direction.

- Further off-site investigation activities should proceed to establish the extent of ground-water contamination. There are other potential sources for contamination in the area that may need to be segregated. Figure 5 indentifies at least nine potential sources for petroleum hydrocarbon contamination in the immediate area.

- As mentioned in an August 4, 1992 letter from Steve Wild of the NMED to Jack Walstad; consideration should be given under USTR Section 1215.C to the

implementation of on-site reclamation measures to remediate contaminated soils and ground water.

Figures



Scale 1"=25'

0 25 50

● monitor well location
○ boring location

FIGURE 1

On-Site Map
Walstad Oil: Lovington, NM
Billings & Associates, Inc. September, 1992

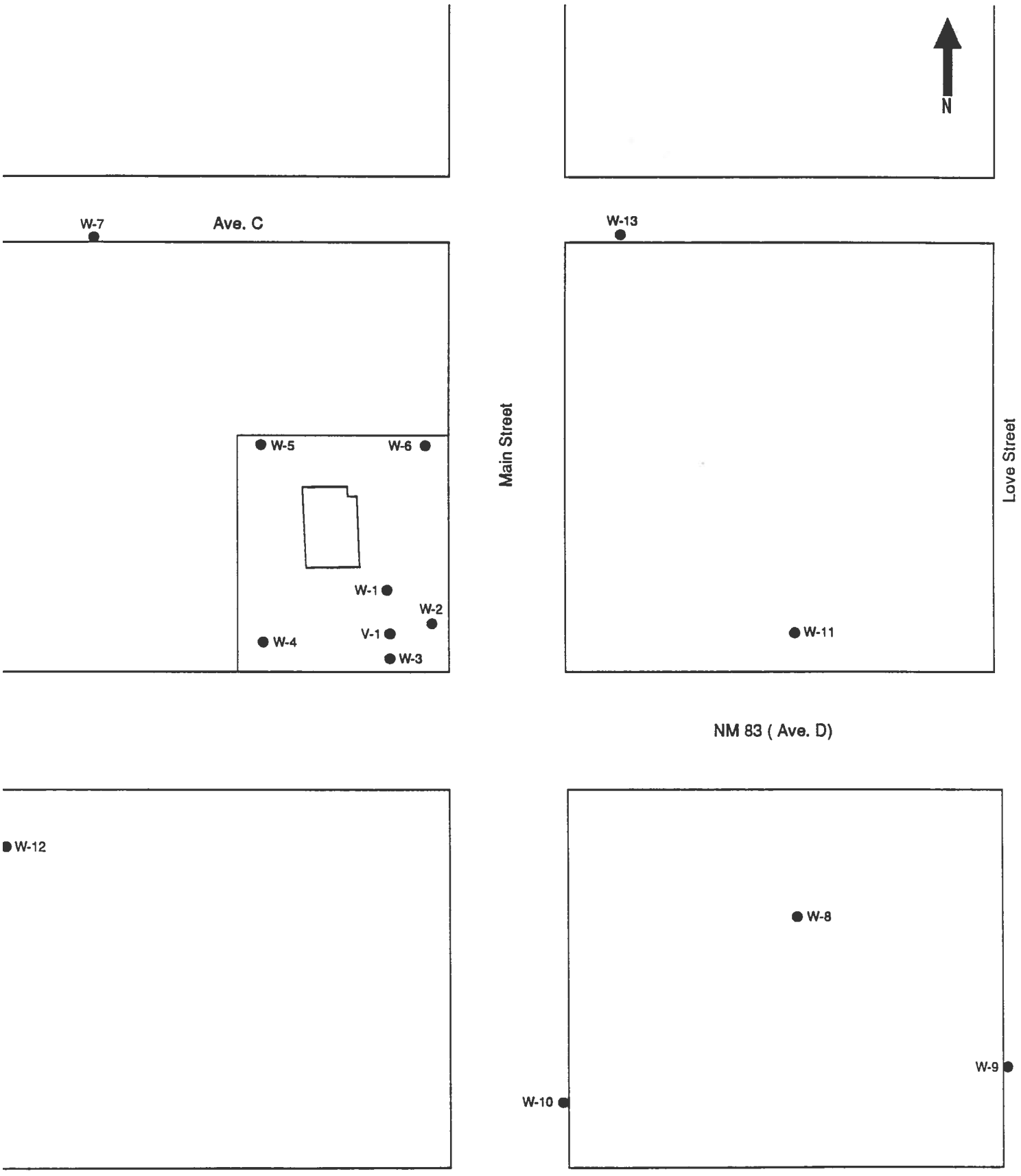


FIGURE 2

Area Map
Walstad Oil: Lovington, NM
Billings & Associates, Inc. September, 1992

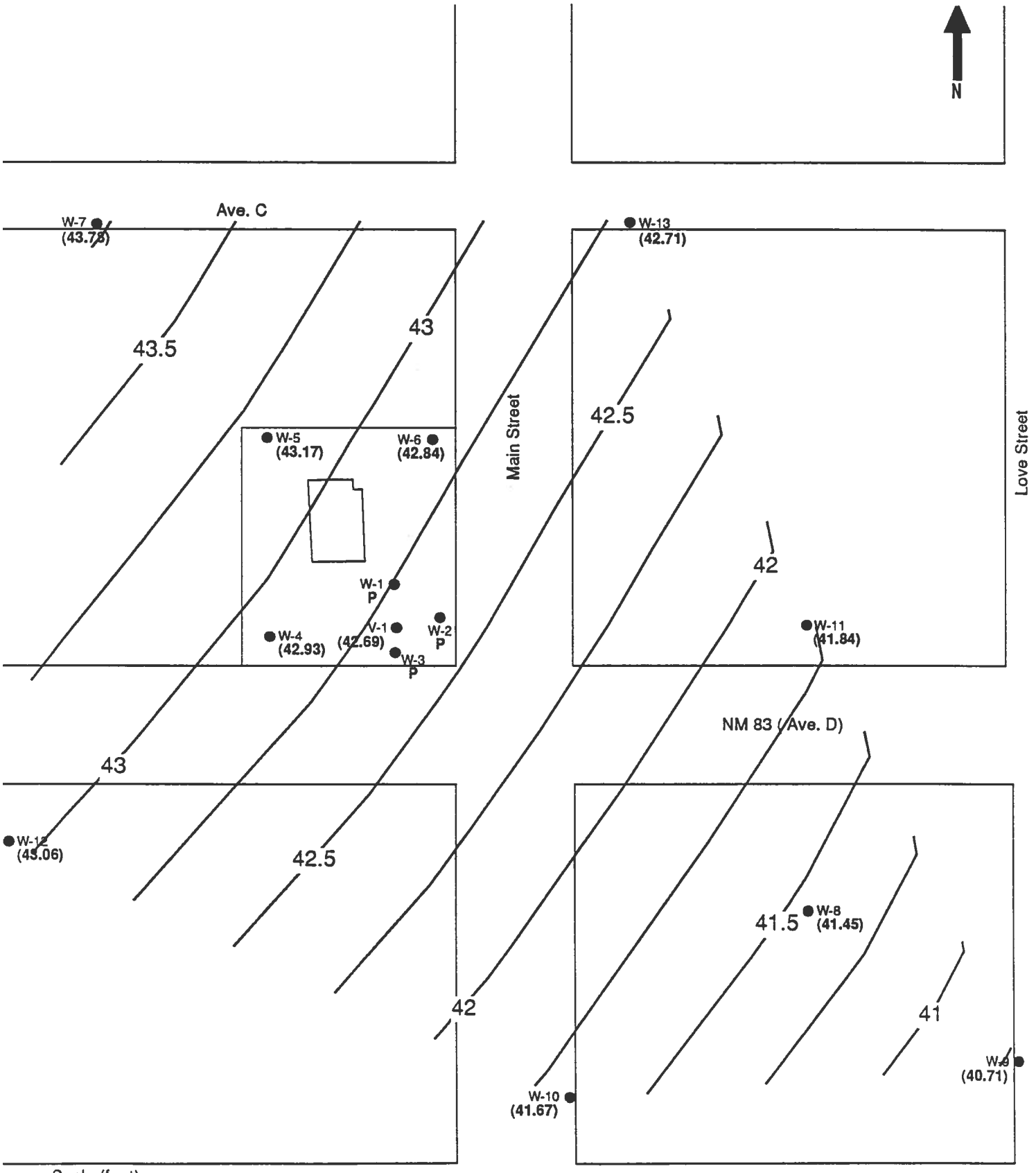


FIGURE 3

Potentiometric Surface Map
Walstad Oil: Lovington, NM
Billings & Associates, Inc. September, 1992

