100.38.104

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

RECEIVED
JUN 2 1 1999
CONTAMINATED SITES
FAIRBANKS

SEATTLE
FAIRBANKS
ANCHORAGE
SAINT LOUIS

June 21, 1999

Alaska Department of Environmental Conservation
Contaminated Sites Remediation Program
610 University Avenue
Fairbanks, AK 99709-3643

Attn: Mr. Douglas Bauer

RE: INTERIM REPORT OF 1998/1999 SITE INVESTIGATION FINDINGS, HOLDER PROPERTY AND DAVISON STREET RIGHT OF WAY, FAIRBANKS, ALASKA, NTP 1820121001A

Shannon & Wilson is performing an investigation of four properties in the Six Mile Richardson Highway area for the Alaska Department of Environmental Conservation (ADEC). This interim report presents a preliminary evaluation of the results of the 1998/1999 field investigation on the Holder property (TL-2806 and TL-2841) and the adjacent Davison Street right of way to confirm the need for remedial action. Our subsequent site assessment report will provide additional details of the current investigation, a summarize of relevant previous investigations, and complete analytical results.

A one-mile-long plume of trichloroethylene (TCE) is present in groundwater in the Six Mile Richardson Highway area. Results of previous site assessments suggested two TCE sources on the Holder property and an area of petroleum hydrocarbon-contaminated soil in the right of way. Since then, several site investigations have been performed in the Six Mile Richardson Highway area to locate other sources of groundwater contamination, determine the extent of the regional TCE plume, and identify and monitor affected residential water supply wells. Sources of TCE and 1,1,1-trichloroethane (TCA) were also found on the Walsky property (TL-2829) to the west of the Holder property; findings of the current investigation on the Walsky property are discussed in a separate report.

The goals of the current investigation on the Holder property and the Davison Street right of way are to:

- Delineate the sources of groundwater contamination,
- Determine the boundaries of the plume of contaminated groundwater, and
- Evaluate potential remedial alternatives to address the groundwater contamination in the Six Mile Richardson Highway area.

2055 HILL ROAD • P.O. BOX 70843
FAIRBANKS, ALASKA 99707-0843
907-479-0600 FAX 907-479-5691

The Davison Street right of way is located between the McCall property (TL-2800) to the east and the Holder property. This interim report includes results of investigation of the 60-foot-wide, 1,300-foot-long portion of the right of way on the south side of the Richardson Highway. Ownership of the right of way is currently unresolved. It lies within the original boundaries of the McCall property, but is listed as a street right of way.

A U.S. Army Antiaircraft Artillery (AAA) site was formerly located on portions of what are now the Holder property, Davison Street right of way, and the McCall property. Of particular concern were four gun emplacements and a generator building, where solvents and/or fuels were likely used. The former location of these structures, based on air photo interpretation, is shown in Figure 1.

Several criteria can be used to define the presence of a "source area." These include:

- A localized area of elevated TCE groundwater concentrations, with much lower TCE concentrations in the groundwater upgradient of that location.

- Elevated soil gas concentrations, which can be caused either by vapors offgassing from water contaminated with high concentrations of TCE, or by vapors travelling through the soil above the water table from a nearby area of soil contaminated by TCE.

- Elevated concentrations of TCE in soil samples.

The first two conditions were observed during this investigation. However, no soil samples collected during this investigation contained elevated levels of TCE. This is not surprising, since chlorinated solvents tend to pass vertically through the ground in a very narrow lateral extent (rather than spreading out over a large area on the water table the way that fuels which are lighter than water do).

There is a rule of thumb that concentrations of chlorinated solvents in groundwater at levels exceeding 1 percent of the solubility of the solvent suggest the presence of free solvent product in the soils below the water table. For TCE, this corresponds to a concentration of TCE in excess of 10,000 micrograms per liter (µg/l), far greater than the highest concentration measured in the groundwater in this investigation. Thus, "pools" of free solvent product are not expected to be present, although residual contamination of soil by TCE must be present to generate the TCE that continues to be present in the water in a dissolved phase.

Investigation Findings

Shannon & Wilson's 1998 and 1999 investigation on the subject sites included a passive soil gas survey, collection and analysis of groundwater samples from probes installed to multiple depths, and collection and analysis of subsurface soil samples from borings. Investigation activities and results are summarized below.

Soil Gas Survey

Soil gas measurements can be used to estimate concentrations of organic compounds in soil and groundwater by measuring the concentrations of these compounds that are present in soil gases. Soil gas sampling with the GoreSorber® Screening Survey was used to provide qualitative information on soil contamination at a large number of sample points to investigate known areas of contamination and determine if additional sources were present.

An initial evaluation of a limited number of soil gas collectors during July 1998 indicated that at this site this survey method was much more sensitive to soil contamination than groundwater contamination. Thus, the soil gas collector results are believed to reflect levels of soil, rather than groundwater, contamination at this site.

Soil gas collectors were subsequently placed in a grid pattern from the trailer on the Holder property southeast to the former gun emplacement area. Fifty-six soil gas collectors were installed on the Holder property, and twelve were placed within the right of way (others were placed on the adjacent McCall property). The collectors were installed at a depth of 2 feet on September 18 and left in the ground for 14 days. Collectors were removed from the ground and shipped to the manufacturer's laboratory for analysis of volatile organic compounds (VOCs). Locations of the soil gas collectors are shown in Figure 1.

On the Holder property, soil gas results indicated elevated concentrations of TCE southeast of the trailer and at the western gun emplacement. The soil gas collector at the center of the west gun emplacement (just inside the Holder property) contained the largest amount of TCE in soil gas measured during this study. Other compounds found at elevated levels in the soil gas collectors on the Holder property were *cis*-1,2-dichloroethylene (a breakdown product of TCE); benzene, toluene, ethylbenzene, and total xylenes (BTEX); and diesel range organic compounds.

In the Davison Street right of way, soil gas results indicated elevated levels of BTEX and fuel hydrocarbons. According to the laboratory, the collector that was installed at the northeast corner of the western gun emplacement was stained and had "a strong gas smell." This suggests petroleum contamination of the soil in which it was installed.

Groundwater Probes

Groundwater samples were obtained from temporary well points installed using a Geoprobe® direct-push system. A slotted section of pipe at the end of ½-inch I.D. steel pipe was driven to the desired sampling depth using the Geoprobe® vibratory hammer. A peristaltic pump was used to purge the stagnant water from the casing and collect a representative groundwater sample from that depth. The screen and casing were then driven to greater depths to collect additional samples at the same location. After the deepest sample was collected, the pipe was retracted from the ground for decontamination and use at the next sampling location.

Between August 1998 and March 1999, probes were installed at 49 locations on the Holder property and four locations within the right of way. Samples were collected from two or three depths at each location (generally 9, 15, and 30 feet below ground surface). Groundwater samples were analyzed for volatile organic compounds by an off-site analytical laboratory. The groundwater probe locations and their labels are shown in Figure 1.

The maximum concentration of TCE at each Geoprobe® location (regardless of sample depth) is shown in Figure 2. The estimated extent of the groundwater plume is drawn in this figure, as well as the inferred locations of the TCE source areas. TCE concentrations at selected depth intervals are shown in Figure 3 through 5.

Groundwater probes were installed in an iterative program (initial results were used to select locations for subsequent investigation) and located with respect to known or inferred soil or groundwater contamination. Four main transects perpendicular to the groundwater flow direction were initially sampled: *A – H* southeast of the trailer, *U – X* at the western gun emplacement, *Z – EE* downgradient of the generator building, and *JJ – MM* north of the trailer. Probes *S, T, DD,* and *EE* in the right of way were extensions of these transects. A line of ten probes was also sampled near the Holder/Walsky property line to determine VOC concentrations leaving the Holder property. After the results of initial sampling were evaluated, additional probes were installed to attempt to more precisely locate source areas and define the margins of the contaminated groundwater plumes.

Groundwater concentrations are reported in units of micrograms per liter (µg/l), which are equivalent to parts per billion. Groundwater results are compared to the maximum contaminant level (MCL) for public drinking water systems. The MCLs for TCE and benzene are both 5 µg/l. The highest TCE groundwater concentrations at a location are depicted in Figure 2. The TCE groundwater concentrations were consistent with the results of the soil gas survey. Two general areas of elevated TCE concentrations are apparent in groundwater on the Holder property: at the former gun emplacement and southeast of the trailer. Sources of TCE are inferred to be located upgradient (southeast) of these high groundwater levels. It is assumed that these sources consist of soil below the water table to which TCE has adsorbed from previous releases from unknown primary sources.

At two locations, TCE concentrations were found to be significantly higher than adjacent probes, implying the presence of multiple localized source areas of TCE in the soil:

- Probe *V* at the former gun emplacement (463 µg/l at 9 feet bgs)
- Probes *B* through *E* east of the trailer (up to 352 µg/l at 9 feet bgs)

At the former gun emplacement, 463 µg/l TCE was measured in groundwater probe *V* at 9 feet below ground surface (bgs). Probes 25 feet on either side of *V*, and 15 feet upgradient of *V*, contained low levels of TCE.

A second, larger, TCE source is evident near the trailer, where concentrations increase to as high as 352 µg/l (probe *E*). Elevated TCE groundwater levels were reported over a distance of about 100 feet perpendicular to the groundwater flow direction, from probe *B* to probe *F*.

In addition, slightly elevated TCE levels (49.5 µg/l) were present in probe *II* at the northwest corner of the southern Holder parcel (TL-2841). Concentrations in upgradient probe *AB* were only 15 µg/l. This suggests the possible presence of an additional TCE source upgradient of probe *II*.

Benzene was found in groundwater samples from three probe locations in excess of its 5 µg/l MCL. Benzene was measured at 167 µg/l in probe *BB* near the southeast corner of the dog yard. The benzene concentration decreases to 19.1 µg/l at the next downgradient probe (*NN*), and to 1.68 µg/l in probe *Q* near the property line. A source of benzene contamination is suspected upgradient of probe *BB*.

A second benzene source is suspected upgradient of probe *HH* at the property line near the northwest corner of the southern Holder parcel, where benzene was measured at 22.5 µg/l. The small corner of the Walsky property between probes *HH* and *GG* may contain benzene greater than its MCL. Where groundwater crosses back onto the northern Holder parcel (Tax Lot 2806), the level of benzene has decreased to 1.45 µg/l in probe *GG*.

The magnitude and extent of groundwater contamination were measured in four transects of groundwater probes on the Holder property. The highest TCE concentration measured in groundwater on the Holder property was 463 µg/l, but at this location the concentration rapidly decreased with distance downgradient, to 34.3 µg/l in probe *AA* 150 feet downgradient. TCE levels then increase to 352 µg/l at probe *E* 150 feet farther downgradient, but decrease to 55.9 µg/l in probe *N* 250 feet downgradient of probe *E*. Concentrations of TCE leaving the Holder property, as indicated by samples collected near the property line, exceed the maximum contaminant level. Exceedances of the MCL occur along at least a 450-foot segment of the property line, from probe *Q* to probe *II*; TCE concentrations leaving the southern Holder parcel range from 19.1 µg/l to 85.8 µg/l. In most cases, the highest TCE concentration was found in the shallowest groundwater sample at each location (9 feet below ground surface, a few feet below the water table surface).

In addition to TCE, the following compounds were detected in groundwater samples on the Holder property at concentrations in excess of their MCL:

Compound	Highest Concentration Detected (µg/l)
Benzene	167
cis-1,2-Dichloroethylene	381
Tetrachloroethylene (PCE)	12.3
Vinyl chloride	2.39

None of these compounds appears to leave the Holder property in excess of their MCL, except for the previously discussed small benzene plume inferred to extend onto the northeast corner of the Walsky property.

The following VOCs were detected in groundwater samples from the Holder property at concentrations less than their MCL: the solvents or breakdown products 1,1-dichloroethylene, *trans*-1,2-dichloroethylene, and 1,2-dichloroethane; and the fuel constituents 1,2,4-trimethylbenzene, toluene, ethylbenzene, and xylenes.

The highest TCE groundwater concentration measured in the Davison Street right of way was 20.8 µg/l in probe *S*. This was the only exceedance of an MCL in a groundwater sample from the right of way. This concentration does not necessarily suggest a source in the right of way. Given the location of probe *S* with respect to *V*, this concentration may represent the crossgradient edge of a plume originating near probe *V* on the Holder property.