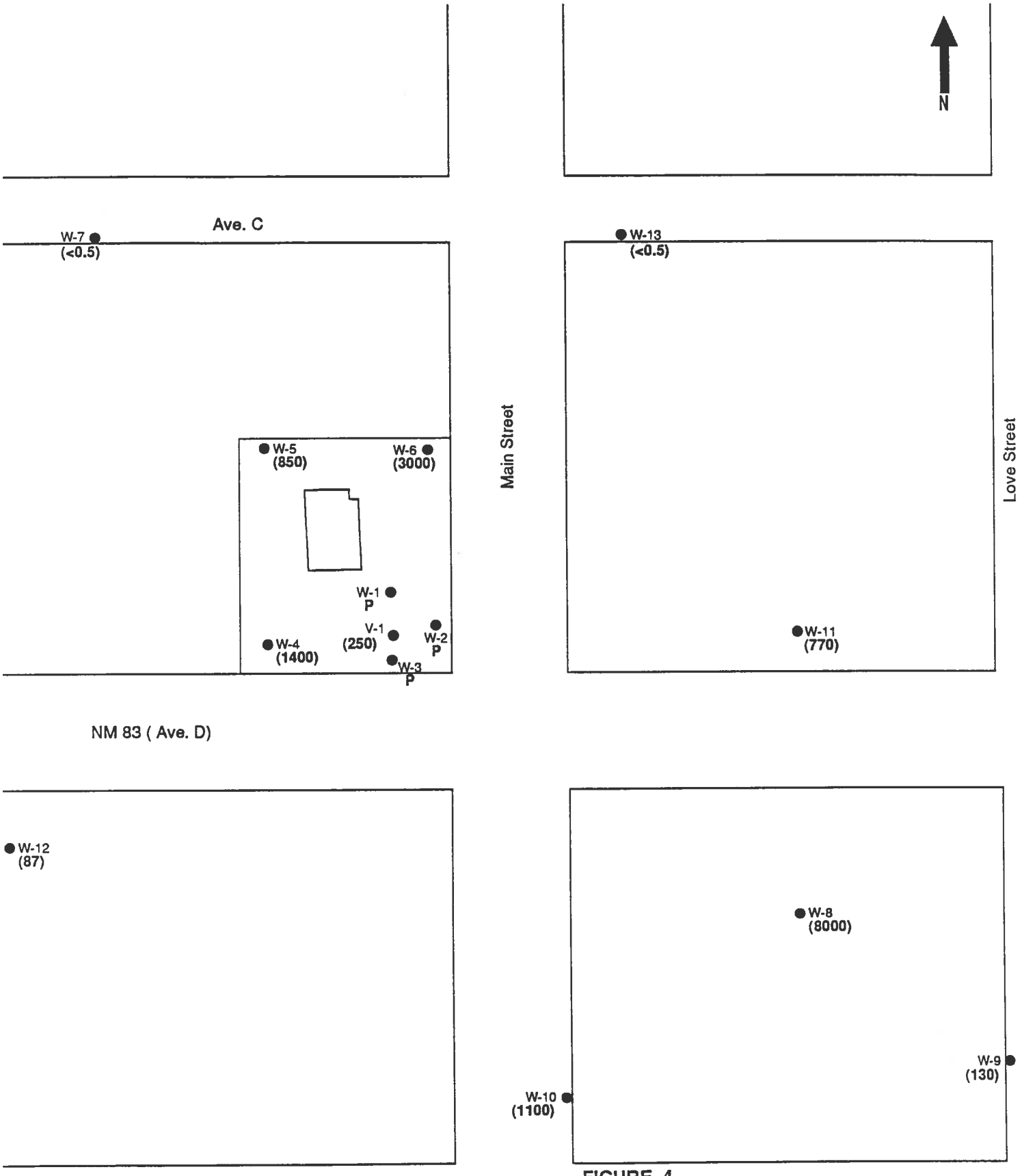


FIGURE 4

Benzene Concentration 8/28-29/92
Walstad Oil: Lovington, NM
Billings & Associates, Inc. September, 1992

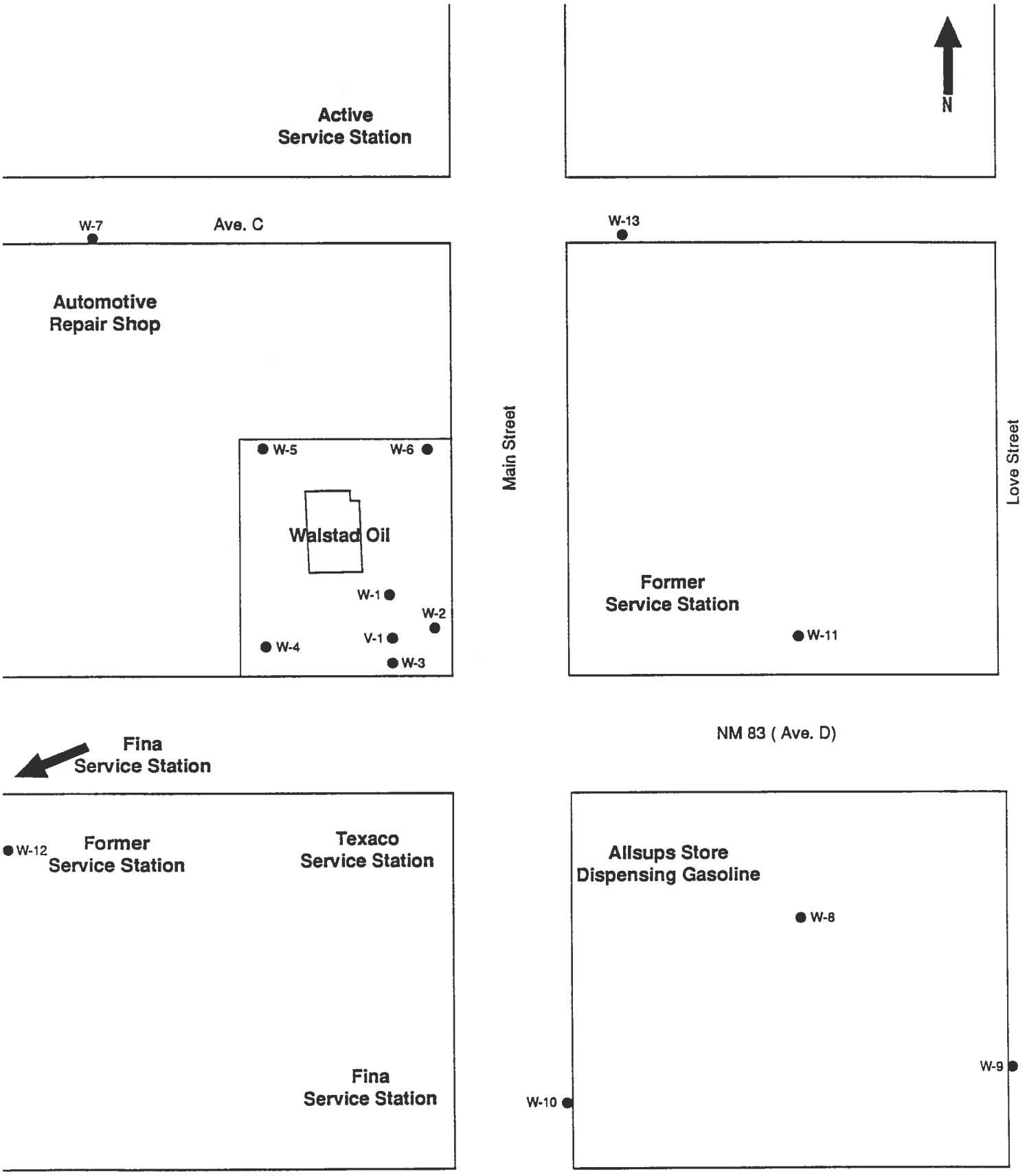


FIGURE 5

Potential Contamination Sources
Walstad Oil: Lovington, NM
Billings & Associates, Inc. September, 1992

Appendices

Appendix A

Organic Water Quality Data

Organic Water Quality Data
Walstad Oil
Lovington, NM

All values are in parts per billion (ppb)

Well	Date	Benzene	Toluene	Ethyl-benzene	Total Xylenes	MTBE
W-4	6/24/92	200	53	21	40	<5.0
	8/28/92	1400	430	95	300	<2.5
W-5	6/24/92	470	250	41	290	<10
	8/28/92	850	400	58	450	3.3
W-6	6/24/92	1400	1200	48	500	<25
	8/28/92	3000	2700	93	860	<2.5
W-7	8/28/92	<0.5	<0.5	<0.5	<0.5	<2.5
W-8	8/28/92	8000	9500	690	5200	<2.5
W-9	8/28/92	130	8.2	16	140	<2.5
W-10	8/28/92	1100	11	120	440	<2.5
W-11	8/28/92	770	13	13	280	<2.5
W-12	8/29/92	87	6.1	2.6	180	<2.5
W-13	8/29/92	<0.5	<0.5	<0.5	<0.5	<2.5
V-1	8/29/92	250	680	240	810	<2.5

Appendix B

Headspace and Lab Soil Data

Soil Headspace and Lab Data

Walstad Oil
Lovington, NM

Boring	Date	Depth (feet)	OVM (ppm-v)	TPH (ppm)
B-1	12/24/91	20	400	
		39	300	
W-1	2/12/92	40	332	
		50	424	
		60	494	
		70	477	
		80	237	
W-2	3/13/92	40	323	
		50	314	
W-3	3/13/92	40	46	
		50	289	
B-4	6/9/92	10	586	6700
		15	222	
		25	115.7	
		30	44.5	
		35	15.4	<10
B-5	6/9/92	10	0.0	
		15	76.3	
		20	133.9	5800 (diesel)
		25	78.4	
		30	28.2	
		35	23.4	<10
B-6	6/9/92	10	13.8	
		15	168	
		20	319	
		25	385	<10
		30	240	
		35	201	<10
B-7	6/10/92	10	667	3400
		15	659	
		20	275	
		25	293	
		30	270	2500
		35	268	

Soil Headspace and Lab Data (page 2)
Walstad Oil
Lovington, NM

Boring	Date	Depth (feet)	OVM (ppm-v)	TPH (ppm)
B-8	6/10/92	5	7.2	
		10	1.3	<10
B-9	6/10/92	5	260	
		10	276	<10
		15	193	
		20	129.3	
		25	76.2	
		30	30.8	
		35	10.1	<10

OVM - organic vapor meter (headspace analysis) calibrated against 100 ppm-v isobutylene standard.