The following VOCs were detected in groundwater samples from the Davison Street right of way at less than their MCL: *cis*-1,2-dichloroethylene, *sec*-butylbenzene, and toluene.

Soil Borings

In November 1998, subsurface soil samples were collected from borings near the western gun emplacement, which overlaps the property line between the southern Holder parcel and the Davison Street right of way. Groundwater and soil gas results suggested this area was a source of TCE and petroleum hydrocarbons. Soil boring locations are shown in Figure 6.

Five hollow-stem auger borings (B-12 through B-16) were drilled on the Holder property at the western gun emplacement. Split-spoon soil samples were collected for laboratory analysis to determine if a TCE source was present. Eleven soil samples were collected at depths of 5 and 6.5 feet (corresponding to the soil immediately above and below the water table surface) and submitted for analysis for VOCs.

Two hollow-stem auger borings (B-1 and B-2) were drilled in the right of way. Four (plus a duplicate) split-spoon soil samples were collected at depths of 3.5, 5, or 6.5 feet and were submitted for analysis for diesel range organics (DRO), residual range organics (RRO), and VOCs. The sample with the highest photoionization detector (PID) reading during field headspace screening was also analyzed for gasoline range organics (GRO).

Nine solid-stem auger borings (B-3 through B-11) were drilled in the right of way near the location of probe P-14 that was sampled in 1994. Soil samples were collected from a depth of 5 feet to delineate the soil contamination based on odor and field screening PID readings. These samples were collected from the soil cuttings on the auger flights. No samples were submitted for laboratory analysis from these borings.

TCE was reported above the detection limit in eight of the ten soil samples from the Holder property, and one of the four samples from the right of way. TCE concentrations were reported from 0.0564 milligrams per kilogram (mg/kg, equivalent to a part per million) to 0.138 mg/kg. All of the detected levels of TCE exceed the most stringent ADEC cleanup level (0.027 mg/kg for the migration to groundwater pathway). The soil samples were collected in or just above the water table (encountered at about 6 feet bgs). In our opinion, the low level of TCE reported in the soil samples reflects the elevated concentration of TCE dissolved in the groundwater (which would have been present as pore water in the soil samples), and does not suggest that significant levels of TCE were present either in the soil pore spaces or adsorbed to the soil particles. While TCE levels were higher on the Holder property than in the right of way, there was no apparent pattern to the TCE soil concentrations. Trichlorofluoromethane and *cis*-1,2-dichloroethylene were also reported in the soil samples from the Holder property.

In the Davison Street right of way, DRO was reported in the soil samples at up to 20,200 mg/kg. The highest level was found in the sample from a depth of 5 feet in boring B-2. Ten feet away, the DRO concentration was 4,710 mg/kg in boring B-1. GRO was measured at 21.3 mg/kg in the one sample analyzed, and likely represents the lighter portion of the diesel contamination. Residual range organics were not reported in the samples. The following petroleum hydrocarbon constituents were reported in a number of samples in the right of way at less than the ADEC soil cleanup levels: 1,3,5-trimethylbenzene, 4-isopropyltoluene, naphthalene, toluene, and *o*-xylene. Only DRO and TCE levels exceeded the soil cleanup levels. No TCE source was inferred to have been detected with soil sampling in the right of way.

A slight petroleum hydrocarbon odor was noted on some of the samples from borings B-12 and B-13 on the Holder property, but PID field screening readings were not significantly elevated. A petroleum hydrocarbon odor was also noted on some of the samples from both borings B-1 and B-2 in the right of way, and a sheen was observed on the water in boring B-2. Samples collected at the water table from borings B-1 and B-2 exhibited elevated PID readings. The inferred extent of petroleum hydrocarbon soil contamination, based on the PID readings, is shown in Figure 6. TCE and DRO analytical results, as well as PID field screening results, are tabulated in Figure 6.

Evaluation of Results

The areas of contamination on the subject sites are described in the following paragraphs in an upgradient to downgradient sequence.

TCE was not reported in the groundwater on the McCall property, which is upgradient of the Holder property and Davison Street right of way. Refer to Shannon & Wilson's Interim Report on the McCall Property for additional upgradient information.

The soil gas survey identified a petroleum hydrocarbon source area in the Davison Street right of way. Contaminated soil is as shallow as 2 feet below ground surface. The area of contaminated soil was delineated by field screening soils with a PID. Soil sampling confirmed the presence of diesel-range fuel above the ADEC soil cleanup level. VOC groundwater contamination above MCLs does not appear to be associated with this source area. TCE is not associated with this hydrocarbon source, although it and the TCE source described below overlap somewhat. Cleanup of the contaminated soils is required under 18 AAC 75.340.

A small TCE source is inferred at the former gun emplacement on the Holder property. This area was first identified by a localized elevated TCE concentration in the soil gas survey. Follow-up soil sampling detected soil contamination. An area of elevated groundwater contamination surrounding the soil gas sample location is inferred to be less than 50 feet wide, and extend less than 15 feet below ground surface. In our opinion, this apparent source does not add significantly to the regional plume.

A large TCE source is located in the area upgradient of probes *B* through *F* east of the trailer. In our opinion, this is the most significant TCE source on the Holder property with respect to its contribution to the regional TCE plume. The area was identified by the soil gas survey and confirmed by groundwater results. No soil samples were collected here during this investigation, but residual soil contamination must be present to cause the groundwater plume. Groundwater results indicate contamination over a 100-foot-wide area. Groundwater contamination persists from this area to the downgradient property line.

Lastly, a TCE source is inferred to be present upgradient of probe *II* at the northwest corner of TL-2841. This source may be contributing to the occurrence of TCE on downgradient properties including the northern Holder parcel and the Eskimo Museum Lane properties. However, it is difficult to distinguish the contribution of this localized source from possible contributions from other sources farther upgradient.

Benzene sources are inferred to be upgradient of probes *BB* and *HH*, resulting in small benzene plumes. Benzene is not known to be a regional problem on the south side of the Richardson Highway.

The extent of the TCE groundwater contamination on the Holder property is depicted in Figure 2. The plume is about 300 feet wide at its widest point on this site. In general, TCE groundwater concentrations at 9 or 10 feet below ground surface were greater than those at 30 feet, suggesting that the sources are shallow and that the released TCE did not penetrate deep into the aquifer. The limited data suggest that groundwater as deep as 50 feet below ground surface is also contaminated with TCE. The TCE plume extends downgradient onto the Walsky property. One or more sources of TCE, as well as TCA, on the Walsky property also contribute to the plume of groundwater contamination. Since the Walsky TCE source or sources are approximately downgradient of the Holder TCE source, the two plumes commingle. No TCA was detected on the Holder property, implying that the TCA source is entirely on the Walsky property.

State regulations (18 AAC 75.345) require that groundwater be cleaned up to levels that do not exceed the MCL. Up to 463 µg/l TCE was measured in groundwater on the Holder property. This concentration is 90 times the drinking water MCL. To a lesser degree, benzene also exceeds the MCL in smaller areas on the Holder property.

Conclusions

Based on the findings of the 1998 and 1999 field investigation, Shannon & Wilson concludes:

- At least two, and possibly three, sources of TCE groundwater contamination are present on the Holder property.
- The TCE plume originating on the Holder property extends downgradient onto the Walsky property, where it joins a plume of groundwater contamination originating on that property.
- TCE groundwater concentrations exceed the MCL both on the Holder property and at the downgradient property line with the Walsky property.
- Benzene groundwater concentrations exceed the MCL at a small area on the Holder property, but not at the downgradient property line.
- An area of subsurface soil in the Davison Street right of way is contaminated with diesel fuel above applicable soil cleanup levels.

- Petroleum hydrocarbon constituents in the groundwater in the Davison Street right of way do not exceed MCLs.

- A small area of groundwater within the Davison Street right of way exceeds the MCL for TCE.

Copies of laboratory results will be provided with the final site assessment and are available at our office. Shannon & Wilson, Inc., has prepared the following *Important Information About Your Geotechnical/Environmental Report* to assist you and others in understanding the use and limitation of our reports. We trust this information is satisfactory for your needs at this time.

Sincerely,

SHANNON & WILSON, INC.

Julie Keener
Engineer

Reviewed By
David M. McDowell
Senior Associate

Attachments:
Figure 1 - Locations of Soil Gas Collectors and Groundwater Probes
Figure 2 - Highest TCE Groundwater Concentrations Regardless of Depth
Figure 3 - TCE Groundwater Concentrations at 9, 10, and 15 Feet
Figure 4 - TCE Groundwater Concentrations at 30 Feet
Figure 5 - TCE Groundwater Concentrations at 50 Feet
Figure 6 - Field Screening and Analytical Soil Sample Results
Important Information About Your Geotechnical/Environmental Report

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Dated: June 21, 1999
To: Mr. Douglas Bauer
ADEC CSRP X-928-033

Important Information About Your Geotechnical/Environmental Report

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include: the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used: (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors which were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/ environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the
ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland

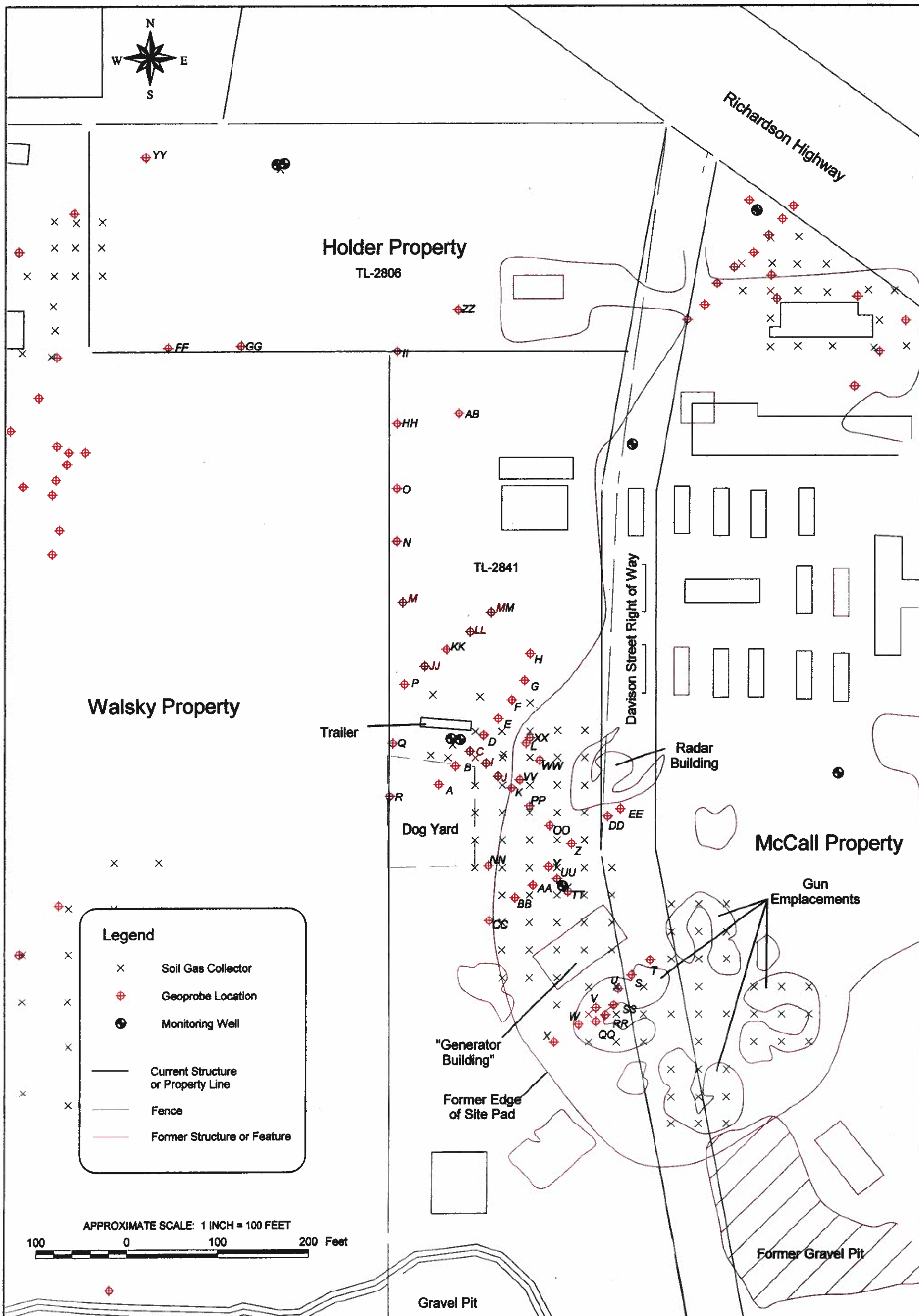
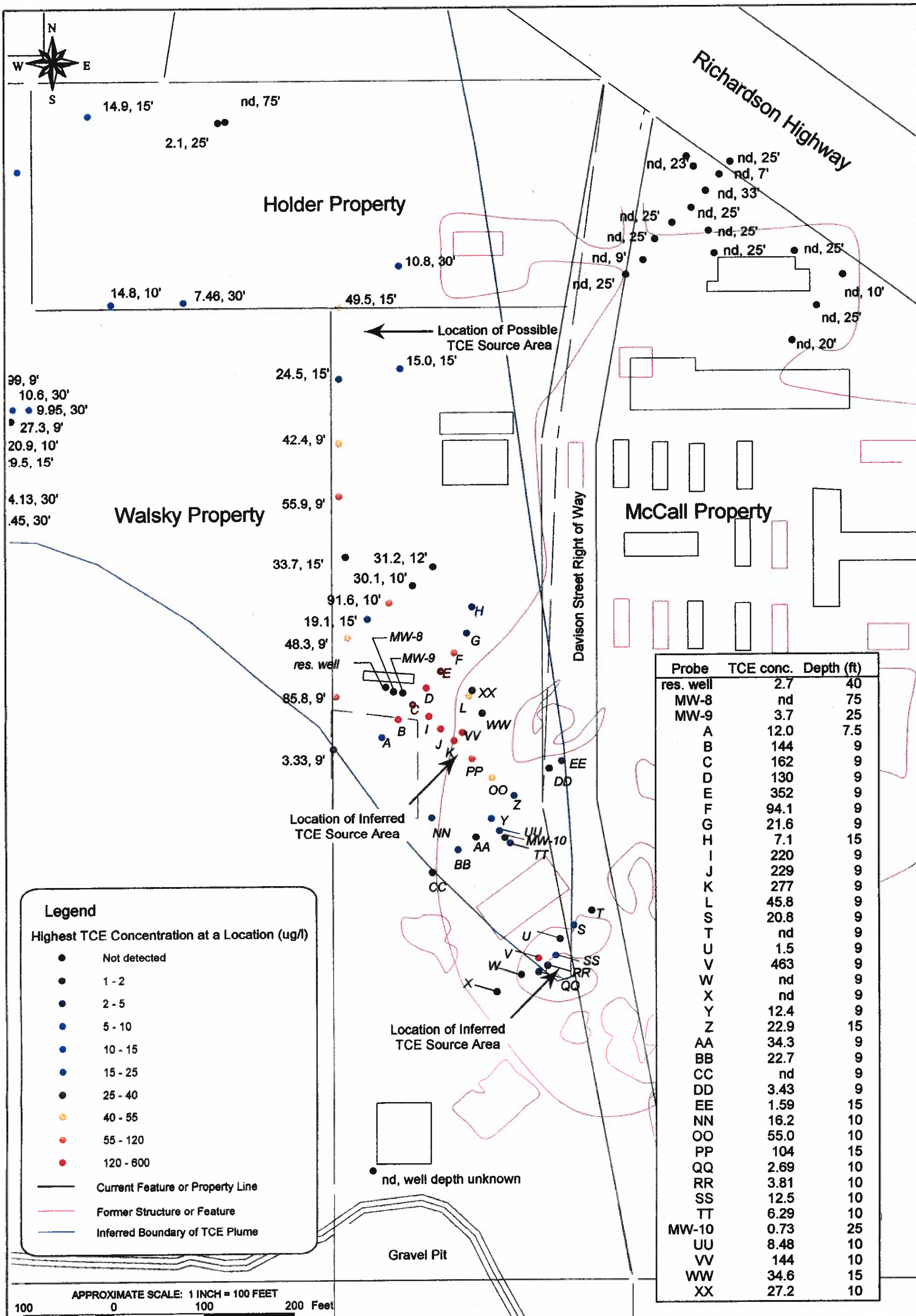


Figure Number	SHANNON & WILSON, INC. GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS	
1	Date: June 18, 1999	Project: X-0928-33
	Drawn: JAK	File: Holder Figure 1
	Checked: DMM	Scale: 1 inch = 100 feet

Project: Location of Soil Gas Collectors and Groundwater Probes

Title: Six-Mile Richardson Highway Site Assessments
Fairbanks, Alaska

REVISION:		
NO.	DATE:	BY:



Probe	TCE conc.	Depth (ft)
res. well	2.7	40
MW-8	nd	75
MW-9	3.7	25
A	12.0	7.5
B	144	9
C	162	9
D	130	9
E	352	9
F	94.1	9
G	21.6	9
H	7.1	15
I	220	9
J	229	9
K	277	9
L	45.8	9
S	20.8	9
T	nd	9
U	1.5	9
V	463	9
W	nd	9
X	nd	9
Y	12.4	9
Z	22.9	15
AA	34.3	9
BB	22.7	9
CC	nd	9
DD	3.43	9
EE	1.59	15
NN	16.2	10
OO	55.0	10
PP	104	15
QQ	2.69	10
RR	3.81	10
SS	12.5	10
TT	6.29	10
MW-10	0.73	25
UU	8.48	10
VV	144	10
WW	34.6	15
XX	27.2	10