TPH - total petroleum hydrocarbons (lab analysis) as gasoline unless otherwise noted.

Soil data for boring B-1 and monitoring wells W-1, 2, and 3 derived from investigation report completed by AEI Tank, Inc. April, 1992. All other data obtained by BAI personnel.

Appendix C

Depth To Water and Free Product Data

Water Table Elevation and Free Product Data

Walstad Oil
Lovington, NM

Well	Date	TOC Elevation (feet)	Depth to Water (feet)	Water Table Elevation (feet)
W-1	2/12/92		~1/8" free product (AEI Tank)	
	6/8/92		>30" free product (BAI)	
	6/24/92	100.00	>30" free product (BAI)	
	8/27/92		>30" free product (BAI)	
	8/28/92		0.25" free product (BAI)	
	8/29/92		>30" free product (BAI)	
W-2	3/13/92		~1/8" free product (AEI Tank)	
	6/8/92		>30" free product (BAI)	
	6/24/92	99.12	>30" free product (BAI)	
	8/27/92		>30" free product (BAI)	
	8/28/92		5.5" free product (BAI)	
W-3	3/13/92		~1/8" free product (AEI Tank)	
	6/8/92		>30" free product (BAI)	
	6/24/92	99.13	>30" free product (BAI)	
	8/27/92		>30" free product (BAI)	
	8/28/92		4.0" free product (BAI)	
W-4	6/24/92	99.62	57.04	42.58
	8/28/92		56.69	42.93
W-5	6/24/92	100.41	57.59	42.82
	8/28/92		57.24	43.17
W-6	6/24/92	99.48	56.97	42.51
	8/28/92		56.64	42.84
W-7	8/28/92	100.07	56.29	43.78
W-8	8/28/92	98.69	57.24	41.45
W-9	8/28/92	97.47	56.76	40.71
W-10	8/28/92	97.85	56.18	41.67

Water Table Elevation and Free Product Data (page 2)
Walstad Oil
Lovington, NM

Well	Date	TOC Elevation (feet)	Depth to Water (feet)	Water Table Elevation (feet)
W-11	8/28/92	98.66	56.82	41.84
W-12	8/29/92	99.34	56.28	43.06
W-13	8/29/92	99.07	56.36	42.71
V-1	8/29/92	99.37	56.68	42.69

TOC - Top of Casing

All elevations are relative to monitoring well W-1, which was arbitrarily set to to an elevation of 100.00 feet.

Appendix D

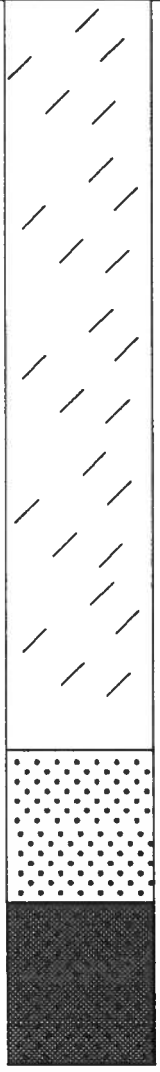
Boring Logs

Billings & Associates, Inc.

BORING LOG

Project No.: Walstad
Boring No.: W-7
Location: See Figure 2

Installation Date: 8.27.92 & 8.28.92
By: Jim Griswold

Depth (ft)	Profile Sketch	Odor (y/n)	PID Field Data (ppm)	Lab Data TPH (ppm)	Description
1					off-white caliche
40					med. to fine grained limey sandstone
55					med. to fine grained sand, med. brown with ~10% silts
67					

* Field Monitoring Point

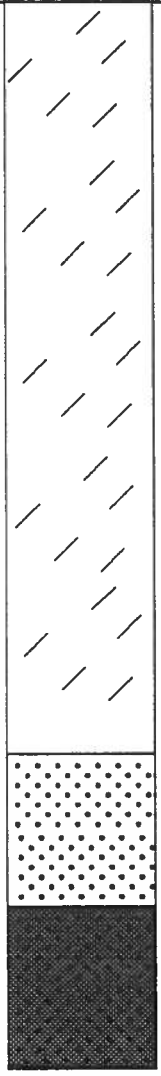
Water Table:
Completion Depth: 65'

Billings & Associates, Inc.

BORING LOG

Project No.: Walstad
Boring No.: W-8
Location: See Figure 2

Installation Date: 8.27.92 & 8.28.92
By: Jim Griswold

Depth (ft)	Profile Sketch	Odor (y/n)	PID Field Data (ppm)	Lab Data TPH (ppm)	Description
1					off-white caliche
40					med. to fine grained limey sandstone
55					med. to fine grained sand, med. brown with ~10% silts
67					

* Field Monitoring Point

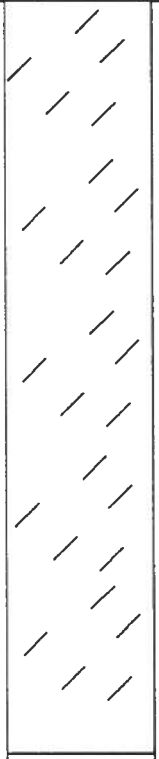
Water Table:
Completion Depth: 65'

Billings & Associates, Inc.

BORING LOG

Project No.: Walstad
Boring No.: W-9
Location: See Figure 2

Installation Date: 8.27.92 & 8.28.92
By: Jim Griswold

Depth (ft)	Profile Sketch	Odor (y/n)	PID Field Data (ppm)	Lab Data TPH (ppm)	Description
1					off-white caliche
40					med. to fine grained limey sandstone
55					med. to fine grained sand, med. brown with ~10% silts
67					

* Field Monitoring Point

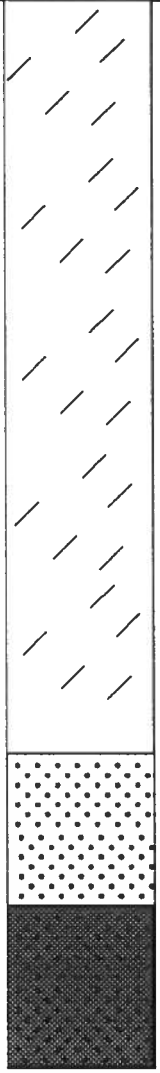
Water Table:
Completion Depth: 65'

Billings & Associates, Inc.

BORING LOG

Project No.: Walstad
Boring No.: W-10
Location: See Figure 2

Installation Date: 8.27.92 & 8.28.92
By: Jim Griswold

Depth (ft)	Profile Sketch	Odor (y/n)	PID Field Data (ppm)	Lab Data TPH (ppm)	Description
1					off-white caliche
40					med. to fine grained limey sandstone
55					med. to fine grained sand, med. brown with ~10% silts
67					

* Field Monitoring Point

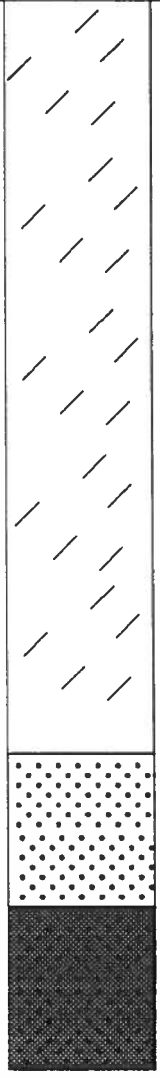
Water Table:
Completion Depth: 65'

Billings & Associates, Inc.