Figure Number: 2

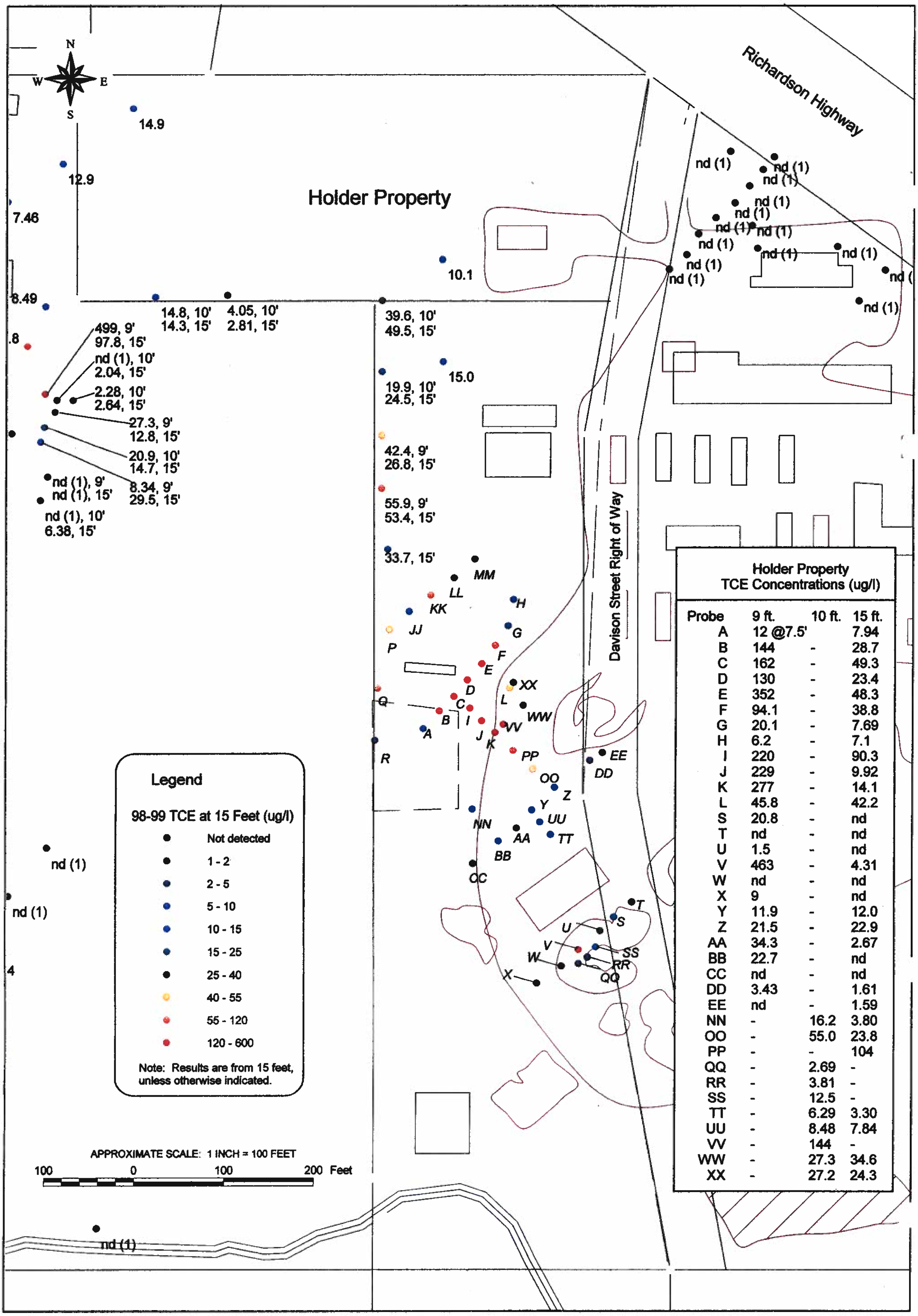
SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Date: June 18, 1999 | Project: X-0926-39
Drawn: JAK | File: Holder Figure 2
Checked: DMM | Scale: 1 inch = 100 feet

Project: Highest TCE Groundwater Concentrations Regardless of Depth

Title: Six-Mile Richardson Highway Site Assessments
Fairbanks, Alaska

REVISION: NO. DATE: BY:



Holder Property TCE Concentrations (ug/l)

Probe	9 ft.	10 ft.	15 ft.
A	12 @7.5'		7.94
B	144	-	28.7
C	162	-	49.3
D	130	-	23.4
E	352	-	48.3
F	94.1	-	38.8
G	20.1	-	7.69
H	6.2	-	7.1
I	220	-	90.3
J	229	-	9.92
K	277	-	14.1
L	45.8	-	42.2
S	20.8	-	nd
T	nd	-	nd
U	1.5	-	nd
V	463	-	4.31
W	nd	-	nd
X	9	-	nd
Y	11.9	-	12.0
Z	21.5	-	22.9
AA	34.3	-	2.67
BB	22.7	-	nd
CC	nd	-	nd
DD	3.43	-	1.61
EE	nd	-	1.59
NN	-	16.2	3.80
OO	-	55.0	23.8
PP	-	-	104
QQ	-	2.69	-
RR	-	3.81	-
SS	-	12.5	-
TT	-	6.29	3.30
UU	-	8.48	7.84
VV	-	144	-
WW	-	27.3	34.6
XX	-	27.2	24.3

Figure Number: 3

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Date: June 18, 1999 | Project: X-0928-33
Drawn: JAK | File: Holder Figure 3
Checked: DMM | Scale: 1 inch = 100 feet

Project: TCE Groundwater Concentrations at 9, 10, and 15 Feet
Title: Six-Mile Richardson Highway Site Assessments
Fairbanks, Alaska

REVISION: NO. | DATE: | BY:

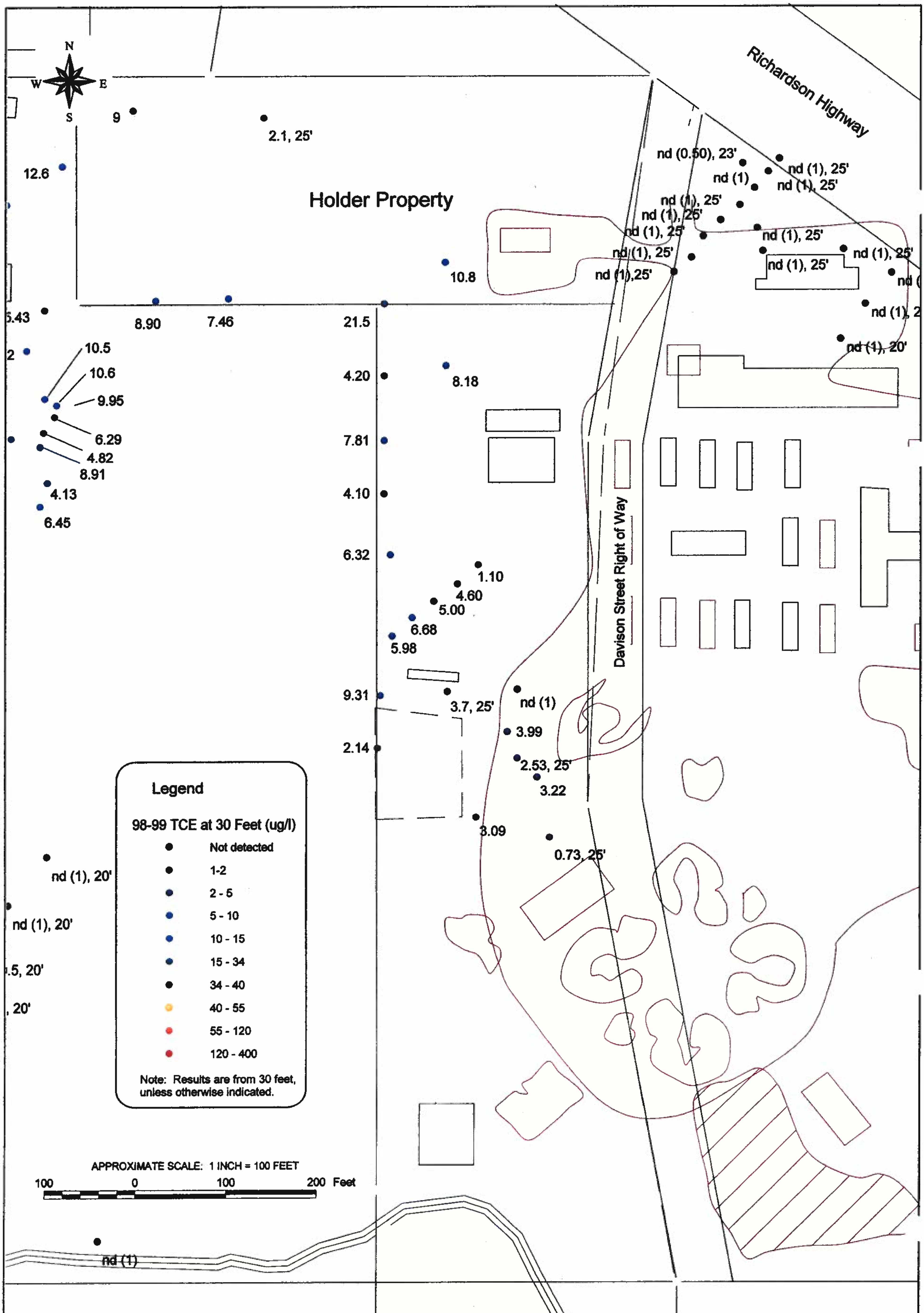


Figure Number: 4	SHANNON & WILSON, INC. GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS	Project: TCE Groundwater Concentrations at 30 Feet
	Date: June 18, 1999 — Project: X-0928-33	Title: Six-Mile Richardson Highway Site Assessments, Fairbanks, Alaska
	Drawn: JAK — File: Holder Figure 4	REVISION: NO. DATE: BY:
	Checked: DMM — Scale: 1 inch = 100 feet	