BORING LOG

Project No.: Walstad
Boring No.: W-11
Location: See Figure 2

Installation Date: 8.27.92 & 8.28.92
By: Jim Griswold

Depth (ft)	Profile Sketch	Odor (y/n)	PID Field Data (ppm)	Lab Data TPH (ppm)	Description
1					off-white caliche
40					med. to fine grained limey sandstone
55					med. to fine grained sand, med. brown with ~10% silts
67					

* Field Monitoring Point

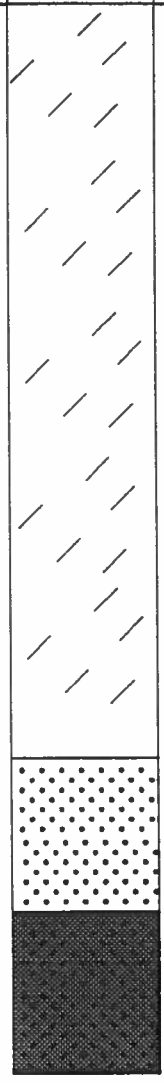
Water Table:
Completion Depth: 65'

Billings & Associates, Inc.

BORING LOG

Project No.: Walstad
Boring No.: W-12
Location: See Figure 2

Installation Date: 8.27.92 & 8.28.92
By: Jim Griswold

Depth (ft)	Profile Sketch	Odor (y/n)	PID Field Data (ppm)	Lab Data TPH (ppm)	Description
1					off-white caliche
40					med. to fine grained limey sandstone
55					med. to fine grained sand, med. brown with ~10% silts
67					

* Field Monitoring Point

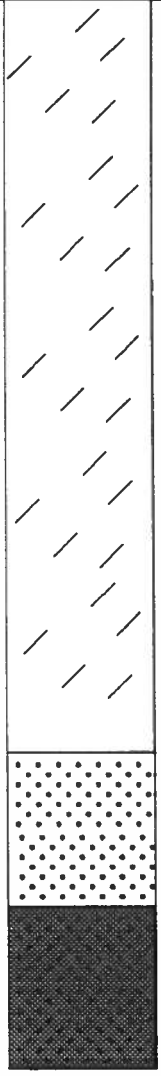
Water Table:
Completion Depth: 65'

Billings & Associates, Inc.

BORING LOG

Project No.: Walstad
Boring No.: W-13
Location: See Figure 2

Installation Date: 8.27.92 & 8.28.92
By: Jim Griswold

Depth (ft)	Profile Sketch	Odor (y/n)	PID Field Data (ppm)	Lab Data TPH (ppm)	Description
1					off-white caliche
40					med. to fine grained limey sandstone
55					med. to fine grained sand, med. brown with ~10% silts
67					

* Field Monitoring Point

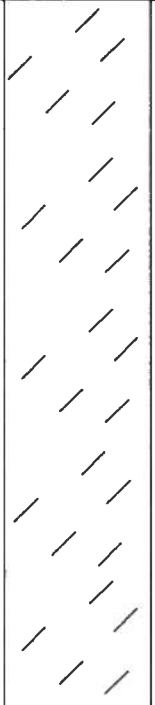
Water Table:
Completion Depth: 65'

Billings & Associates, Inc.

BORING LOG

Project No.: Walstad
Boring No.: V-1

Installation Date: 8.28.92
By: Jim Griswold

Depth (ft)	Profile Sketch	Odor (y/n)	PID Field Data (ppm)	Lab Data TPH (ppm)	Description
1					off-white caliche
40		Y			med. to fine grained sandstone
55		Y			med. to fine grained sand, med. brown with ~10% silts
70					as above with <5% silts
80					

* Field Monitoring Point

Water Table:
Completion Depth: 80'

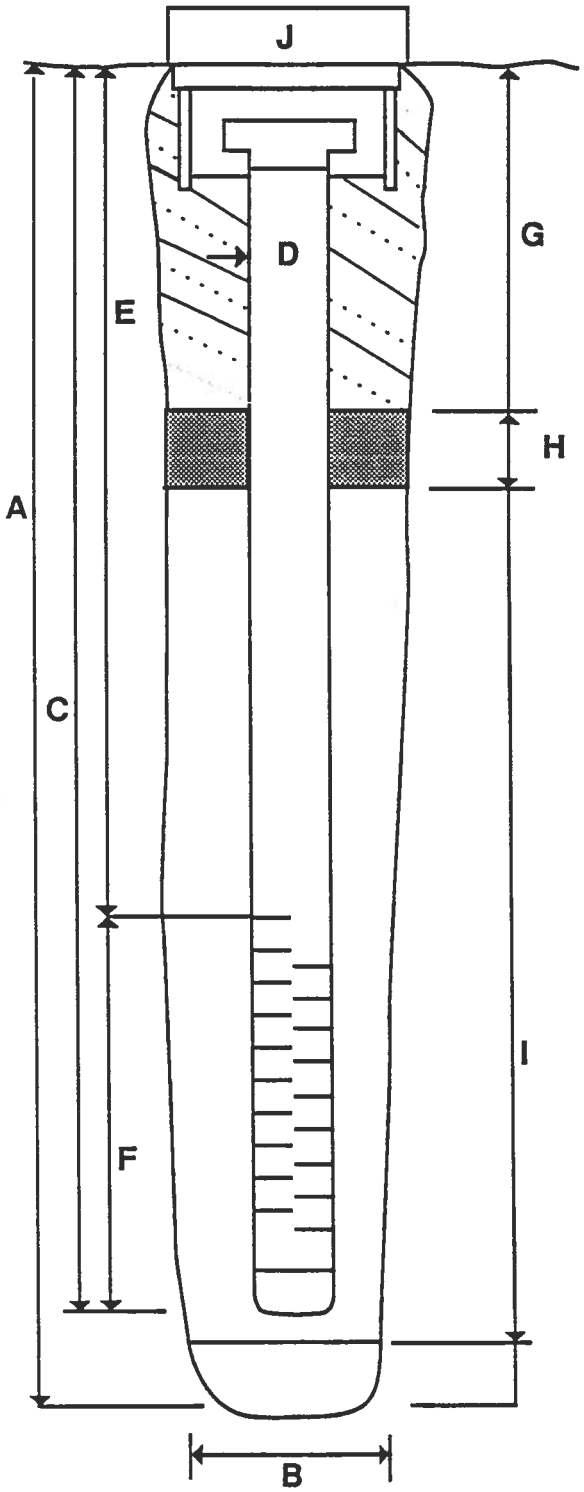
Appendix E

Well Completion Logs

WELL DETAILS

PROJECT NAME: Walstad
PROJECT NUMBER:
WELL NO: W-7

CASING ELEVATION:
SURFACE ELEVATION:
COMPLETION DATE: 8.27.92



A. Total depth: 67 feet

B. Boring Diameter: 4.5 inches

Drilling method: Air Rotary

C. Casing Length: 55 feet

Material: Threaded PVC

D. Casing Diameter: 2 inch

E. Depth to Perforations: 55 BGS

F. Perforated Length: 10 feet

Perforated Interval: 55 feet to 65 feet

Perforation Type: Factory slot

Perforation Size: .020

G. Surface Seal: 0 foot to 52 feet

Seal Material: Grout

H. Pack Seal: 52-54 feet

Seal Material: 1/2" Bentonite Pellets

I. Gravel Pack: 54 feet to 65 feet

Pack Material: Silica sand

Size: 10-20 mesh

J. Surface Mount: 8" Flush Mount

BY: Jim Griswold

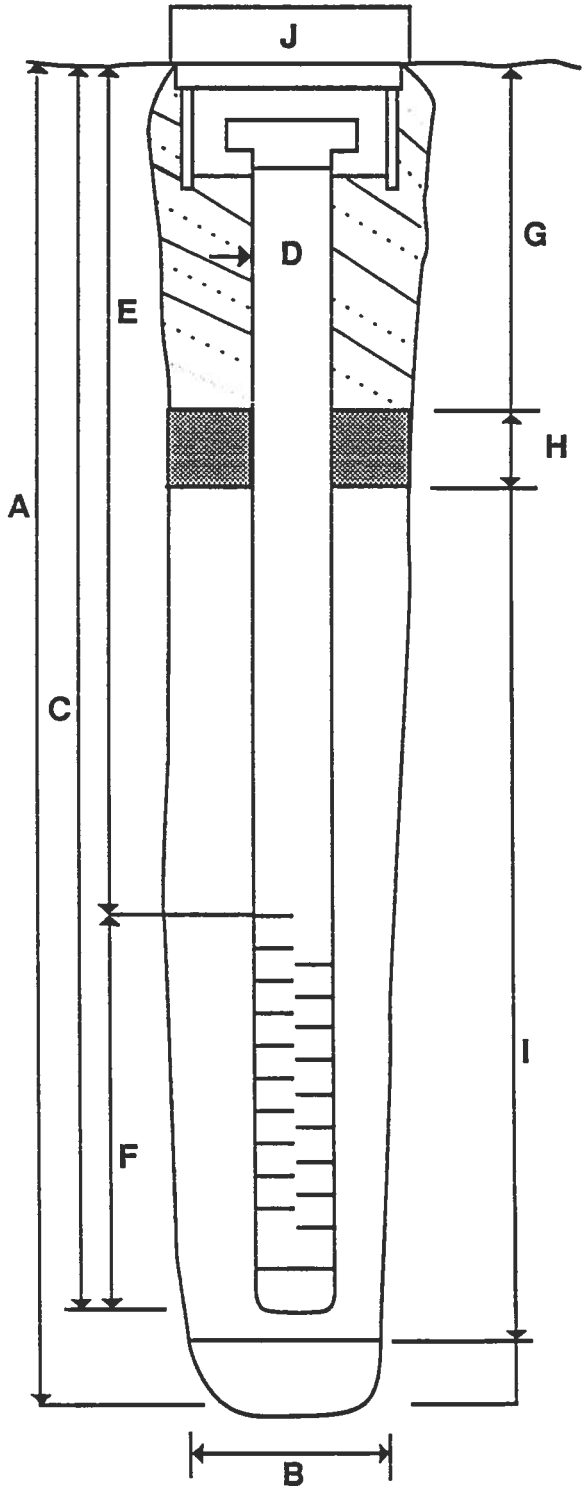
Billings & Associates, Inc.

an environmental consulting company

WELL DETAILS

PROJECT NAME: Walstad
PROJECT NUMBER:
WELL NO: W-8

CASING ELEVATION:
SURFACE ELEVATION:
COMPLETION DATE: 8.27.92



A. Total depth: 67 feet

B. Boring Diameter: 4.5 inches

Drilling method: Air Rotary

C. Casing Length: 55 feet

Material: Threaded PVC

D. Casing Diameter: 2 inch

E. Depth to Perforations: 55 BGS

F. Perforated Length: 10 feet

Perforated Interval: 55 feet to 65 feet

Perforation Type: Factory slot

Perforation Size: .020

G. Surface Seal: 0 foot to 52 feet

Seal Material: Grout

H. Pack Seal: 52-54 feet

Seal Material: 1/2" Bentonite Pellets

I. Gravel Pack: 54 feet to 65 feet

Pack Material: Silica sand

Size: 10-20 mesh

J. Surface Mount: 8" Flush Mount

BY: Jim Griswold

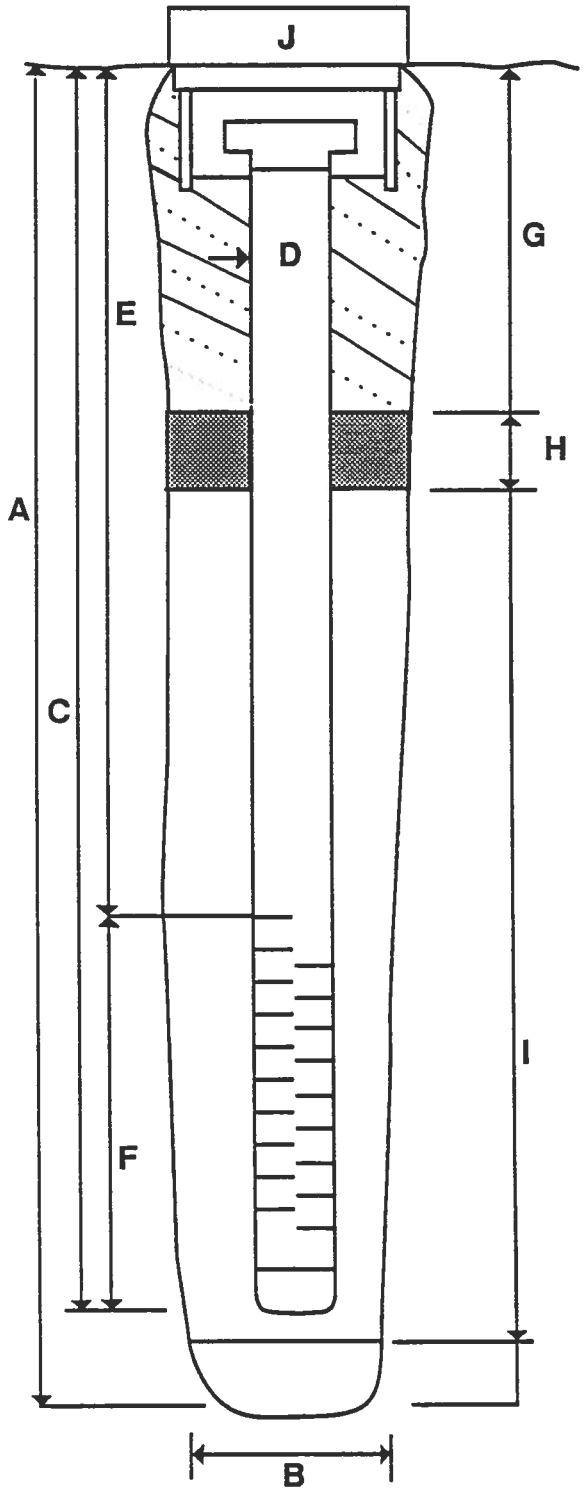
Billings & Associates, Inc.