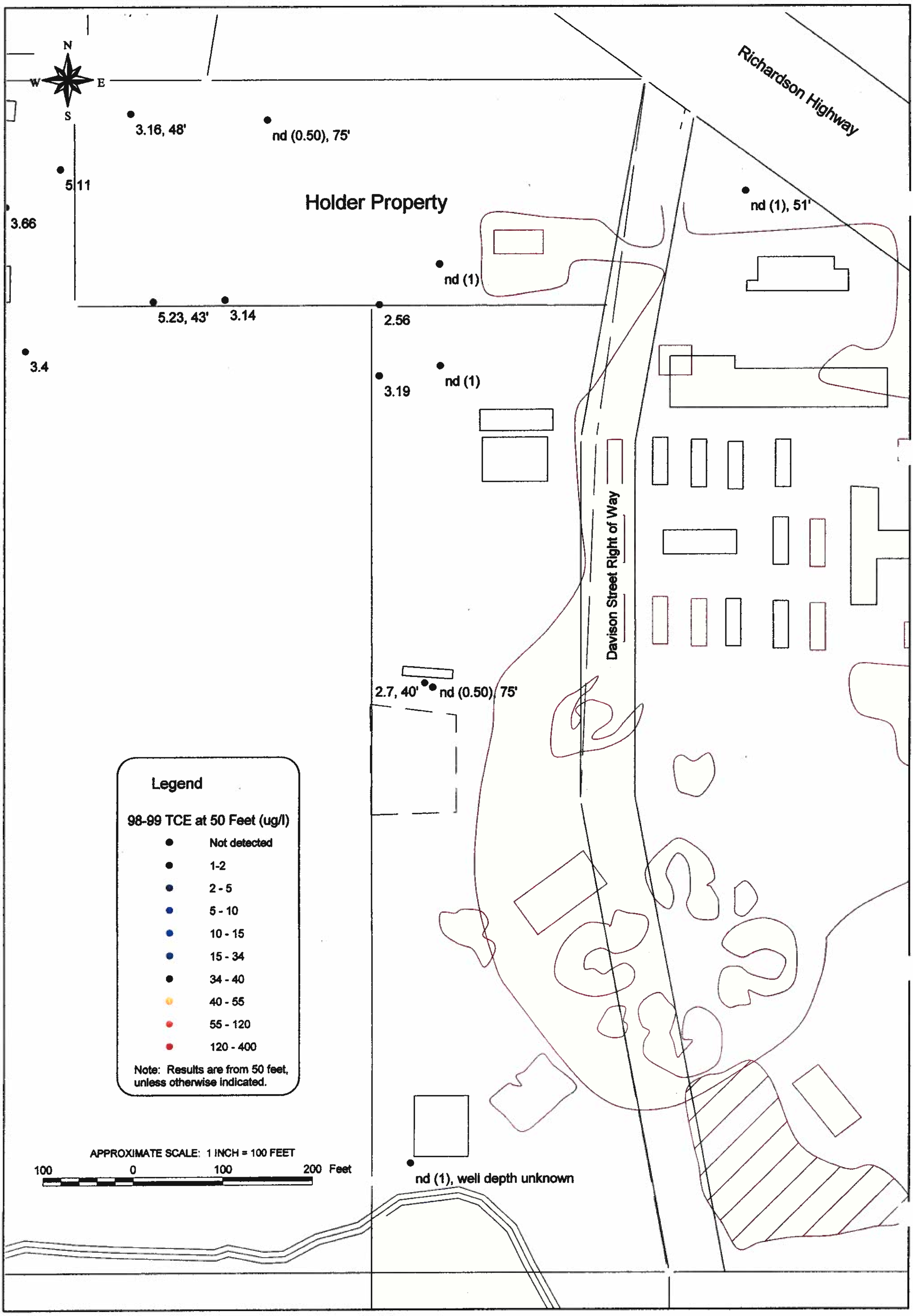


Figure Number: 5

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

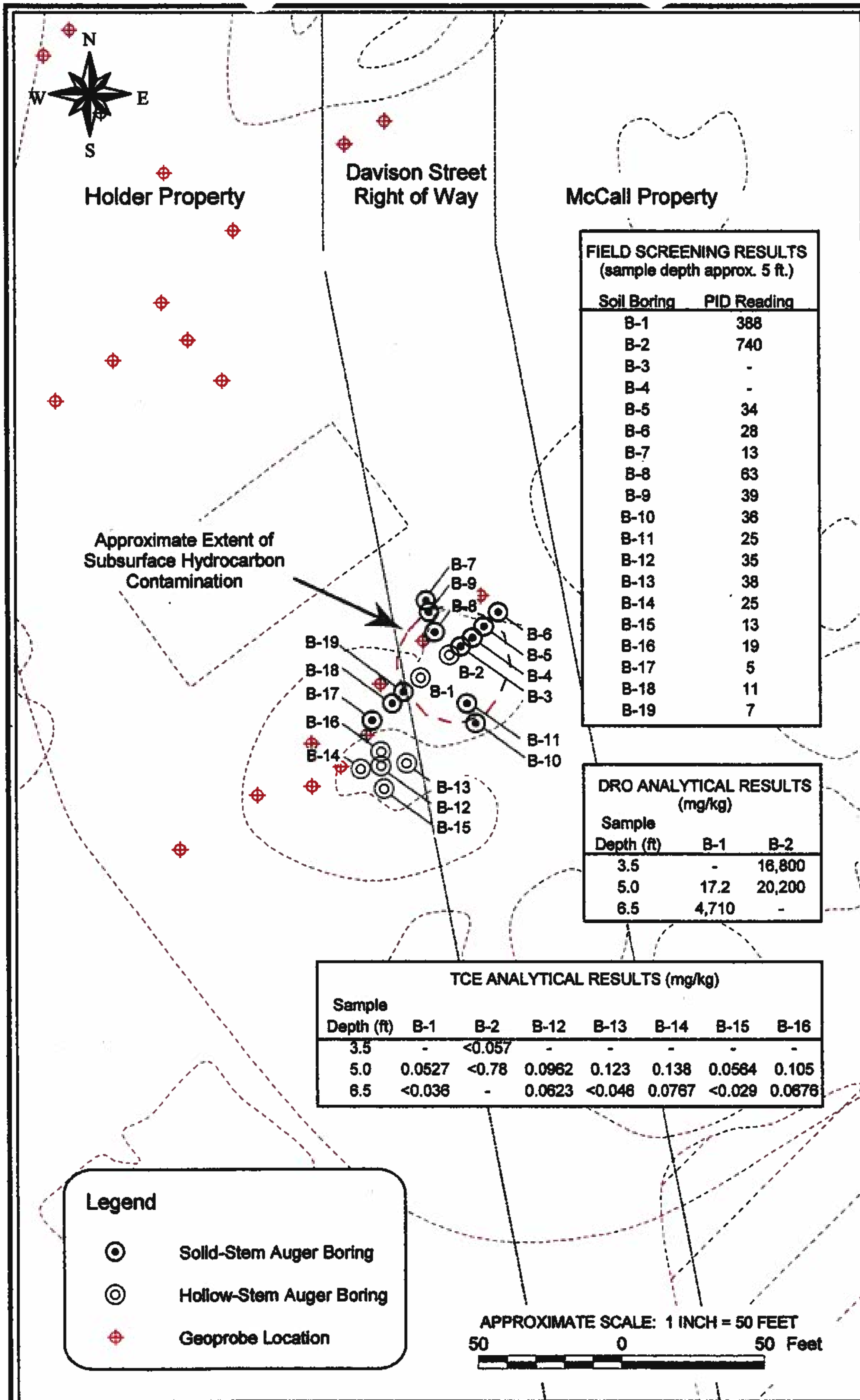
Date: June 18, 1999	Project: X-0928-33
Drawn: JAK	File: Holder Figure 5
Checked: DMM	Scale: 1 inch = 100 feet

Project: TCE Groundwater Concentrations at 50 Feet

Title: Six-Mile Richardson Highway Site Assessments
Fairbanks, Alaska

REVISION:

NO.	DATE:		BY:



FIELD SCREENING RESULTS
(sample depth approx. 5 ft.)

Soil Boring	PID Reading
B-1	388
B-2	740
B-3	-
B-4	-
B-5	34
B-6	28
B-7	13
B-8	63
B-9	39
B-10	36
B-11	25
B-12	35
B-13	38
B-14	25
B-15	13
B-16	19
B-17	5
B-18	11
B-19	7

DRO ANALYTICAL RESULTS
(mg/kg)

Sample Depth (ft)	B-1	B-2
3.5	-	16,800
5.0	17.2	20,200
6.5	4,710	-

TCE ANALYTICAL RESULTS (mg/kg)

Sample Depth (ft)	B-1	B-2	B-12	B-13	B-14	B-15	B-16
3.5	-	<0.057	-	-	-	-	-
5.0	0.0527	<0.78	0.0962	0.123	0.138	0.0564	0.105
6.5	<0.036	-	0.0623	<0.046	0.0767	<0.029	0.0676

TITLE: Field Screening and Analytical Soil Sample Results

PROJECT: Six-Mile Richardson Highway Site Assessments
Fairbanks, Alaska

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

DATE: June 15, 1999
DRAWN BY: JAK
CHECKED BY: DMM

FIGURE NUMBER:
6