an environmental consulting company

WELL DETAILS

PROJECT NAME: Walstad
PROJECT NUMBER:
WELL NO: W-9

CASING ELEVATION:
SURFACE ELEVATION:
COMPLETION DATE: 8.27.92



A. Total depth: 67 feet

B. Boring Diameter: 4.5 inches

Drilling method: Air Rotary

C. Casing Length: 55 feet

Material: Threaded PVC

D. Casing Diameter: 2 inch

E. Depth to Perforations: 55 BGS

F. Perforated Length: 10 feet

Perforated Interval: 55 feet to 65 feet

Perforation Type: Factory slot

Perforation Size: .020

G. Surface Seal: 0 foot to 52 feet

Seal Material: Grout

H. Pack Seal: 52-54 feet

Seal Material: 1/2" Bentonite Pellets

I. Gravel Pack: 54 feet to 65 feet

Pack Material: Silica sand

Size: 10-20 mesh

J. Surface Mount: 8" Flush Mount

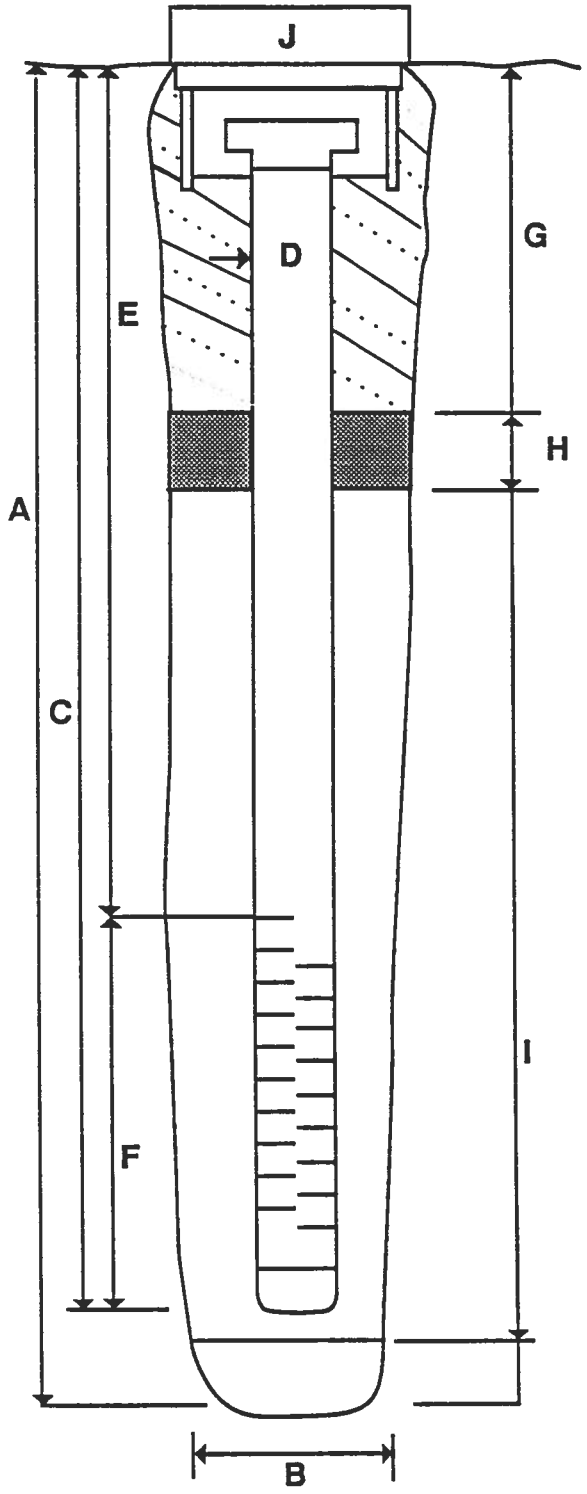
BY: Jim Griswold

Billings & Associates, Inc.
an environmental consulting company

WELL DETAILS

PROJECT NAME: Walstad
PROJECT NUMBER:
WELL NO: W-10

CASING ELEVATION:
SURFACE ELEVATION:
COMPLETION DATE: 8.27.92



A. Total depth: 67 feet

B. Boring Diameter: 4.5 inches

Drilling method: Air Rotary

C. Casing Length: 55 feet

Material: Threaded PVC

D. Casing Diameter: 2 inch

E. Depth to Perforations: 55 BGS

F. Perforated Length: 10 feet

Perforated Interval: 55 feet to 65 feet

Perforation Type: Factory slot

Perforation Size: .020

G. Surface Seal: 0 foot to 52 feet

Seal Material: Grout

H. Pack Seal: 52-54 feet

Seal Material: 1/2" Bentonite Pellets

I. Gravel Pack: 54 feet to 65 feet

Pack Material: Silica sand

Size: 10-20 mesh

J. Surface Mount: 8" Flush Mount

BY: Jim Griswold

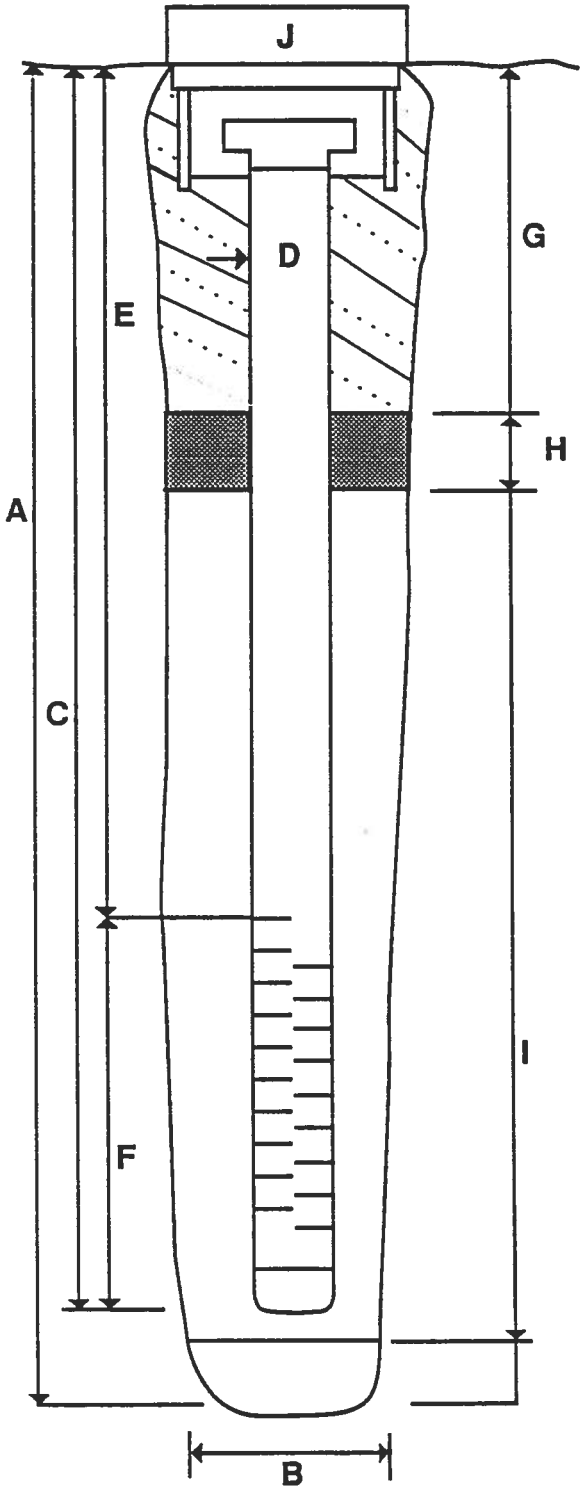
Billings & Associates, Inc.

an environmental consulting company

WELL DETAILS

PROJECT NAME: Walstad
PROJECT NUMBER:
WELL NO: W-11

CASING ELEVATION:
SURFACE ELEVATION:
COMPLETION DATE: 8.27.92



A. Total depth: 67 feet

B. Boring Diameter: 4.5 inches

Drilling method: Air Rotary

C. Casing Length: 55 feet

Material: Threaded PVC

D. Casing Diameter: 2 inch

E. Depth to Perforations: 55 BGS

F. Perforated Length: 10 feet

Perforated Interval: 55 feet to 65 feet

Perforation Type: Factory slot

Perforation Size: .020

G. Surface Seal: 0 foot to 52 feet

Seal Material: Grout

H. Pack Seal: 52-54 feet

Seal Material: 1/2" Bentonite Pellets

I. Gravel Pack: 54 feet to 65 feet

Pack Material: Silica sand

Size: 10-20 mesh

J. Surface Mount: 8" Flush Mount

BY: Jim Griswold

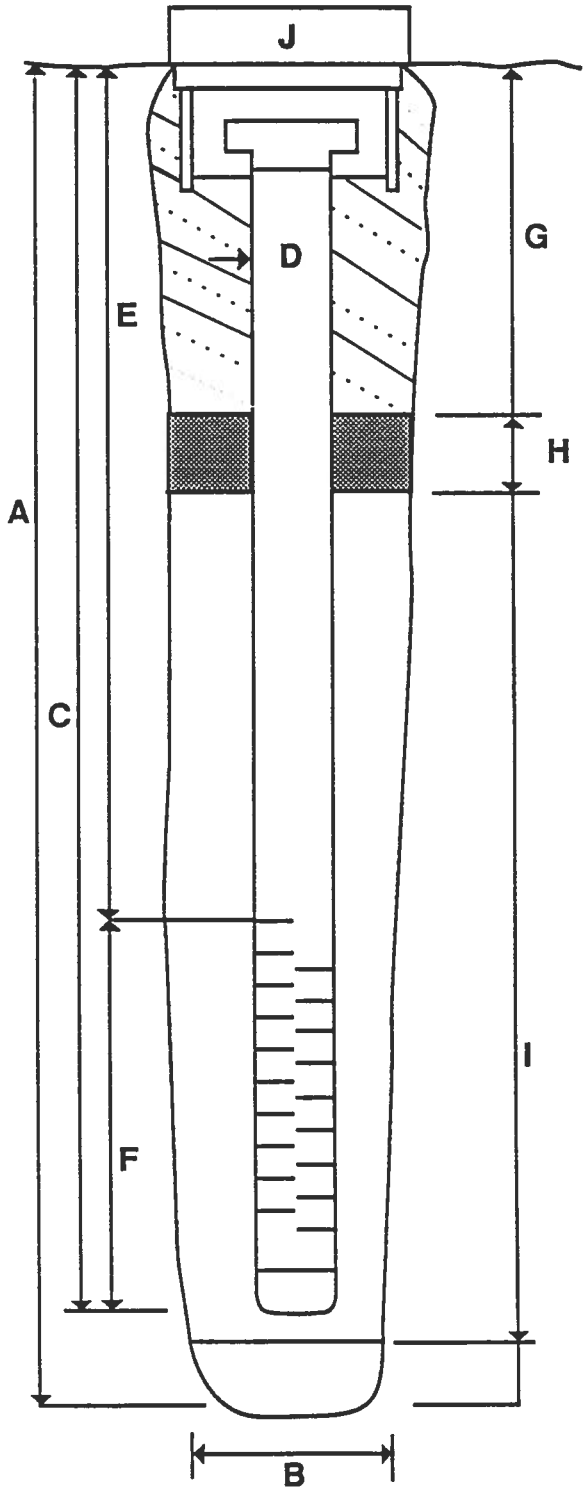
Billings & Associates, Inc.

an environmental consulting company

WELL DETAILS

PROJECT NAME: Walstad
PROJECT NUMBER:
WELL NO: W-12

CASING ELEVATION:
SURFACE ELEVATION:
COMPLETION DATE: 8.28.92



A. Total depth: 67 feet

B. Boring Diameter: 4.5 inches

Drilling method: Air Rotary

C. Casing Length: 55 feet

Material: Threaded PVC

D. Casing Diameter: 2 inch

E. Depth to Perforations: 55 BGS

F. Perforated Length: 10 feet

Perforated Interval: 55 feet to 65 feet

Perforation Type: Factory slot

Perforation Size: .020

G. Surface Seal: 0 foot to 52 feet

Seal Material: Grout

H. Pack Seal: 52-54 feet

Seal Material: 1/2" Bentonite Pellets

I. Gravel Pack: 54 feet to 65 feet

Pack Material: Silica sand

Size: 10-20 mesh

J. Surface Mount: 8" Flush Mount

BY: Jim Griswold

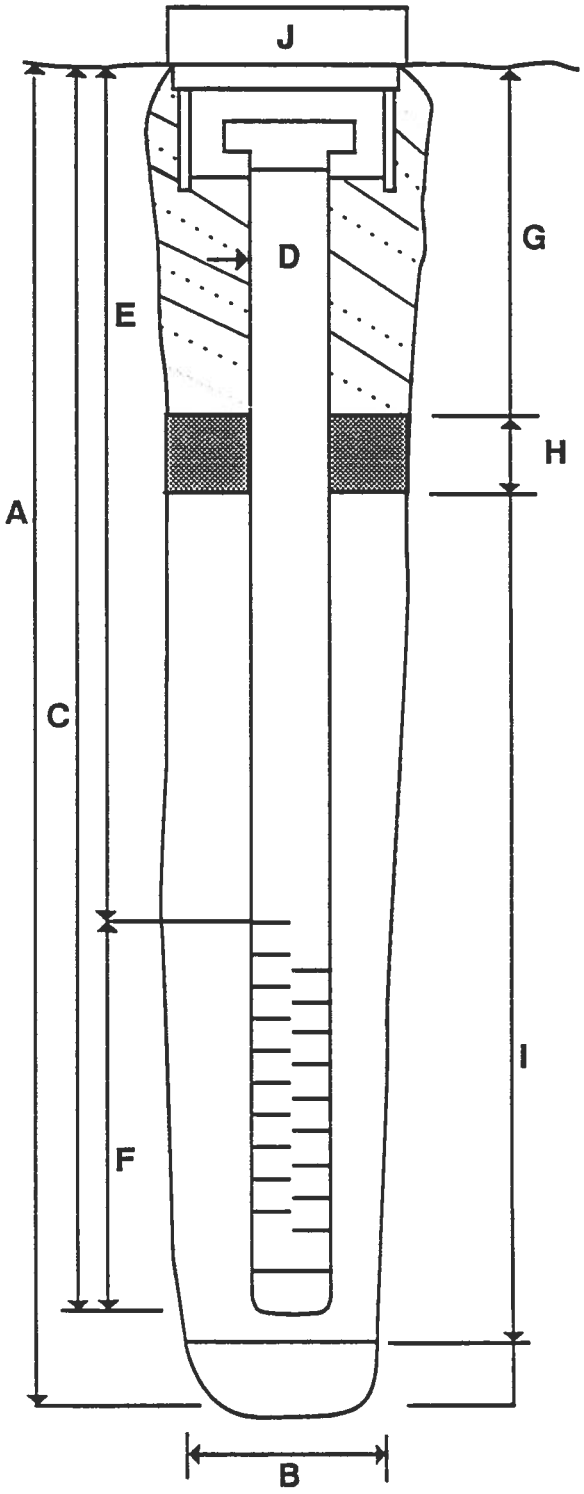
Billings & Associates, Inc.

an environmental consulting company

WELL DETAILS

PROJECT NAME: Walstad
PROJECT NUMBER:
WELL NO: W-13

CASING ELEVATION:
SURFACE ELEVATION:
COMPLETION DATE: 8.28.92



A. Total depth: 67 feet

B. Boring Diameter: 4.5 inches

Drilling method: Air Rotary

C. Casing Length: 55 feet

Material: Threaded PVC

D. Casing Diameter: 2 inch

E. Depth to Perforations: 55 BGS

F. Perforated Length: 10 feet

Perforated Interval: 55 feet to 65 feet

Perforation Type: Factory slot

Perforation Size: .020

G. Surface Seal: 0 foot to 52 feet

Seal Material: Grout

H. Pack Seal: 52-54 feet

Seal Material: 1/2" Bentonite Pellets

I. Gravel Pack: 54 feet to 65 feet

Pack Material: Silica sand

Size: 10-20 mesh

J. Surface Mount: 8" Flush Mount

BY: Jim Griswold

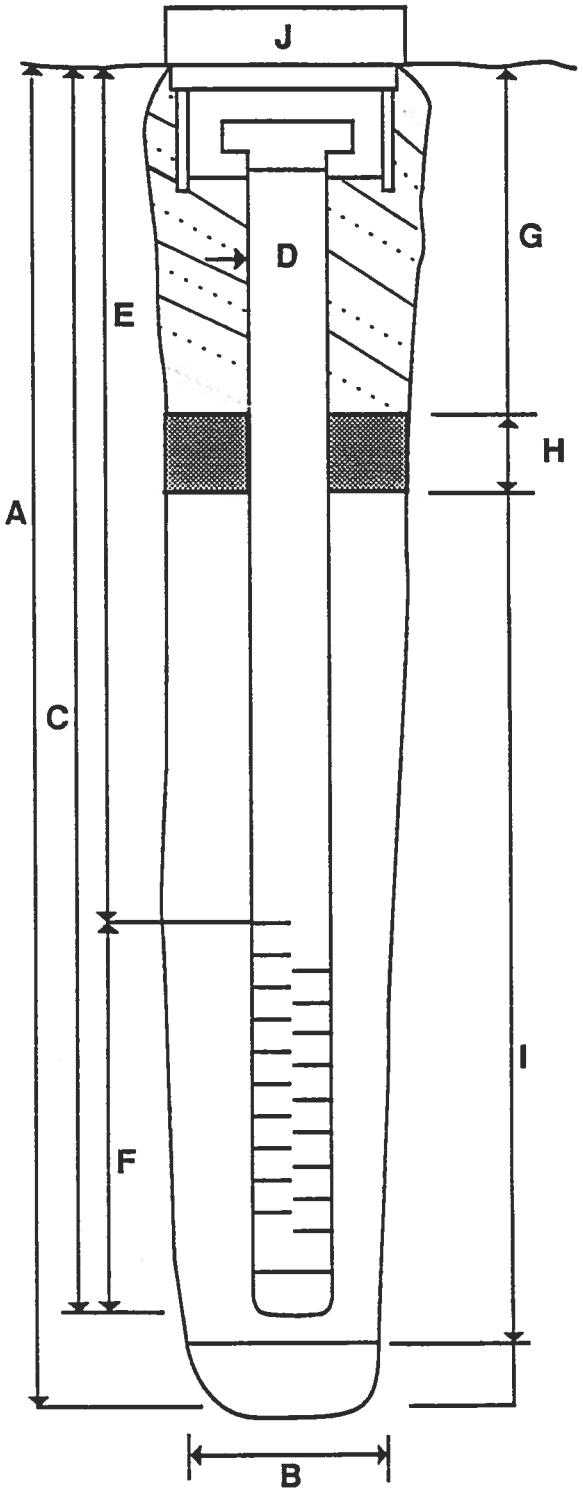
Billings & Associates, Inc.

an environmental consulting company

WELL DETAILS

PROJECT NAME: Walstad
PROJECT NUMBER:
WELL NO: V-1

CASING ELEVATION:
SURFACE ELEVATION:
COMPLETION DATE: 8.28.92



A. Total depth: 82 feet

B. Boring Diameter: 4.5 inches

Drilling method: Air Rotary

C. Casing Length: 75 feet

Material: Threaded PVC

D. Casing Diameter: 2 inch

E. Depth to Perforations: 75 BGS

F. Perforated Length: 5 feet

Perforated Interval: 75 feet to 80 feet

Perforation Type: Factory slot

Perforation Size: .020

G. Surface Seal: 0 foot to 72 feet

Seal Material: Grout

H. Pack Seal: 72-74 feet

Seal Material: 1/2" Bentonite Pellets

I. Gravel Pack: 74 feet to 80 feet

Pack Material: Silica sand

Size: 10-20 mesh

J. Surface Mount: 8" Flush Mount

BY: Jim Griswold

Billings & Associates, Inc.

an environmental consulting company

Appendix F

Laboratory Water Quality Data

Hall Environmental Analysis Laboratory

FILE

Hall Environmental Analysis Laboratory
2403 San Mateo N.E., Suite P-13
Albuquerque, N.M. 87110
(505) 880-1803

9/3/92

Billings and Associates, Inc.
3816 Academy Parkway N.E.
Albuquerque, N.M. 87109

Dear Mr. Jim Griswold,

Enclosed are the results for the analyses that were requested. These were done according to E.P.A. procedures or the equivalent.

Please don't hesitate to contact me for any additional information or clarifications.

Sincerely,

Scott Hallenbeck, Lab Manager

Project: Walstad

2403 San Mateo N.E. Suite P-13 • Albuquerque, NM 87110

Results for sample : Walstad W-4

Date collected: 8/28/92 Date received: 8/31/92
Date extracted: NA Date injected: 9/1/92
Client: Billings and Associates, Inc.
Project Name: Walstad HEAL #: 920828-1
Project Manager: Jim Griswold Sampled by: JEG/PG

Compound	Amount	Units
MTBE	<2.5	PPB (UG/L)
Benzene	1,400	PPB (UG/L)
Toluene	430	PPB (UG/L)
Ethyl Benzene	95	PPB (UG/L)
Total Xylene	300	PPB (UG/L)

BFB (Surrogate) Recovery = 106 %

Dilution Factor = 1

Results for sample : Walstad W-5

Date collected: 8/28/92 Date received: 8/31/92
Date extracted: NA Date injected: 9/1/92
Client: Billings and Associates, Inc.
Project Name: Walstad HEAL #: 920828-2
Project Manager: Jim Griswold Sampled by: JEG/PG

Compound	Amount	Units
MTBE	3.3	PPB (UG/L)
Benzene	850	PPB (UG/L)
Toluene	400	PPB (UG/L)
Ethyl Benzene	58	PPB (UG/L)
Total Xylene	450	PPB (UG/L)

BFB (Surrogate) Recovery = 100 %

Dilution Factor = 1

Results for sample : Walstad W-6

Date collected: 8/28/92 Date received: 8/31/92
Date extracted: NA Date injected: 9/1/92
Client: Billings and Associates, Inc.
Project Name: Walstad HEAL #: 920828-3
Project Manager: Jim Griswold Sampled by: JEG/PG

Compound	Amount	Units
MTBE	<2.5	PPB (UG/L)
Benzene	3,000	PPB (UG/L)
Toluene	2,700	PPB (UG/L)
Ethyl Benzene	93	PPB (UG/L)
Total Xylene	860	PPB (UG/L)

BFB (Surrogate) Recovery = 106 %

Dilution Factor = 1

Results for sample : Walstad W-7

Date collected: 8/28/92 Date received: 8/31/92
Date extracted: NA Date injected: 9/1/92
Client: Billings and Associates, Inc.
Project Name: Walstad HEAL #: 920828-4
Project Manager: Jim Griswold Sampled by: JEG/PG

Compound	Amount	Units
MTBE	<2.5	PPB (UG/L)
Benzene	<0.5	PPB (UG/L)
Toluene	<0.5	PPB (UG/L)
Ethyl Benzene	<0.5	PPB (UG/L)
Total Xylene	<0.5	PPB (UG/L)

BFB (Surrogate) Recovery = 100 %

Dilution Factor = 1

Results for sample : Walstad W-8

Date collected: 8/28/92 Date received: 8/31/92
Date extracted: NA Date injected: 9/1/92
Client: Billings and Associates, Inc.
Project Name: Walstad HEAL #: 920828-5
Project Manager: Jim Griswold Sampled by: JEG/PG

Compound	Amount	Units
MTBE	<2.5	PPB (UG/L)
Benzene	8,000	PPB (UG/L)
Toluene	9,500	PPB (UG/L)
Ethyl Benzene	690	PPB (UG/L)
Total Xylene	5,200	PPB (UG/L)

BFB (Surrogate) Recovery = 98 %

Dilution Factor = 1

Results for sample : Walstad W-9

Date collected: 8/28/92 Date received: 8/31/92
Date extracted: NA Date injected: 9/1/92
Client: Billings and Associates, Inc.
Project Name: Walstad HEAL #: 920828-6
Project Manager: Jim Griswold Sampled by: JEG/PG

Compound	Amount	Units
MTBE	<2.5	PPB (UG/L)
Benzene	130	PPB (UG/L)
Toluene	8.2	PPB (UG/L)
Ethyl Benzene	16	PPB (UG/L)
Total Xylene	140	PPB (UG/L)

BFB (Surrogate) Recovery = 101 %

Dilution Factor = 1

Results for sample : Walstad W-10

Date collected: 8/28/92 Date received: 8/31/92
Date extracted: NA Date injected: 9/1/92
Client: Billings and Associates, Inc.
Project Name: Walstad HEAL #: 920828-7
Project Manager: Jim Griswold Sampled by: JEG/PG

Compound	Amount	Units
MTBE	<2.5	PPB (UG/L)
Benzene	1,100	PPB (UG/L)
Toluene	11	PPB (UG/L)
Ethyl Benzene	120	PPB (UG/L)
Total Xylene	440	PPB (UG/L)

BFB (Surrogate) Recovery = 108 %

Dilution Factor = 1

Results for sample : Walstad W-11

Date collected: 8/28/92 Date received: 8/31/92
Date extracted: NA Date injected: 9/1/92
Client: Billings and Associates, Inc.
Project Name: Walstad HEAL #: 920828-8
Project Manager: Jim Griswold Sampled by: JEG/PG

Compound	Amount	Units
MTBE	<2.5	PPB (UG/L)
Benzene	770	PPB (UG/L)
Toluene	13	PPB (UG/L)
Ethyl Benzene	13	PPB (UG/L)
Total Xylene	280	PPB (UG/L)

BFB (Surrogate) Recovery = 99 %

Dilution Factor = 1

Results for sample : Walstad W-12

Date collected: 8/29/92 Date received: 8/31/92
Date extracted: NA Date injected: 9/1/92
Client: Billings and Associates, Inc.
Project Name: Walstad HEAL #: 920828-9
Project Manager: Jim Griswold Sampled by: JEG/PG

Compound	Amount	Units
MTBE	<2.5	PPB (UG/L)
Benzene	87	PPB (UG/L)
Toluene	6.1	PPB (UG/L)
Ethyl Benzene	2.6	PPB (UG/L)
Total Xylene	180	PPB (UG/L)

BFB (Surrogate) Recovery = 103 %

Dilution Factor = 1

Results for sample : Walstad W-13

Date collected: 8/29/92 Date received: 8/31/92
Date extracted: NA Date injected: 9/1/92
Client: Billings and Associates, Inc.
Project Name: Walstad HEAL #: 920828-10
Project Manager: Jim Griswold Sampled by: JEG/PG

Compound	Amount	Units
MTBE	<2.5	PPB (UG/L)
Benzene	<0.5	PPB (UG/L)
Toluene	<0.5	PPB (UG/L)
Ethyl Benzene	<0.5	PPB (UG/L)
Total Xylene	<0.5	PPB (UG/L)

BFB (Surrogate) Recovery = 99 %

Dilution Factor = 1

Results for sample : Walstad V-1

Date collected: 8/29/92	Date received: 8/31/92
Date extracted: NA	Date injected: 9/1/92
Client: Billings and Associates, Inc.	
Project Name: Walstad	HEAL #: 920828-11
Project Manager: Jim Griswold	Sampled by: JEG/PG

Compound	Amount	Units
MTBE	<2.5	PPB (UG/L)
Benzene	250	PPB (UG/L)
Toluene	680	PPB (UG/L)
Ethyl Benzene	240	PPB (UG/L)
Total Xylene	810	PPB (UG/L)

BFB (Surrogate) Recovery = 101 %

Dilution Factor = 1

Results for QC: Reagent Blank

Date extracted: NA Date injected: 9/1/92
Client: Billings and Associates, Inc.
Project Name: Walstad HEAL #: RB 9/1
Project Manager: Jim Griswold

Compound	Amount	Units
MTBE	<2.5	PPB (UG/L)
Benzene	<0.5	PPB (UG/L)
Toluene	<0.5	PPB (UG/L)
Ethyl Benzene	<0.5	PPB (UG/L)
Total Xylene	<0.5	PPB (UG/L)

BFB (Surrogate) Recovery = 103 %

Dilution Factor = 1

Results for QC: Blank Spike/Blank Spike Dup

Date extracted: NA — Date injected: 9/1/92
Client: Billings and Associates, Inc.
Project Name: Walstad — HEAL #: BS/BSD 9/1
Project Manager: Jim Griswold — Sampled by: NA

Compound	Sample Result	Amount Added	Blank Spike	BS %	BS Dup	BSD %	RPD
MTBE	<2.5	40.0	37.5	94	35.7	89	5
Benzene	<0.5	20.0	18.1	91	16.3	81	10
Toluene	<0.5	20.0	17.9	90	17.4	87	3
Ethyl Benzene	<0.5	20.0	18.4	92	17.7	88	4
Total-Xylene	<0.5	60.0	56.5	94	55.6	93	2

HALL ENVIRONMENTAL ANALYSIS LABORATORY
2403 SAN MATEO NE, SUITE P-13 • ALBUQUERQUE, NM 87110 • (505) 880-1803

CHAIN-OF-CUSTODY RECORD

ANALYSIS REQUEST

CLIENT: Billings & Assoc., Inc.

PROJECT MANAGER: Jim Griswold

ADDRESS: 3816 Academy Pky NNE, Albq., NM 87109

PHONE #: 345-1116

FAX #: 345-1756

PROJECT NAME: Walstad

SAMPLER: JEG/PG

PROJECT #:

DATE	TIME	MATRIX	SAMPLE I.D. NO.	NUMBER/ VOLUME	PRESERVATIVE: $HgCl_2$	PRESERVATIVE: HCl	PRESERVATIVE: OTHER	BTEX (METHOD 602)	BTEX + MTBE (602)	TPH (METHOD 8015 MOD)	BTEX + TPH COMBINATION	601/602	601 ONLY	602 ONLY			AIR BUBBLES OR HEADSPACE (Y OR N)	SAMPLES COLD: (Y OR N) / HEAL #
8/28/92	14:01	Water	Walstad W-4	2 @ 40ml	L				L									920828-1
8/28/92	12:20	Water	W-5		L				L									-2
8/28/92	PM	Water	W-6		L				L									-3
8/28/92	11:37	Water	W-7		L				L									-4
8/28/92	PM	Water	W-8		L				L									-5
8/28/92	PM	Water	W-9		L				L									-6
8/28/92	PM	Water	W-10		L				L									-7
8/28/92	15:49	Water	W-11		L				L									-8
8/29/92	AM	Water	W-12		L				L									-9
8/29/92	AM	Water	W-13		L				L									-10
8/29/92	AM	Water	V-1		L				L									-11

RELINQUISHED BY: (Signature)	DATE:	TIME:	RECEIVED BY:
	8/31/92		
RELINQUISHED BY: (Signature)	DATE:	TIME:	RECEIVED BY:

REMARKS: