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WORK PLANS

1995

Ground Water Remediation Plan

for the

Transwestern Pipeline Company
Compressor Station No. 5
Thoreau, New Mexico

Submitted to:

The Navajo Nation Environmental Protection Administration
and
State of New Mexico Oil Conservation Division

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Executive Summary

This document presents the site background and justification for the proposed remediation of shallow ground water impacted by hydrocarbons at the Transwestern Pipeline Company (TPC) Compressor Station No. 5 (Thoreau Station). TPC is a wholly-owned subsidiary of ENRON Operations Corporation. The objective of the plan is to establish remediation methods and clean-up criteria for certain petroleum hydrocarbon compounds contained-in ground water at the Thoreau Station site. Upon regulatory and landowner approval, TPC will implement the proposed corrective actions.

The Thoreau Station is located approximately 1.5 miles north-northwest of Thoreau, New Mexico. The compressor station is one of a series of compressor stations located along the TPC natural gas pipeline which transports natural gas from producers in West Texas and New Mexico to customers in California. The primary function of the compressor station is to re-compress natural gas in order to "push" the product down the pipeline (westward). The TPC pipeline, including the Thoreau Station, has been in operation since 1960.

The compressor station facility also serves as a location where pipeline liquids, also referred to as condensate, are removed from the pipeline. The pipeline liquids are primarily water and light aliphatic hydrocarbons which are very similar in composition to gasoline. During prior years of operation, pipeline liquids were stored in an unlined earthen impoundment which was located in the southeast corner of the compressor station site. Inadvertently, some of the hydrocarbon liquids and water containing dissolved hydrocarbon compounds migrated from the surface impoundment, downward through the subsurface soil, to a perched ground water table.

In 1989, TPC initiated a subsurface investigation to evaluate the potential release of petroleum hydrocarbon compounds to shallow ground as a result of prior operations of the unlined surface impoundment. This investigation led to the discovery of the BTEX (benzene, toluene, ethylbenzene, and xylenes) plume located downgradient (south) of the former impoundment.

Several subsurface investigations have been completed since the discovery of the BTEX plume. The primary objective of each investigation was to evaluate the quality of ground water downgradient of the former surface impoundment. During the course of these investigations, several soil borings were drilled both on-site and off-site south of the surface impoundment. Twenty-seven of the soil borings were completed as shallow ground water monitor wells. Eleven of the wells are located on-site and sixteen are located off-site. The off-site monitor wells are located on property owned by the Navajo Nation. TPC has proposed to lease approximately fifteen acres of land from the Navajo Nation in order to gain access to the off-site monitor wells. A number of additional investigations have also been completed for the purpose of further characterizing impacts to ground water and obtaining information to assist with development of the remediation plan.

The shallow ground water impacted by BTEX compounds is present in the alluvium, perched on top of the Chinle Formation. The Chinle Formation is the principal bedrock underlying the station, is comprised mostly of red claystones and mudstones, and is roughly 1000 to 1300 feet thick. The saturated thickness of the shallow ground water is approximately 10 to 15 feet over most of the site and is found at a depth of approximately 50 feet to 60 feet below ground surface (bgs) in the vicinity of the Thoreau Station. Results of previous hydraulic testing at the site indicate that the shallow ground water flows south at an average velocity of approximately 34 feet per year. The shallow alluvial perched water zone is a very minor source of water in the area. Only about twenty wells in the Thoreau area are known or suspected to be screened within the alluvium. The nearest of these wells is about two miles south-southeast of the station.

The lateral and vertical distribution of dissolved phase BTEX compounds have been well defined and monitored by a system of twenty-seven ground water monitoring wells completed in the shallow alluvium aquifer. Benzene is the only compound found to exceed a U.S. Safe Drinking Water Act (SDWA) Maximum Contaminant Level (MCL) off-site. Therefore, benzene is the primary constituent of concern. Extensive monitoring of shallow ground water quality indicates that natural processes, in particular the aerobic biodegredation of benzene, are actively attenuating

the concentration of dissolved phase benzene in ground water. The proposed remediation system has been designed to enhance the in-situ aerobic biodegradation process.

Several options were considered for the remediation of ground water at the subject site. Of the options considered, the three most applicable options were considered in greater detail; these three options were: 1) ground water extraction and treatment, 2) in-situ enhancement of anaerobic biodegradation, and 3) in-situ enhancement of aerobic biodegradation. A variation of the third option, in-situ enhancement of aerobic biodegradation by air sparging and soil vapor extraction, has been selected for implementation at the subject site.

The objective of the proposed remediation plan is to reduce the mass of benzene in the vicinity of the impacted area and in the shallow perched ground water immediately downgradient of the impacted area by enhancement of natural biological processes. This will be accomplished by the addition of oxygen via air sparging (air injection) to the subsurface environment. This will be complemented by a soil vapor extraction system which will contain the injected air so that it does not migrate away from the impacted area. The proposed remediation system and natural attenuation processes will be monitored until the concentration of dissolved phase benzene has declined throughout the plume to the proposed cleanup levels. The result would be remediation of the shallow ground water to a level commensurate with the potential risk to human health and the environment and acceptable to the landowners and regulatory agencies involved.

1.0 Introduction

1.1 Scope of the Remediation Plan

This document presents the site background and justification for the proposed remediation of shallow ground water impacted by hydrocarbons at the Transwestern Pipeline Company (TPC) Compressor Station No. 5 (also referred to in this document as the Thoreau Station). TPC is a wholly-owned subsidiary of ENRON Operations Corporation. The plan was prepared at the request of the Navajo Nation Environmental Protection Administration (NNEPA) and the State of New Mexico Oil Conservation Division (NMOCD). The objective of the plan is to establish remediation methods and clean-up criteria for certain petroleum hydrocarbon compounds (i.e. BTEX) contained-in contaminated media (ground water) at the Thoreau Station site. Upon regulatory approval by the NNEPA and the NMOCD, TPC will implement the proposed corrective actions.

1.2 Supporting Documents

Several investigative reports and other related documents have been prepared for the subject site over the course of the last five years. The titles of these supporting documents are as follows:

- "Hydrogeology at the Transwestern Pipeline Compressor Station No. 5, Thoreau, New Mexico, Volume I & Volume II" (DBS&A, February 1990),
- "Ground -Water Assessment Report for Compressor Station No. 5, Thoreau, New Mexico, Volume I & Volume II" (DBS&A, July 26,1991),
- "PCB Investigation, Thoreau Monitor Wells 5-1B and 5-6B" (DBS&A, December 1992),
- "Summary of Hydrogeological Investigations Conducted at the Thoreau Compressor Station, July 1991 Through February 1994" (DBS&A, April 20, 1994),
- "An Archeological Survey of Three Parcels Adjacent to the Thoreau, Leupp, and Klagetoh Compressor Stations" (Office of Contract Archeology, UNM, January 8, 1990),
- "An Archeological Survey of Water Testing Units at the Thoreau Compressor Station at Thoreau, McKinley County, New Mexico for the Transwestern Pipeline Company" (Navajo Nation Archaeology Department, December 1992), and
- "New Source Permit Application; Thoreau Compressor Station, Transwestern Pipeline Company, McKinley County, New Mexico", (CES, March 31, 1994).

This plan was developed with the intent that it would be submitted for review along with copies of each of these documents. This document will reference information presented in the seven previously named reports. Additional information, not included in these reports, will be included and referenced as a figure, table, or appendix to this document.

1.3 Name and Address for Future Correspondence

For all correspondence purposes, the contact, company name, address, and telephone number is as follows:

Mr. Fenley "Ted" Ryther, Jr., P.E.
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Environmental Affairs, Rm. 3AC3137
ENRON Operations Corp.
P.O. Box 1188
Houston, TX 77251-1188
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TPC will notify the NNEPA and the NMOCD in the event the contact name and address information changes.

2.0 Site Background

2.1 Facility Location, Description and Setting

The Thoreau Station is located approximately 1.5 miles north-northwest of Thoreau, New Mexico in McKinley County, as shown on Figure 1.

The address of the subject facility is as follows:

Transwestern Pipeline Company
Compressor Station No. 5
1.5 miles North of Thoreau
Thoreau, New Mexico 87323

The compressor station is one of a series of compressor stations located along the Transwestern Pipeline Company (TPC) natural gas pipeline which transports natural gas from producers in West Texas and New Mexico to customers in California. The primary function of the compressor station is to re-compress natural gas in order to "push" the product down the pipeline (westward). The facility also serves as a location where pipeline liquids, also referred to as condensate, are removed from the pipeline. The TPC pipeline, including the Thoreau Station, has been in operation since 1960. A site map of the compressor station is shown in Figure 2.

The land surface at the station slopes gently to the south and is sparsely vegetated with native grasses, juniper, and piñon pine. The land surface elevation is about 7300 feet above mean sea level (fmsl). The station is located on the north side of a broad east-west trending valley just east of the continental divide. The Zuni Mountains to the south rise to about 9100 feet, and the prominent cliffs of the Owl Rock escarpment define the northern edge of the valley. No well defined surface drainages cross the station. A 7.5 minute USGS topgraphical map is included as Appendix D.

The climate in the vicinity of the Thoreau Station is semi-arid. Mean annual precipitation is about 10 to 12 inches, and gross annual lake evaporation is about 40 inches. Roughly half the precipitation falls in summer months as brief but intense thunderstorms. Snow fall is common during winter; however, the southerly exposure at the station limits the accumulation of snow pack.

2.2 Land Ownership Status

The Thoreau Station is situated on a 40 acre site which is owned in fee by Transwestern Pipeline Company. Property owners adjacent to the station are the Bureau of Land Management and the Navajo Nation as shown in Figure 3.

In order to gain access to sixteen monitor wells that were installed in the area just south of the station site, TPC has proposed to lease approximately fifteen (15) acres of land from the Navajo Nation. The proposed lease area is shown in Figure 4.

2.3 Archeological Surveys

Several archeological surveys and reports have been completed in the area imediately surrounding the site. There are two reports that cover the area of particular interest to the ground water remediation effort. Copies of these reports are submitted along with this document.

The first report of interest was prepared by The Office of Contract Archeology at the University of New Mexico. This report is titled "An Archeological Survey of Three Parcels Adjacent to the Thoreau, Leupp, and Klagetoh Compressor Stations" and dated January 8, 1990. This report identified two archeological sites within the area surveyed. The area surveyed is shown in Figure 5. Archeological clearence was recommended with the stipulation

that sites should be avoided during drilling activities and that an archeological monitor be present during drilling activities.

The second report of interest was prepared by The Navajo Nation Archaeology Department. This report is titled "An Archeological Survey of Water Testing Units at the Thoreau Compressor Station at Thoreau, McKinley County, New Mexico for the Transwestern Pipeline Company" and dated December 1992. This report identified three additional archeological sites within the area surveyed. The area surveyed is shown in Figure 5. Archeological clearence was recommended with the stipulation that sites should be flagged such that all construction activities would avoid the sites by a minimum of 50 ft. from the site boundary.

All proposed construction activities will be conducted within the current Thoreau Station boundary. All off-site ground water monitoring activity will be conducted within the areas cleared by an archaeological survey. An archaeological survey has been completed for most of the proposed lease area with the exception of the most southern 3.7 acres as shown in Figure 5.

2.4 Threatened and Endangered Species Survey

In a letter dated January 18, 1994, TPC requested a "species of concern" report from the Navajo Natural Heritage Program (NNHP). The NNHP responded with a letter dated March 3, 1994 which identified five (5) species known to occur on or near the project site and two (2) species with potential to occur within the area covered by the Thoreau 7.5-minute quad map. The NNHP also expressed a concern for the potential presence of wetlands within the project area.

TPC obtained the services of Ecosphere Environmental Services Inc. (EESI) of Farmington, NM to survey the proposed lease addition for threatened and endangered species and to make a wetlands determination for the area. EESI concluded that "No wetlands and none of the species of concern were found during the field survey of the above described project areas." EESI further concluded that "It is the opinion of EESI that no wetlands or threatened/endangered species exist within or adjacent to the proposed project area." A copy of the EESI report is included in Appendix A.

3.0 Hydrogeology and Ground Water Resources

3.1 Previous Hydrogeological Investigations and Reports

Transwestern Pipeline Company retained the services of Daniel B. Stephens & Associates (DBS&A) in 1989 to conduct the first comprehensive hydrogeological investigation at the Thoreau Station. The objective of the initial investigation was to perform monitoring activities in accordance with a Toxic Substances Control Act (TSCA) Consent Decree between Transwestern Pipeline Company and the U.S. Environmental Protection Agency (USEPA) Region VI. The primary objective of the ground-water portion of the Consent Decree was to evaluate the quality of ground water downgradient of a former surface impoundment (herein referred to as the former waste pit).

The scope of activities reported in this initial DBS&A report included drilling and completion of three deep ground water monitor wells, the drilling of nine shallow soil borings, the completion of six shallow ground water monitor wells, field and laboratory tests for hydrologic properties of the shallow ground water saturated alluvium, and a determination of the potential for polychlorinated biphenyl (PCB) compounds to impact usable ground water. A detailed description of investigation activities can be found in the initial investigation report (DBS&A, 1990).

A *Ground-Water Assessment Report* (GAR) was submitted in July 1991 as required by the Consent Decree with the USEPA Region VI. The scope of activities reported in the GAR included completion of 13 shallow ground water monitor wells, 11 exploratory borings, field and laboratory tests for hydrologic properties characterization, two geophysical surveys, and several special investigations pertaining to ground-water flow and transport. Details regarding these investigations can be found in the GAR (DBS&A, 1991).

A number of additional investigations have been undertaken since the GAR was issued, primarily for the purpose of further characterizing impacts to ground water and obtaining information to assist with development of a remediation plan. The additional activities performed at the site include:

- Abandonment of deep regional test wells,
- An in-situ bioremediation pilot test,
- Installation of additional exploratory borings and monitor wells,
- Ongoing evaluation of water levels, hydraulic gradients, and water quality, and
- Soil vapor extraction pilot tests on several wells.

Each of these activities is summarized in a report titled *Summary of Hydrogeological Investigations Conducted at the Thoreau Compressor Station, July 1991 Through February 1994* and dated April 20, 1994.

The locations of soil borings installed during the various investigations are shown in Figure 6.

3.2 Summary of Site Hydrogeology

The following is a brief summary of site hyrogeology. A more detailed description of site hydrogeology is presented within the previously described reports.

The Chinle Formation is the principal bedrock underlying the station. The Chinle Formation is comprised mostly of red claystones and mudstones and is roughly 1000 to 1300 feet thick. The upper part of the Chinle Formation has been eroded so that its surface generally slopes southward and nearly opposite to the dip of the formation. The Chinle Formation is overlain by 30 to more than 75 feet of alluvium over most of the station and surrounding area.

The alluvium consists of reddish brown, silty sand that is fine- to very fine-grained, moderately to well sorted, with thin silty interbeds. Approximately 1 to 5 feet of weathered, sandy clay mark the transition between the surficial alluvium and underlying Chinle Formation.

Perched ground water is present in the alluvium on top of the Chinle Formation. The perched zone is approximately 10 to 15 feet thick over most of the site, with the thickness increasing locally due to the presence of

paleochannels that eroded the top of the Chinle Formation. The depth to perched ground water is approximately 45 to 50 feet below ground surface (bgs) at the southern part of the Thoreau Station and increases to the south to approximately 65 feet bgs at monitor well 5-58B. The locations of two subsurface cross-sections drawn through the area of interest is shown in Figure 7. The East-West cross-section A-A' is shown in Figure 8 and the North-South cross-section B-B' is shown in Figure 9.

Results of previous hydraulic testing at the site indicate that the perched ground water has an average hydraulic conductivity of approximately 10^{-4} centimeters per second (cm/sec). The average hydraulic gradient at the site is approximately 0.04 feet per foot (ft/ft) to the south. A ground water elevation map is shown in Figure 10. Assuming an effective porosity of 0.12, ground water flows at an average velocity of approximately 3.3×10^{-5} cm/sec or 34 feet per year.

3.3 Local Ground Water Use

The following is a brief summary of local ground water use. A more detailed discussion of ground water use is presented in the 1990 DBS&A report.

Hydrogeologic data were compiled from wells in the vicinity of the site. The inventory was based mostly on data in the files of the New Mexico State Engineer, US Geological Survey, and tabulations in private consulting reports. Well construction information, water depths, water quality indices and water use data are summarized in the 1990 DBS&A report for about 100 wells located within about 10 miles of the compressor station.

Ground water use in the vicinity of the Thoreau Station is primarily from three sources: the shallow alluvial perched water zone above the Chinle Formation, the Sonsela sandstone, and the San Andres-Glorieta aquifer.

The shallow alluvial perched water zone is a very minor source of water in the area. Only about twenty (20) wells in the Thoreau area are known or suspected to be screened within the alluvium. These wells are typically used for domestic purposes. The nearest of these wells is about two miles south-southeast of the station.

The Sonsela sandstone is a middle member of the Chinle Formation. As previously described, the Chinle Formation is the principal bedrock underlying the station, comprised mostly of red claystones and mudstones, and is roughly 1000 to 1300 feet thick. The Sonsela sandstone is approximately 90 to 130 feet thick at a depth of approximately 650 feet below the station. It is used mostly for individual domestic water supplies, stock watering, and industry. There are three on-site ground water production wells which are all completed in the Sonsela aquifer. These wells supply water mostly for domestic and industrial use on-site.

The San Andreas-Glorieta aquifer is a principle aquifer in the region and is used for small scale irrigation, industrial water supply, and domestic water supply. The depth to the San Andreas-Glorieta aquifer is approximately 1200 feet at the station site. The village of Thoreau, population about 950, is served mostly by water from this aquifer. The nearest off-site ground water well is completed in the San Andres-Glorieta aquifer. This well is located approximately 0.5 miles south of the Thoreau Station at the Thoreau High School. There are actually two ground water production wells at this location.

4.0 Source and Distribution of Hydrocarbons in Ground Water

4.1 Source of Dissolved Phase BTEX Compounds

As previously described, the facility collected pipeline liquids (also referred to as condensate) from the pipeline. The pipeline liquids are primarily water and light aliphatic hydrocarbons which are very similar in composition to gasoline. Aromatic hydrocarbons are also present but comprise a relatively small fraction of the condensate liquid. Currently, pipeline liquids which are removed from the pipeline at the Thoreau Station are stored in an aboveground storage tank. Accumulated liquids are periodically removed by tank truck for off-site disposal. During prior years of operation, pipeline liquids were stored in an unlined earthen impoundment which was located in the southeast corner of the site as indicated in Figure 2 as the "Former Waste Pit Area". Inadvertently, some of the hydrocarbon liquids and water containing dissolved hydrocarbon compounds migrated from the surface impoundment, downward through the alluvium, to the perched ground water table. The former liquid waste impoundment was in service from the early 1960's through the mid 1980's.

In 1985, Transwestern Pipeline Company discovered that compressor lubrication oil containing polychlorinated biphenyls (PCBs) had entered the pipeline at the TPC Compressor Station No. 8. Station No. 8 is located near Corona, New Mexico. This occurred when PCB containing lubrication oil was used in a turbine compressor which was installed at the Corona Station in 1967. The use of PCB containing lubrication oil was discontinued in 1972. As a result of prior pipeline liquid handling operations, small quantities of PCBs were present in the soil at several TPC compressor station sites, including soil in the vicinity of the former waste pit at the Thoreau Station site. TPC subsequently entered into a Toxic Substances Control Act (TSCA) Consent Decree with the U.S. Environmental Protection Agency (EPA) Region VI. During June 1990, impacted soil in the vicinity of the surface impoundment was excavated and removed for off-site disposal at a permitted TSCA landfill facility in accordance with the Consent Decree. Also in accordance with the Consent Decree, TPC evaluated shallow ground water in the vicinity of the site for potential impact from PCB compounds. This investigation led to the discovery of the BTEX (benzene, toluene, ethylbenzene, and xylenes) plume located downgradient (south) of the former impoundment.

The former surface impoundment was the primary source of hydrocarbon compounds found in the shallow ground water south of the station site. The potential residual source in this area was removed to a depth of approximately 42 feet below ground surface during the excavation activities associated with the PCB clean-up. The area immediately around the pipeline pig reciever, located just south of the surface impoundment, was also a potential source of hydrocarbon compounds found in the shallow ground water. However, subsurface investigation of this area did not indicate any significant residual source remaining.

Phase separated hydrocarbon (PSH) has been found in only two soil borings or monitor wells at the site. A very small quantity was collected during the bioremediation pilot test in the ground water extraction well (5-36E) after the well had been pumped continuously for several months. A small quantity was also just recently detected in monitor well 5-34B during a December 1994 check of water levels in on-site monitor wells. This is possibly a result of PSH collecting in the well screen subsequent to a soil vapor extraction (SVE) pilot test conducted in November 1993.

4.2 Source of Dissolved Phase PCB Compounds

As previously described, the former surface impoundment was the primary source of hydrocarbon compounds found in the shallow ground water south of the station site. However, this is most likely not the source of PCB compounds detected in shallow ground water on-site. PCB compounds have been detected in only two monitor wells, 5-1B and 5-6B. PCB compounds present in these two wells are most likely a result of poor monitor well installation practices which allowed PCB compounds contained in surface soil at low concentrations to be carried down to the screened interval. The rational for this argument is based on the following points:

1. No other monitor well, not even those closer to the former surface impoundment have indicated the presence of PCB compounds,

2. There was no other significant source of PCB compounds near monitor wells 5-1B and 5-6B, although low concentrations were present in the near surface soils along a natural storm water runoff area just north of monitor wells 5-1B and 5-6B,
3. PCB compounds are relatively immobile in the subsurface and are not likely to have migrated the distance from the former surface impoundment to monitor wells 5-1B and 5-6B, and
4. In order for PCB compounds to have migrated to monitor wells 5-1B and 5-6B they would have required a carrier (i.e. condensate liquid), yet BTEX compounds are not found at elevated concentrations in either ground water samples or in soil samples collected from the 5-1B and 5-6B soil borings.

As a result of extensive investigation into this issue, TPC concludes that PCB compounds are not present in shallow ground water at the site and therefore remediation of shallow ground water in the vicinity of monitor wells 5-1B and 5-6B is not necessary.

4.3 Monitoring Network for the Shallow Perched Ground Water

Water quality of the shallow perched ground water is monitored by a network of twenty-seven (27) monitor wells. Eleven (11) of the wells are located on-site and sixteen (16) are located off-site. The location of the monitor wells in relation to the site and the former surface impoundment is shown in Figure 11.

The function of each monitor well can generally be grouped into one of four categories:

1. Upgradient "clean wells" which define background water quality,
2. Perimeter and/or downgradient "clean wells" which define the furthest potential extent of impacted ground water,
3. Interior "impacted wells" which monitor ground water quality of impacted ground water, and
4. Additional pilot test area wells.

Of the twenty-seven (27) monitor wells, one (1) is an upgradient "clean well", seven (7) are perimeter "clean wells", three (3) are additional pilot test area wells, and the remaining sixteen (16) are interior "impacted wells". The category associated with each monitor well is shown in Table 9 which is located in Section 8.4 of this document.

The most recent sampling schedule included sampling twenty-four (24) of the monitor wells annually during an October sampling event; thirteen (13) of these wells were also sampled during an April sampling event. The thirteen wells sampled during both events are located along the downgradient axis of the plume. Ground water at all locations is monitored for general water quality parameters during sampling (i.e. pH, conductivity, DO, etc.). Collected samples are delivered to a qualified laboratory for analysis by EPA Method 8020 for benzene, toluene, ethyl-benzene, and total xylenes (BTEX) concentrations. Samples from three monitor wells, 5-1B, 5-6B, and 5-17B are also analyzed by EPA Method 8080 for PCB concentrations.

A history of ground water sample analysis is included in the DBS&A April 1994 report. The earliest sampling event reported is May 1989. The most recent sampling event was completed in April 1993. A total of twenty-seven (27) ground water sampling events have occurred during this time frame, although, not all monitoring locations existed or were sampled during each event. The October 1993, April 1994, and October 1994 sampling events have been postponed until access to the off-site monitor wells is granted by the Navajo Nation.

4.4 Distribution of Dissolved Phase Hydrocarbons

4.4.1 Lateral Distribution of BTEX Compounds

The lateral distribution of dissolved phase BTEX compounds is shown in Figures 12 thru 15. Concentrations that exceed Safe Drinking Water Act Maximum Contaminent Levels (MCLs) are shown in bold. A summary of the maximum concentration measured, during the most recent sampling event, of each BTEX compound is shown in Tables 1 and 2. It is apparent from the information presented in Figures 12 thru 15, that the lateral distribution of dissolved phase BTEX compounds has been well defined. It is also apparent that benzene is the only compound that exceeds an MCL off-site and therefore is the primary constituent of concern.

Table 1. Constituents in Ground Water in All Monitor Wells, On-site and Off-site

Constituent	Frequency of Detection	Range of Sample Quantitation Limits (µg/L)	Range of Detected Concentrations (µg/L)	Range of Geometric Mean Concentrations (µg/L)
Benzene	13/24	0.5 to 12.5	1.0 to 360	0.5 to 615.5
Ethylbenzene	10/24	0.5 to 12.5	0.5 to 130	0.5 to 130
Toluene	4/24	0.5 to 12.5	8.7 to 1400	0.5 to 1400
Xylene (total)	14/24	0.5 to 25.0	1.4 to 1700	0.5 to 1700
Aroclors-1016	0/3	0.5 to 5.0	--	--
Aroclors-1221	2/3	0.5 to 5.0	82 to 280	0.5 to 180.5
Aroclors-1242	0/3	0.5 to 5.0	--	--
Aroclors-1248	0/3	0.5 to 5.0	--	--
Aroclors-1254	0/3	0.5 to 5.0	--	--

Notes:
-- = None detected
Frequency, sample quantitation limits, and detected concentration ranges are based on the most recent sampling event for each monitoring location.
Range of geometric mean concentrations are based on the last three sampling events and analysis for each constituent. Missing values were not used in the calculation. The SQL was used for non-detect values. A table of concentration values used in each calculation is included in Appendix C.
All analyses performed using EPA method 8020 (for BTEX) and EPA method 8080 (for PCBs).

Table 2. Constituents in Ground Water in Off-site Monitor Wells

Constituent	Frequency of Detection	Range of Sample Quantitation Limits (µg/L)	Range of Detected Concentrations (µg/L)	Range of Geometric Mean Concentrations (µg/L)
Benzene	8/16	0.5 to 12.5	1.4 to 360	0.5 to 615.5
Ethylbenzene	6/16	0.5 to 12.5	0.5 to 34	0.5 to 53.4
Toluene	2/16	0.5 to 12.5	8.7 to 390	0.5 to 655.0
Xylene (total)	8/16	0.5 to 12.5	1.4 to 360	0.5 to 549.9
Aroclors-1016	0/1	0.5	--	--
Aroclors-1221	0/1	0.5	--	--
Aroclors-1242	0/1	0.5	--	--
Aroclors-1248	0/1	0.5	--	--
Aroclors-1254	0/1	0.5	--	--

Notes:
-- = None detected
Frequency, sample quantitation limits, and detected concentration ranges are based on the most recent sampling event for each monitoring location.
Range of geometric mean concentrations are based on the last three sampling events and analysis for each constituent. Missing values were not used in the calculation. The SQL was used for non-detect values. A table of concentration values used in each calculation is included in Appendix C.
All analyses performed using EPA method 8020 (for BTEX) and EPA method 8080 (for PCBs).

4.4.2 Lateral Distribution of PCB Compounds

The lateral distribution of dissolved phase PCB compounds detected in ground water is shown in Figure 16. A summary of the maximum concentration measured during the most recent sampling event is shown in Tables 1 and 2. It is apparent from the information presented in Figure 14 that PCB compounds have not been detected in ground water off-site.

The potential for the lateral spread of ground-water contamination due to PCBs is very low at the Thoreau Station. Factors contributing to the low potential include the low hydraulic conductivity of the alluvium, high sorption capacity of the saturated media, and the absence of a true source of PCBs (this is discussed in section 4.2).

4.4.3 Vertical Distribution of Dissolved Phase Hydrocarbons

The vertical spread of contamination is very limited due to the low vertical permeability of the Chinle shale. Samples of ground water collected from the three TPC production wells and three deep monitor wells at the station showed no detection of any organic compounds, at least not with initial sampling events. Subsequent sampling events of two of the three deep monitor wells did indicate the presence of BTEX compounds; however, this was attributed to migration of contaminated water down the borehole. The deep monitor wells were abandoned in order to eliminate a potential migration pathway to the Sonsela aquifer.

4.5 Natural Attenuation of Dissolved Phase Hydrocarbons

An evaluation of the concentration history of BTEX compounds in ground water, at each of the impacted monitor wells, indicates that natural attenuation of the dissolved phase hydorcarbons is occuring. This is illustrated with concentration history plots for benzene at monitor wells 5-2B, 5-16B, 5-18B and 5-24B (Figures 17 through 20). Natural attenuation is due to a combination of processes: dilution, dispersion, and both biotic and abiotic natural degradation. The evidence for natural attenuation is further supported by the distribution of dissolved oxygen (DO) in ground water as shown in Figure 21. Measurements indicate that DO is at or near saturated concentrations in the upgradient well and in perimeter "clean wells", whereas DO concentrations within the perimeter of the plume are near zero. Furthermore, as determined during a soil vapor extraction (SVE) pilot test, the oxygen concentration in soil vapor is much lower within the impacted area than away from the impacted area. The most prominent attenuation process responsible for these observations is presummable aerobic biodegradation of hydrocarbon compounds.

5.0 Regulatory Background

5.1 Regulatory Status of Normal Facility Operations

The facility is operated in accordance with the regulations established by the State of New Mexico Oil Conservation Division (NMOCD) and the State of New Mexico Environment Department (NMED). The facility maintains a "Discharge Plan" in accordance with requirements of the NMOCD. The facility operates as a "large quantity generator" of hazardous waste in accordance with NMED requirements. The facility also pays air emission fees to the NMED Air Pollution Control Bureau.

5.2 Regulatory Status of Prior Remediation Activities

Prior remediation activities have been regulated by the NMOCD and the USEPA Region VI. In May 1990, a TSCA Consent Decree was entered into between TPC and the USEPA for remediation of PCB contaminated soil at the Thoreau Station. Subsequent remediation activities, during June 1990, included the excavation and disposal of PCB impacted soil. The Consent Decree was terminated in March 1993.

5.3 Regulatory Status of Future Remediation Activities

Remediation activities associated with the subject BTEX plume are regulated by the NMOCD and the Navajo Nation Environmental Protection Administration (NNEPA). Dual jurisdiction is required because ground water has been impacted beneath both private land and tribal trust land. Furthermore, the NNEPA is involved as a representative of the landowner (The Navajo Nation) of adjacent property beneath which ground water has been impacted.

The NMED Air Pollution Control Bureau has required a new source permit application for potential air emissions from remediation activities. A permit application was submitted to the NMED on March 31, 1994 and a permit was issued on July 25, 1994. A copy of the permit is attached as Appendix B.

5.4 Chronology of Significant Events

A chronology of significant events is as follows:

1. Jun '59 Station site is leased from the BLM and subsequently purchased in fee in March 1962,
2. Sep '60 Compressor station is placed in-service,
3. Dec '72 Discontinued use of lube oil containing PCBs in a turbine compressor located at an upstream compressor station,
4. Nov '84 Transwestern Pipeline Company (TPC) is purchased from Texas Eastern Corp. by Houston Natural Gas (HNG); at the time, HNG also owned Houston Pipeline Company (HPL) and Florida Gas Transmission (FGT),
5. Jun '85 HNG merged with Internorth, owner of Northern Natural Gas (NNG), to form HNG-Internorth which subsequently became ENRON Corp.,
6. Oct '85 Initial soil sampling for PCBs,
7. Feb '90 Interim ground water assessment report completed,
8. May '90 TSCA Consent Decree is entered,
9. Aug '90 Initiated removal of 17,649 tons of PCB impacted soil from the former unlined surface impoundment area and disposed of at a permitted TSCA landfill,
10. Jan '91 Completed removal of PCB impacted soil from the former unlined surface impoundment area,
11. May '91 Completed installation of liner (170 ft. × 140 ft. × 50 mil HDPE) and cap over former pit area,
12. Jul '91 Final ground water assessment report (GAR) completed,
13. Dec '92 Completed a pilot test to evaluate nitrate enhanced bioremediation of ground water,
14. Mar '93 TSCA Consent Decree is terminated,
15. Apr '93 Investigation of perched ground water is completed,

16. Sep '93 TPC representatives met with the NNEPA to discuss the status of the ground water investigations and the conceptual remediation plan,
17. Oct '93 TPC representatives met with the NMOCD to discuss the status of the ground water investigations and the conceptual remediation plan,
18. Nov '93 TPC completes a soil vapor extraction pilot test to evaluate potential air emissions prior to design of a ground water remediation system,
19. Dec '93 TPC representatives met with the USEPA (Region IX) to discuss the status of the ground water investigations and the conceptual remediation plan,
20. Jan '94 Navajo Nation Water Resources Management issues TPC sixteen (16) water use permits and sixteen (16) water well drilling permits for the off-site wells,
21. Jan '94 TPC submits a written request to the Navajo Natural Heritage Program for a "species of concern" statement for the area within the proposed lease area,
22. Mar '94 The Navajo Natural Heritage Program responds with a "species of concern" statement requiring a wetlands determination and a threatened and endangered species survey,
23. April '94 A wetlands determination and a threatened and endangered species survey is completed for the proposed lease area,
24. Feb '94 TPC representatives met with the NMED Air Pollution Control Bureau to discuss potential air emissions resulting from the proposed remediation system,
25. Mar '94 TPC submits an air permit application to the Air Pollution Control Bureau of the NMED, and
26. Jul '94 NMED issues an air permit for the proposed remediation system.

6.0 Corrective Action Options

6.1 Options Considered

Several options were considered for the remediation of ground water at the subject site. Of the options considered, the three most applicable options were considered in greater detail; these three options were: 1) ground water extraction and treatment, 2) in-situ enhancement of anaerobic biodegradation, and 3) in-situ enhancement of aerobic biodegradation. A variation of the third option, in-situ enhancement of aerobic biodegradation by air sparging and soil vapor extraction, has been selected for implementation at the subject site. A brief discussion of each of the three options considered follows.

6.2 Ground Water Extraction and Treatment

Ground water extraction and subsequent treatment, also referred to as pump-and-treat, has been a commonly employed method for containing and remediating ground water impacted by hydrocarbon compounds. However, it is well documented that pump-and-treat technology has had limited success when used as a sole remediation method. This is particularly true when hydrogeologic conditions limit the volume of ground water which can extracted. The Thoreau Station site falls into this category; during the nitrate enhanced biodegradation pilot test the maximum sustainable extraction rate was just 0.36 gallons per minute. Therefore, due to hydrogeologic conditions at the site and due to the problems associated with disposal of treated water, this technology was not selected as a remediation strategy for this site.

6.3 In-Situ Enhancement of Anaerobic Biodegradation

A pilot test was conducted on-site to determine the feasibility of using nitrate as an oxidant to enhance anaerobic biodegradation of hydrocarbons. The pilot test was carried out by ENRON's consultant, Daniel B. Stephens & Associated of Albuquerque, New Mexico. Subsequent to the pilot test, DBS&A prepared a technical paper describing the results of the pilot test for presentation at the National Ground Water Association's 1992 Petroleum Hydrocarbons and Organic Chemicals in Ground Water Conference. A copy of the paper is included in Appendix B of the DBS&A summary report dated April 1994.

Nitrate enhanced biodegradation was selected for consideration at the site because moderate to low permeabilities limited the feasibility of using traditional pump-and-treat remediation methods. It was presumed that the addition of nitrate to ground water would provide significantly more oxidizing potential compared to oxygen due to the greater solubility of nitrate and thereby enhancing the in-situ removal of hydrocarbons.

Between May 1992 and October 1992, a recirculating injection/extraction system was used to introduce potassium nitrate into the aquifer. The injection well was installed 15 feet upgradient of the extraction well, with a monitoring well placed halfway between the two. Potassium nitrate, sodium bromide, and monosodium phosphate were injected into the recirculating ground water via an automatic metering pump. Field measurements of nitrate and bromide in the monitoring and extraction wells were made with ion selective electrodes, and water samples were sent to an analytical laboratory to verify the field measurements and to determine the concentrations of BTEX (benzene, toluene, ethylbenzene, and total xylene) compounds and total petroleum hydrocarbons (TPH).

Toluene, ethylbenzene, and total xylene concentrations decreased during the pilot test period, but no reduction in benzene was observed. The presence of nitrite, along with the observed reduction in dissolved hydrocarbon concentrations, indicated that denitrification was occurring. Although the concentration of benzene was not reduced, an argument could still be made to employ a phased remediation approach beginning with nitrate enhanced biodegradation to reduce the concentrations of degradable compounds followed by a system designed to enhance aerobic biodegradation. However, due to the concern for containing injected nitrate (nitrate at elevated levels is also considered a ground water contaminant), the fact that the benzene (the primary compound of concern) concentration was not reduced, and the strong evidence that natural aerobic biodegradation is occuring

throughout the contaminant plume, nitrate enhanced biodegradation was not selected as a remediation strategy for this site.

6.4 In-Situ Enhancement of Aerobic Biodegradation

In-situ enhancement of aerobic biodegradation may be accomplished in a number of ways. Three commonly employed methods include: 1) direct injection of oxygen as a component of air below the water table (i.e. air sparging); 2) replacement of oxygen depleted soil vapor with oxygen rich soil vapor in the unsaturated zone above the water table (i.e. soil vapor extraction); and 3) extraction of oxygen depleted ground water and replacement with oxygen rich water (i.e. addition of either O_2 or H_2O_2). The third method listed was not considered further due to the limitations and concerns discussed in section 6.2.

The first two methods listed, air sparging and soil vapor extraction (SVE), are commonly employed together as a system. In this arrangement, the primary objective of air sparging is to increase the concentration of dissolved oxygen in ground water thereby enhancing aerobic biodegradation of dissolved phase hydrocarbon compounds; and the primary objective of SVE is to control the potential migration of volatile organic compounds away from the impacted area and to enhance the aerobic biodegradation of hydrocarbon compounds trapped above the ground water table. It is this type of system that is proposed for remediation of ground water at the subject site.

The air sparging process involves the injection of air under pressure at an air sparge well screened below the water table. The air migrates upward through the soil column creating air filled channels in the saturated zone. As a result, sparged air increases the oxygen concentration in both the saturated and unsaturated zones, which enhances aerobic biodegradation. Furthermore, volatile organic compounds (VOCs) that are exposed to this sparged air environment volatilize into the gas phase and are carried into the vadose zone where they may be biodegraded or removed by soil vapor extraction. Air sparging combined with soil vapor extraction, provides the following benefits:

- Removes VOCs in the saturated and capillary fringe zones where the mass is greatest;
- Enhances aerobic biodegradation of VOCs due to an increase in dissolved oxygen levels;
- Reduces clean-up times and cost savings over pump and treat and/or SVE alone;
- Minimizes ground water extraction and associated treatment and disposal costs;
- Removes any potential source of continuing dissolved phase contamination in the ground water; and
- Reduces the mass of potential dissolved phase contaminants.

In-situ enhancement of aerobic biodegradation by air sparging and SVE was selected for implementation at the Thoreau Station site primarily for two reasons: First, aerobic biodegradation has already been proven effective at the site for the removal of benzene; and Second, this system can be implemented with the least disturbance to the adjacent property owned by the Navajo Nation.

7.0 Corrective Action Plan

7.1 General Approach

The objective of this remediation plan is to reduce the mass of benzene in the vicinity of the impacted area and in the shallow perched ground water immediately downgradient of the impacted area by enhancement of natural biological processes. This will be accomplished by the addition of oxygen (via air injection) to the subsurface environment. The proposed remediation system and natural attenuation processes will be monitored until the concentration of dissolved phase benzene has declined throughout the plume to the proposed cleanup level specified in Section 10 of this document. The result would be remediation of the shallow ground water to a level commensurate with the potential risk to human health and the environment and acceptable to the landowners and regulatory agencies involved.

In order to achieve this objective, a three phase remediation plan has been developed. A three phase approach was developed in order to limit the volatile organic compound emission rate from soil vapor extraction and to allow opportunities to optimize system components between phases.

7.2 Phase I - Limited Soil Vapor Extraction

7.2.1 System Objective and Description

The primary objective of the Phase I system is to remove a limited volume of soil vapor to reduce the concentration of volatile organic compounds (VOC) from within the area of most significant impact prior to initiation of air injection. This will be accomplished by extracting soil vapor from a single SVE well at a rate of 20-25 cfm (Figure 22). The purpose of the limited vapor extraction rate is to maintain the VOC emission rate below which emission control equipment is required. Typically, the VOC emissions from an SVE system are greatest at the start-up of the system and drop off rapidly to a much lower sustained rate. Therefore, rather than control VOC emissions with emission control equipment for such a short duration, the Phase I system will maintain a low emission rate from a single SVE well for a longer duration. Once the concentration of VOCs have declined to lower levels, the Phase II system will start-up without limitations imposed by VOC emission rates.

The estimated duration of Phase I is based on the time required to remove five (5) pore volumes of soil gas from within a radius of 60 feet from the extraction well. Therefore,

where, h = thickness of vadose zone;
r = radius of influence; and
ϕ = effective porosity of vadose zone.

The duration for one pore volume $= h \times \pi \times r^2 \times \phi / \text{rate}$
$= 50 \text{ ft} \times \pi \times (75 \text{ ft})^2 \times 0.35 / (22.5 \text{ ft}^3/\text{min} \times 60 \text{ min/hr} \times 24 \text{ hr/day})$
$= 6.1 \text{ days}$

Therefore, the duration of Phase I is estimated at 30 days (5 pore volumes × 6.1 days/pore volume). After 30 days of operation, the Phase II system is scheduled to start-up.

7.2.2 Soil Vapor Extraction Point

Monitor well 5-34B will be utilized as an extraction well during Phase I. This location was selected because it is centrally located within the area of most significant impact (Figure 22). It was determined during an SVE pilot test that a sustainable extraction rate of approximately 21 cfm could be maintained from well 5-34B at a vacuum of 6" of H_2O. In the event the SVE equipment is not capable of limiting the vapor extraction rate from monitor well 5-34B to less than 25 cfm, then monitor well 5-35B will be used as the extraction well during Phase I. It was

determined during the SVE pilot test that a sustainable extraction rate of approximately 22 cfm could be maintained from well 5-35B at a vacuum of 27″ of H_2O.

7.2.3 SVE Equipment

The surface equipment associated with the vapor extraction system will consist of the following:

- 1 - Regenerative blower with 1/2 Hp XP motor;
- 1 - Vapor filter assembly;
- 1 - Water knockout assembly;
- 2 - Vacuum gauges
- 1 - Vapor flowmeter, 5-50 cfm range; and
- 2 - Orifice plate flanges and multiple size orifice plates.

These items will be skid mounted for easy portability. The purpose of the orifice plate is to limit the vapor extraction rate, and likewise the "potential emission rate", of the equipment to less than 25 cfm. The orifice plate, if necessary, will be located between the extraction well and the SVE blower. Due to the short duration of Phase I, the equipment skid will may be placed directly on the ground surface and located adjacent to the extraction well. However, TPC does plan to install a small metal building to house the Phase II and III equipment; if a building is in place prior to the Phase I start-up, then the Phase I epuipment will also be placed within the building.

The surface equipment associated with the single vapor extraction well will consist of a vacuum gauge and a ball valve.

7.2.4 Control of Air Emissions

The State of New Mexico Air Quality Control Regulation (AQCR) 702 requires that "Permits must be obtained from the division by.....a stationary source which has a potential emission rate greater than 10 pounds per hour or 25 tons per year of any regulated air contaminant for which there is a National or New Mexico Ambient Air Quality Standard." The "potential emission rate" is the emission rate of a source at its maximum capacity in the absence of air pollution control equipment....." AQCR 703.1 requires that "any owner or operator intending to modify a stationary source which either prior to or following the modification has a potential emission rate greater than 10 tons per year of any regulated air contaminant.....shall file a Notice of Intent with the division."

Based on the results of the SVE pilot test, the only regulated air contaminant that will approach either 10 pounds per hour or 10 tons per year is total non-methane volatile organic compounds (NMVOC). The estimated emission rates for Phase I were calculated based on measurements and samples taken during the SVE pilot test. A calculation of the initial emission rates for SVE well 5-34B, at the pilot test extraction rate of 22 cfm, is included in the New Source Permit Application. The results of the calculation are shown in Table 3.

Table 3. Estimated maximum vapor concentrations and emission rates during Phase I system operation.

Compound	Concentration ppmv	Concentration ug/L	Emission Rate lb/hr	Emissions tons[1]
benzene	192	474	0.04	0.01
toluene	969	2821	0.26	0.07
ethybenzene	96	322	0.03	0.01
xylene (m-, p-, & o-)	552	1853	0.17	0.05
hexanes	4200	11445	1.07	0.29
heptanes	5500	17422	1.63	0.45
octanes	8900	32131	3.00	0.82
nonanes	1200	4867	0.46	0.12
decanes	200	900	0.08	0.02
undecanes	0	0	0.00	0.00
Total NMVOC[2]	21809	72236	6.75	1.85

1 Phase I total emissions based on one month of operation
2 NMVOC = non-methane volatile organic compounds

Based on the estimated emission rates presented here and in the air permit application, neither a permit or a notice of intent would normally be required for the installation and operation of this system. However, due to the fact that this system would be located at a "grandfathered" facility, the State of New Mexico Environment Department (NMED) Air Pollution Control Bureau had indicated that any increase in emissions might require the entire facility to be permitted. This issue was addressed during a meeting between TPC representatives and the NMED Air Pollution Control Bureau. A decision was made to submit an air permit application for the proposed remediation system emission source as if it were a new source, separate from the compressor station facility. A major factor in this decision was the fact that, within the next two years, a Title V operating permit will be prepared for the main facility in order to comply with the 1990 Clean Air Act. The air permit for the new source was issued by the NMED Air Pollution Control Bureau in July 1994. A copy of the permit, which includes the conditions of the permit, is included in Appendix B.

7.3 Phase II - Initial Air Sparging and SVE System

7.3.1 System Objective and Description

The purpose of the Phase II system is to increase the concentration of dissolved oxygen in the shallow ground water in order to stimulate the aerobic biodegredation of hydrocarbons. This will be accomplished by injecting air below the water table at eleven (11) sparge points and simultaneously extracting soil vapor from four (4) SVE wells (Figure 23). All Phase II air sparging and SVE wells will be located within the area of most significant impact. The air injection rate will be regulated at each sparge point to achieve an injection rate of 4 cfm at each of the eleven sparge points for a total air injection rate of 44 cfm. The total vapor extraction rate will be maintained at twice the air injection rate, 88 cfm, to ensure that there is not vapor transport of VOCs away from the impacted area.

The estimated duration of Phase II is six to twelve months. This time frame will allow sufficient time to evaluate the operation of the system and to make plans to optimize the system during installation of Phase III.

7.3.2 Soil Vapor Extraction Points

Monitor wells 5-4B, 5-34B, and 5-35B will be utilized as extraction wells during Phase II. In addition, a fourth extraction well will be drilled and completed just west of 5-34B to ensure containment of injected air (Figure 23). A well construction diagram for a typical soil vapor extraction well is shown in Figure 24. It is anticipated that a sustainable extraction rate of approximately 88 cfm will be maintained from the four wells with a vacuum of 20" of H_2O.

7.3.3 Air Sparge Points

Eleven sparge points will be drilled and completed within the zone of most significant impact (Figure 23). The sparge points will be located on 25 foot centers and staggered perpendicular to the direction of shallow ground water flow in order to achieve efficient coverage in this area. The sparge points will be completed with a 2 ft. section of slotted screen with the top of the screen set 8 - 12 feet below the water table. A completion detail for a typical sparge point is shown in Figure 25. A cross-section of the Phase II system is shown in Figure 26. Several soil borings in the vicinity of the proposed sparge point locations have indicated that the alluvium grades from fine sand to clay or silty clay at approximately 60 ft below ground surface; therefore, a split spoon sampler will be utilized during installation of the sparge points to ensure that the bottom of each sparge point is set above any clay or silty clay layer. It is anticipated that approximately 12-18 psig (1.5 psi/ft. below water table) pressure will be required at each sparge point to achieve the design injection rate.

7.3.4 Air Sparging and SVE Equipment

The surface equipment for both the air sparging and SVE systems will be mounted on the same skid for easy portability and integration of the two systems. As previously discussed, the equipment will be located in a metal building near the area of the SVE and air sparge points.

The surface equipment associated with the vapor extraction system has been sized to accommodate the capacity requirements of both the Phase II and Phase III systems. This system will consist of the following:

- 1 - Regenerative blower with 5 Hp XP motor;
- 1 - Vapor filter assembly;
- 1 - Water knockout assembly and 30 gallon reservoir tank;
- 2 - Vacuum gauges;
- 1 - Butterfly valve; and
- 1 - Vapor flowmeter, 20-200 cfm range.

The surface equipment associated with the vapor extraction wells will consist of a vacuum gauge and a ball valve. A single 4" PVC pipe header will serve all SVE wells. Each SVE well will be connected to the header by 2" PVC pipe.

The surface equipment associated with the air sparging system has also been sized to accommodate the capacity requirements of both the Phase II and Phase III systems. This system will consist of the following:

- 1 - Liquid ring blower with 15 Hp motor;
- 1 - Air filter assembly;
- 1 - 60 gallon water recirculation system for liquid seals;
- 2 - Pressure gauges; and
- 1 - Flowmeter, 10-100 cfm range.

The surface equipment associated with the air sparging wells will consist of a pressure gauge and pressure regulator. The pressure regulator will regulate flow between a common header maintained at approximately 20 psig and each individual sparge point. The purpose of regulating flow at each well is to ensure air injection to each sparge point. A single 4" PVC pipe header will serve all sparge points. Each sparge point will be connected to the header by 1" PVC pipe.

7.3.5 Control of Air Emissions

Based on the results of the SVE pilot test, the only regulated air contaminant that will approach either 10 pounds per hour or 10 tons per year is total non-methane volatile organic compounds (NMVOC). The estimated emission rates for Phase II were calculated based on measurements and samples taken during the SVE pilot test. The initial emission rates were estimated assuming an average extraction rate of 88 cfm for the duration of Phase II and the VOC concentrations measured during the pilot test at the monitor well 5-4B location. The results of the calculation are shown in Table 4.

Table 4. Estimated maximum vapor concentrations and emission rates during Phase II system operation.

Compound	Concentration ppmv	Concentration ug/L	Emission Rate lb/hr	Emissions tons[1]
benzene	1	2	< 0.01	< 0.01
toluene	31	90	0.03	0.05
ethybenzene	6	20	0.01	0.01
xylene (m-, p-, & o-)	76	255	0.08	0.14
hexanes	< 1	< 1	< 0.01	< 0.01
heptanes	100	317	0.10	0.17
octanes	300	1083	0.36	0.59
nonanes	100	406	0.13	0.22
decanes	< 1	< 1	< 0.01	< 0.01
undecanes	< 1	< 1	< 0.01	< 0.01
Total NMVOC[2]	614	2173	0.72	1.17

1 Phase II total emissions based on six months of operation
2 NMVOC = non-methane volatile organic compounds

7.4 Phase III - Expanded Air Sparging and SVE System

7.4.1 System Objective and Description

The purpose of the Phase III system is to increase the concentration of dissolved oxygen in the shallow ground water along a broader cross-section of the saturated alluvium. This will be accomplished by an expansion of the Phase II system which, when complete, will inject air below the water table at twenty-two (22) sparge points and will simultaneously extract soil vapor from five (5) SVE wells (Figure 27). The additional Phase III air sparging points will extend the coverage of the remediation system beyond the periphery of the area of most significant impact. The air injection rate will be regulated at each sparge point to achieve an injection rate of 4 cfm at each of the twenty-two sparge points for a total air injection rate of 88 cfm. The total vapor extraction rate will be maintained between 132 and 176 cfm; 1.5 to 2.0 times the total air injection rate.

The estimated duration of Phase III is two to five years. This time frame should be sufficient to achieve the remediation objectives and proposed clean-up criteria.

7.4.2 Soil Vapor Extraction Points

Monitor well 5-5B will be utilized as an extraction well in addition to the four wells utilized during Phase II. It is anticipated that a sustainable extraction rate of approximately 132 - 176 cfm will be maintained from the five wells with a vacuum of 30-40"of H_2O. If necessary, a sixth extraction well will be drilled and completed to ensure containment of injected air. Information obtained during Phase II will determine whether a sixth extraction well would be necessary.

7.4.3 Air Sparge Points

Eleven additional sparge points will be drilled and completed as shown in Figure 27. The sparge points will be located on 25 foot centers and in a line perpendicular to the presumed direction of shallow ground water flow. The sparge points will be constructed as described in section 7.3.3 assuming no optimization of design is necessary.

7.4.4 Air Sparging and SVE Equipment

Assuming that no optimization of the air injection or SVE equipment is necessary, there would be no modification necessary.

The surface equipment associated with the additional vapor extraction wells will consist of a vacuum gauge and a ball valve for each SVE well.

The surface equipment associated with the additional air sparging points will consist of a pressure gauge and pressure regulator for each sparge point. The pressure regulator will regulate flow between a common header maintained at approximately 20 psig and each individual sparge point.

7.4.5 Control of Air Emissions

As with both the Phase I and Phase II systems, based on the results of the SVE pilot test, the only regulated air contaminant that will approach either 10 pounds per hour or 10 tons per year is total non-methane volatile organic compounds (NMVOC). The estimated emission rates for Phase III were calculated based on measurements and samples taken during the SVE pilot test. A conservative (on the high side) estimate for the emission rates during Phase III has been prepared by assuming an average extraction rate of 176 cfm for the duration of Phase III and the VOC concentrations measured during the pilot test at the monitor well 5-4B location. The results of the calculation are shown in Table 5.

Table 5. Estimated maximum vapor concentrations and emission rates during Phase III system operation.

Compound	Concentration ppmv	Concentration ug/L	Emission Rate lb/hr	Emissions tons[1]
benzene	1	2	< 0.01	< 0.01
toluene	31	90	0.06	0.05
ethybenzene	6	20	0.01	0.01
xylene (m-, p-, & o-)	76	255	0.17	0.15
hexanes	< 1	< 1	< 0.01	< 0.01
heptanes	100	317	0.21	0.19
octanes	300	1083	0.71	0.65
nonanes	100	406	0.27	0.24
decanes	< 1	< 1	< 0.01	< 0.01
undecanes	< 1	< 1	< 0.01	< 0.01
Total NMVOC[2]	614	2173	1.43	1.31

1 Phase III total emissions based on five months of operation
2 NMVOC = non-methane volatile organic compounds

Based on the emission estimates presented for all three phases of the remediation system, the maximum estimated emission rate is 6.75 lb/hr, this maximum rate will occur at start-up. The maximum estimated total emissions for the first year of operation is 4.33 tons NMVOCs. The maximum estimated total emissions for subsequent years of operation is < 3.13 tons NMVOCs.

8.0 Operation, Maintenance and Monitoring

8.1 Operation and Maintenance

The surface facilities associated with the remediation system will be maintained by TPC employees and/or a local contractor. The TPC employees and/or local contractor delegated responsibility for operation and maintenance (O&M) activities will be trained on day-to-day operations, including (1) balancing flow rates and vacuums to the individual sparge wells and SVE wells, (2) development of applicable emergency procedures (in accordance to TPC requirements), (3) required equipment maintenance tasks and schedules, (4) sampling requirements and procedures, and (5) record keeping procedures. An O&M plan, data record sheets, and schedules will be assembled during the first month of operation following implementation of the Phase I system. It is anticipated that the first month of operation following the implementation of each phase of the remediation system will require the greatest O&M activity. During this period, the O&M plan will be modified as needed to accomodate system changes.

8.2 System Performance Monitoring

System performance will be evaluated on the basis of soil-vapor and ground water sample analytical results. During Phase I, Phase II, and the first month of Phase III, soil vapor samples will be collected from the SVE system discharge and analyzed in a qualified laboratory for BTEX, extended refinery gases, and fixed gases (O2, CO2, and N2). After the first month of Phase III implementation, soil vapor samples collected from the SVE system will be analyzed on-site with an organic vapor meter (OVM of either the FID or PID type). Ground water samples will be collected from selected monitor wells and analyzed for BTEX, and TPH. Ground water will be analyzed on-site during sample collection for dissolved oxygen concentration. The proposed schedule for performance monitoring is detailed in Tables 6 through 8.

Table 6. Schedule for Performance Monitoring for the Phase I System

Period (months from start-up)	SVE Vapor Sample Frequency	Ground Water Sample Locations	Ground Water Sampling Frequency
start-up to 1 month	every 2 weeks	5-4B	every 2 weeks
1 to 3 months (1)	monthly	5-4B	monthly
3 months and beyond (2)	quarterly	5-4B	quarterly

(1) - in the event Phase II does not start-up after 1 month
(2) - untill start-up of Phase II

Table 7. Schedule for Performance Monitoring for the Phase II System

Period (months from start-up)	SVE Vapor Sample Frequency	Ground Water Sample Locations	Ground Water Sampling Frequency
start-up to 1 month	every 2 weeks	5-4B, 5-34B & 5-48B	every 2 weeks
1 to 3 months	monthly	5-4B, 5-34B & 5-48B	monthly
3 months and beyond (1)	quarterly	5-4B, 5-34B & 5-48B	quarterly

(1) - untill start-up of Phase III

Table 8. Schedule for Performance Monitoring for the Phase III System

Period (months from start-up)	SVE Vapor Sample Frequency	Ground Water Sample Locations	Ground Water Sampling Frequency
start-up to 1 month	every 2 weeks	5-4B, 5-34B & 5-48B	every 2 weeks
1 to 3 months	monthly	5-4B, 5-34B & 5-48B	monthly
3 months and beyond (1)	quarterly (2)	5-4B, 5-34B & 5-48B	quarterly

(1) - or untill any major modification which may require more frequent monitoring
(2) - vapor samples will be analyzed on-site with an OVM

8.3 Annual Ground Water Quality Monitoring

TPC proposes to continue to monitor the water quality in the shallow perched ground water. In general, this will be accomplished by an annual ground water sampling event. Ground water samples will be collected from the twenty-four (24) monitor wells listed in Table 9. In addition, replicate samples will be obtained from two (2) of the twenty-four (24) monitor locations. All samples will be delivered to a qualified laboratory for analyses as specified in Table 9.

8.4 Reporting Requirements

A report summarizing system performance and annual ground water quality monitoring results will be submitted to the NMOCD and the NNEPA semiannually during the first year of operation and annually thereafter. The reports will document work performed during the preceding period and will include the following information:

- Copies of the results of all soil vapor and ground water analyses
- All hydrogeologic data collected
- The performance and efficiency of each aspect of the remediation system
- Maintenance procedures performed
- Progress of remediation toward closure

Table 9. Proposed Ground Water Monitoring Locations for the Annual Sampling Event

Monitor Well ID	Monitor Well Catagory	Purgeable Aromatics EPA Method 8020	PCB Compounds EPA Method 8080
5-1B	3	X	X
5-2B	3	X	
5-3B	1	X	
5-4B	3	X	
5-5B	3	X	
5-6B	3	X	X
5-6B(r)	3	X	X
5-12B	2	X	
5-13B	3	X	
5-14B	2	X	
5-15B	2	X	
5-16B	3	X	
5-17B	2	X	X
5-18B	3	X	
5-19B	3	X	
5-20B	3	X	
5-22B	3	X	
5-23B	2	X	
5-24B	3	X	
5-34B	4		
5-35B	3	X	
5-36E	4		
5-37I	4		
5-41B	3	X	
5-47B	3	X	
5-48B	3	X	
5-48B(r)	3	X	
5-57B	2	X	
5-58B	2	X	
# of Samples		26	4

(r) - Indicates a replicate sample will be taken at this location.
Monitor Well Catagories: (1) up-gradient clean well; (2) perimeter clean well; (3) interior impacted well; and (4) additional pilot test well

9.0 Amendment of the Remediation Plan

9.1 Regulatory Approval Process for Amendment

In the event that it becomes apparent that the remediation system must be significantly modified in order to achieve a timely and effective clean-up, then an amendment to the remediation plan will be submitted to both the NNEPA and the NMOCD for regulatory review and approval. Significant modifications would include expanding the system off-site and/or implementation of an alternative technology.

9.2 Potential Plan Modifications

Currently, the only potential plan modification that reasonably could be anticipated would be the expansion of the proposed remediation system to the area just south of the proposed system. In this event, additional soil borings would be drilled and completed for air injection and soil vapor extraction. Any additional surface facilities would most likely remain within the TPC facility fence line.

10.0 Proposed Clean-up Criteria for BTEX Compounds

As previously stated, the objective of this remediation plan is to reduce the mass of benzene in the vicinity of the impacted area to a level that would ensure that natural biological and physical processes would continue the attenuation of dissolved phase benzene in the shallow perched ground water below a specified criteria. The specified criteria will be commensurate with the potential risk to human health and the environment and acceptable to the landowners and regulatory agencies involved. The proposed clean-up criteria are set equivalent to the Human Health Standards of the State of New Mexico Water Quality Control Commission Regulations, Part 3, Section 3-103.A, as indicated in Table 10.

Table 10. Proposed Clean-up Criteria for BTEX Compounds in Ground Water

Compound	Criteria mg/L
Benzene	0.01
Toluene	0.75
Ethylbenzene	0.75
Total Xylenes	0.62

11.0 Termination and Duration of Corrective Action Activities

11.1 Termination of Corrective Action Activities

Operation of the proposed remediation system will be suspended when laboratory results for samples collected from monitor wells located downgradient of the impacted area indicate the proposed clean-up criteria for benzene will be met without continued operation of the remediation system. Corrective action activities will be terminated when laboratory results for samples collected from monitor wells located downgradient of the impacted area indicate the proposed clean-up criteria for benzene has been met after a minimum of three sample events. At least two sample events will be subsequent to suspension of operation of the proposed remediation system and the three sample events will cover a minimum period of eighteen (18) months. The geometric mean of laboratory results for samples collected from each ground water monitoring location will be used to determine if the termination of corrective action activities criteria has been met.

11.2 Estimated Duration of Operation

It is difficult to accurately predict the duration of operation at this time. However, based on the observed natural attenuation currently occuring and the expected increase in attenuation due to the proposed remediation system, termination of corrective action activities is expected to occur within ten (10) years from start-up of the remediation system.

11.3 Certification of Completion

A written certification of completion will be provided by the NNEPA and the NMOCD within 90 days subsequent to termination of corrective action activities. This certification only applies to the remediation of BTEX constituents addressed by this proposed remediation plan.

12.0 Abandonment of the Remediation System

12.1 Removal of Surface Facilities

As proposed, there are no proposed surface facilities located off-site other than the sixteen existing monitor wells. In the event the remediation plan is amended to include surface facilities outside the boundary of the TPC facility, upon termination of corrective action activities, all surface facilities will be removed from off-site property.

12.2 Abandonment of Monitoring Wells

All ground water monitor wells located off-site will be removed in accordance to the current (i.e. at the time of abandonment) American Society for Testing and Materials standard guide for decommissioning of ground water wells, currently, ASTM D5299 - Guide for the decommissioning of ground water wells, vadose zone monitoring devices, boreholes, and other devices for environmental activities.

All ground water monitor wells located on-site will be removed in accordance with the applicable requirements of the State of New Mexico.

13.0 References

Cypress Engineering Services, Inc. New Source Permit Application; Thoreau Compressor Station, Transwestern Pipeline Company, McKinley County, New Mexico. March 31, 1994.

Daniel B. Stephens & Associates, Inc. (DBS&A). Hydrogeology at the Transwestern Pipeline Compressor Station No. 5, Thoreau, New Mexico. Prepared for Transwestern Pipeline Company, Houston, Texas, February 1990.

DBS&A. Ground-Water Assessment Report for Compressor Station No. 5, Thoreau, New Mexico. Prepared for Transwestern Pipeline Co., Houston, Texas, July 26, 1991.

DBS&A. PCB Investigation, Thoreau Monitor Wells 5-1B and 5-6B. Prepared for ENRON Environmental Affairs, Houston, Texas, December 1992.

DBS&A. Summary of Hydrogeological Investigations Conducted at the Thoreau Compressor Station, July 1991 Through Febuary 1994. Prepared for ENRON Environmental Affairs, Houston, Texas, April 20, 1994.

Francisco, A.J. An Archaeological Survey of Water Testing Units at the Thoreau Compressor Station at Thoreau, McKinley County, New Mexico for the Transwestern Pipeline Company. Prepared for Edwin R. Peck, Jr., Director, Right-of-Way Agent, Transwestern Pipeline Company, Houston, Texas, December 1992.

Office of Contract Archeology, UNM. An Archeological Survey of Three Parcels Adjacent to the Thoreau, Leupp, and Klagetoh Compressor Stations. January 8, 1990.

Risser, D.W. and F.P. Lyford. Water resources on the Pueblo of Laguna, west-central New Mexico. U.S. Geological Survey Water-Resources Investigations Report 83-4038, Water Resources Division, Albuquerque, New Mexico. 1983.

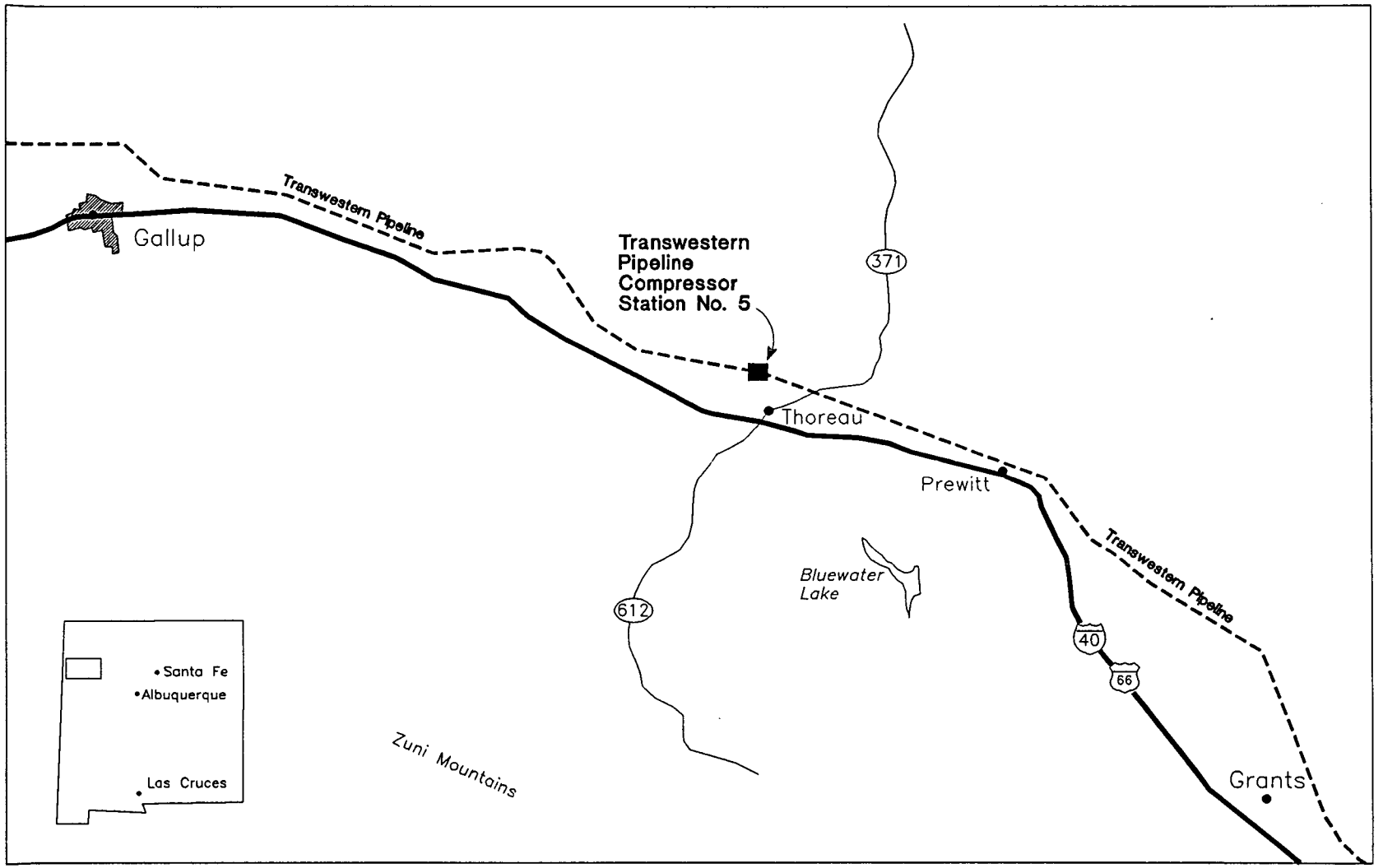
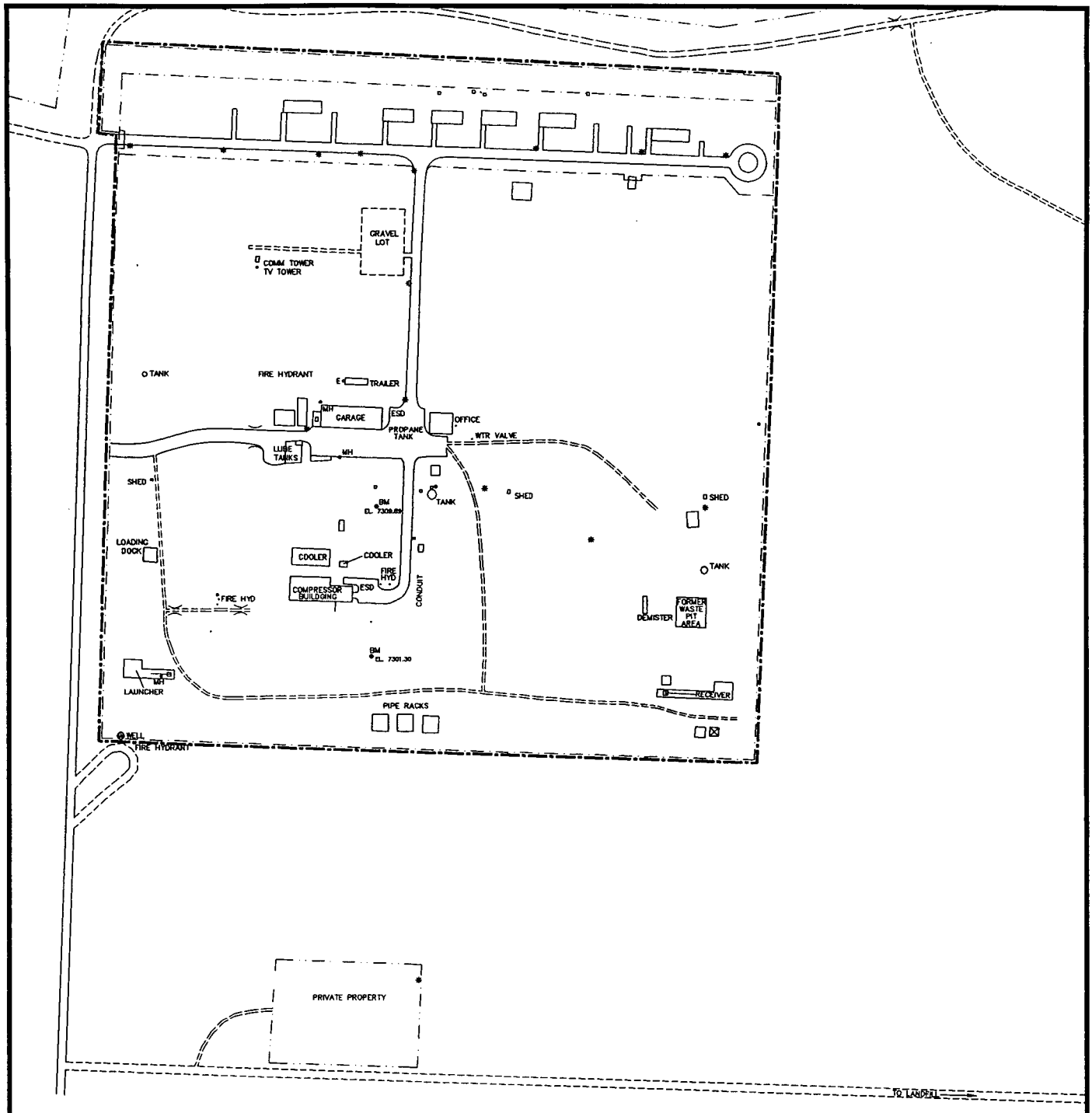


Figure 1

THOREAU COMPRESSOR STATION
Regional Location Map

DANIEL B. STEPHENS & ASSOCIATES, INC.
1-94 JN 2105



N

0 400'

Explanation

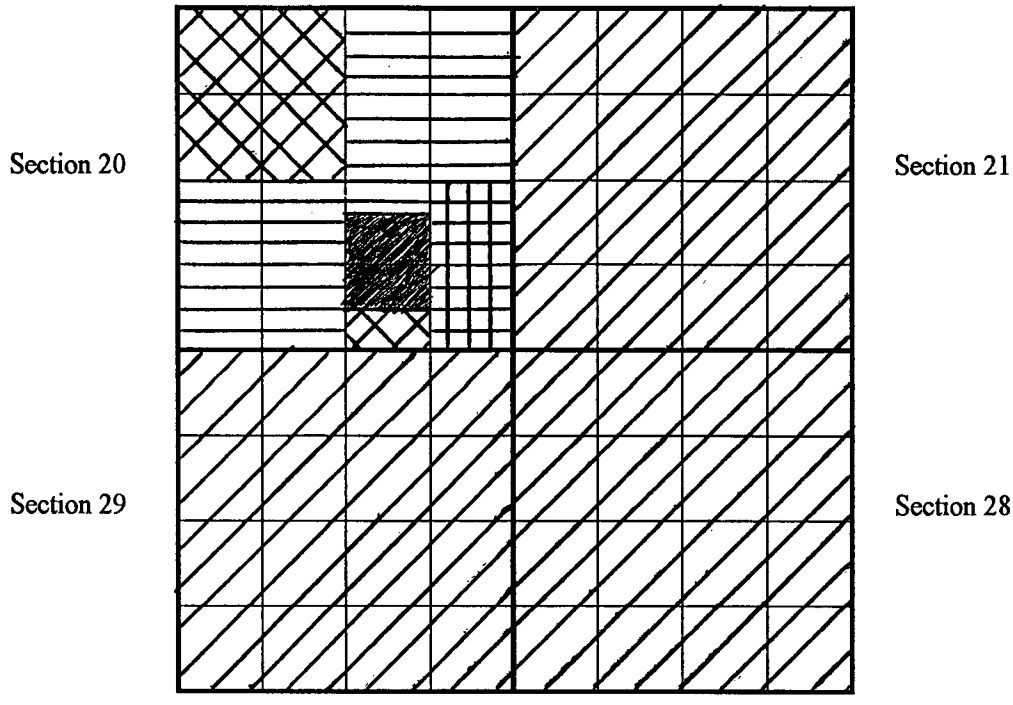
- Chainlink Fence
- Compressor Station Boundary
- Gravel Road
- Light

Site Map
Thoreau Compressor Station

TRANSWESTERN PIPE LINE COMPANY
2-94

Figure 2

Sections located in T14N, R13W N.M.P.M.
McKinley County, New Mexico.



TPC CS#5

Navajo; original tribal trust

Navajo; from trade with BLM

BLM; waiting on trade to Navajos

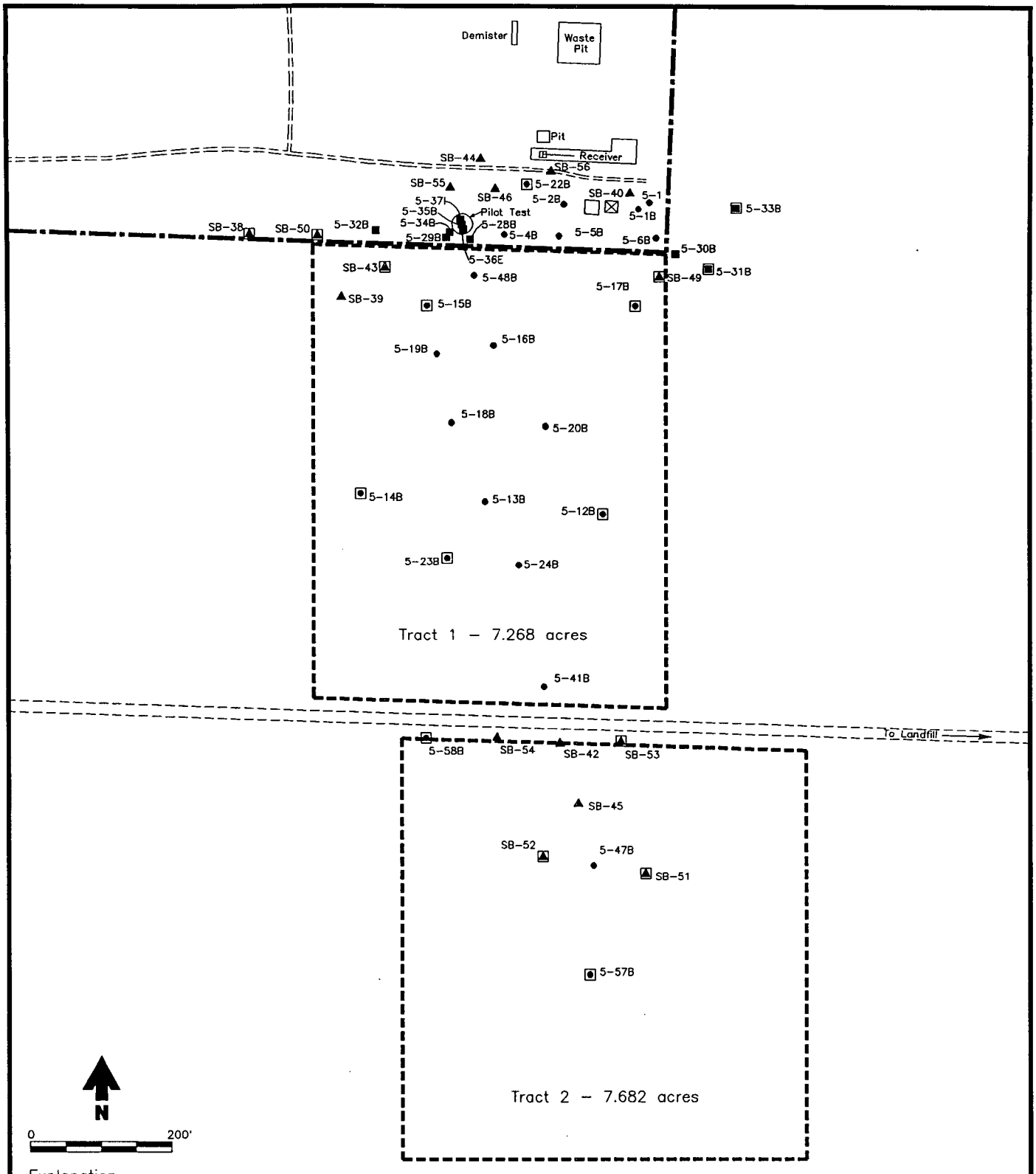
BLM

Thoreau Compressor Station

Property Ownership in the

Vicinity of the Thoreau Station

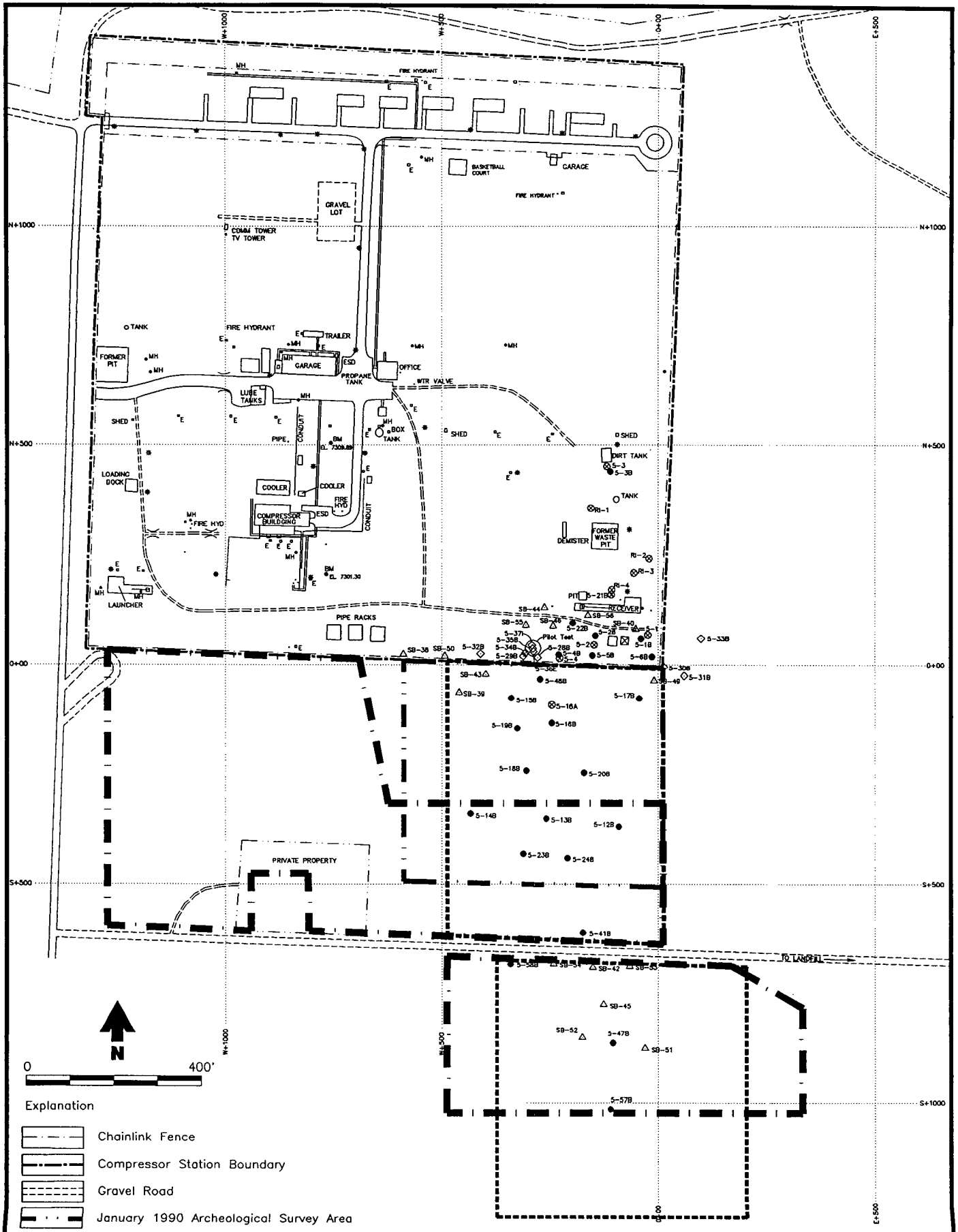
Figure 3



Thoreau Compressor Station
Proposed Lease Area

TRANSWESTERN PIPELINE COMPANY
12-93

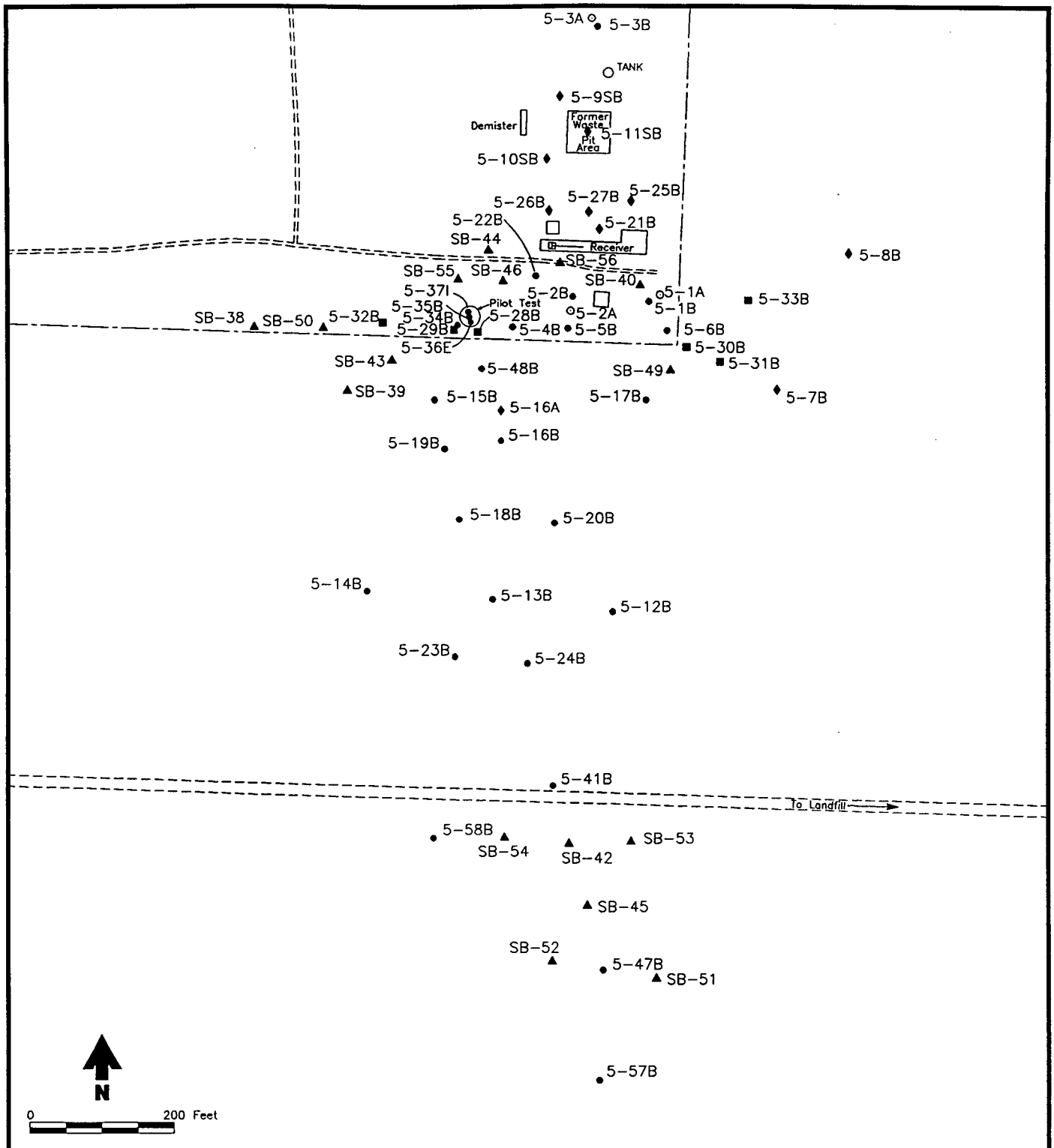
Figure 4



Thoreau Compressor Station
Archaeological Survey Areas

TRANSWESTERN PIPE LINE COMPANY
8-93

Figure 5



Explanation

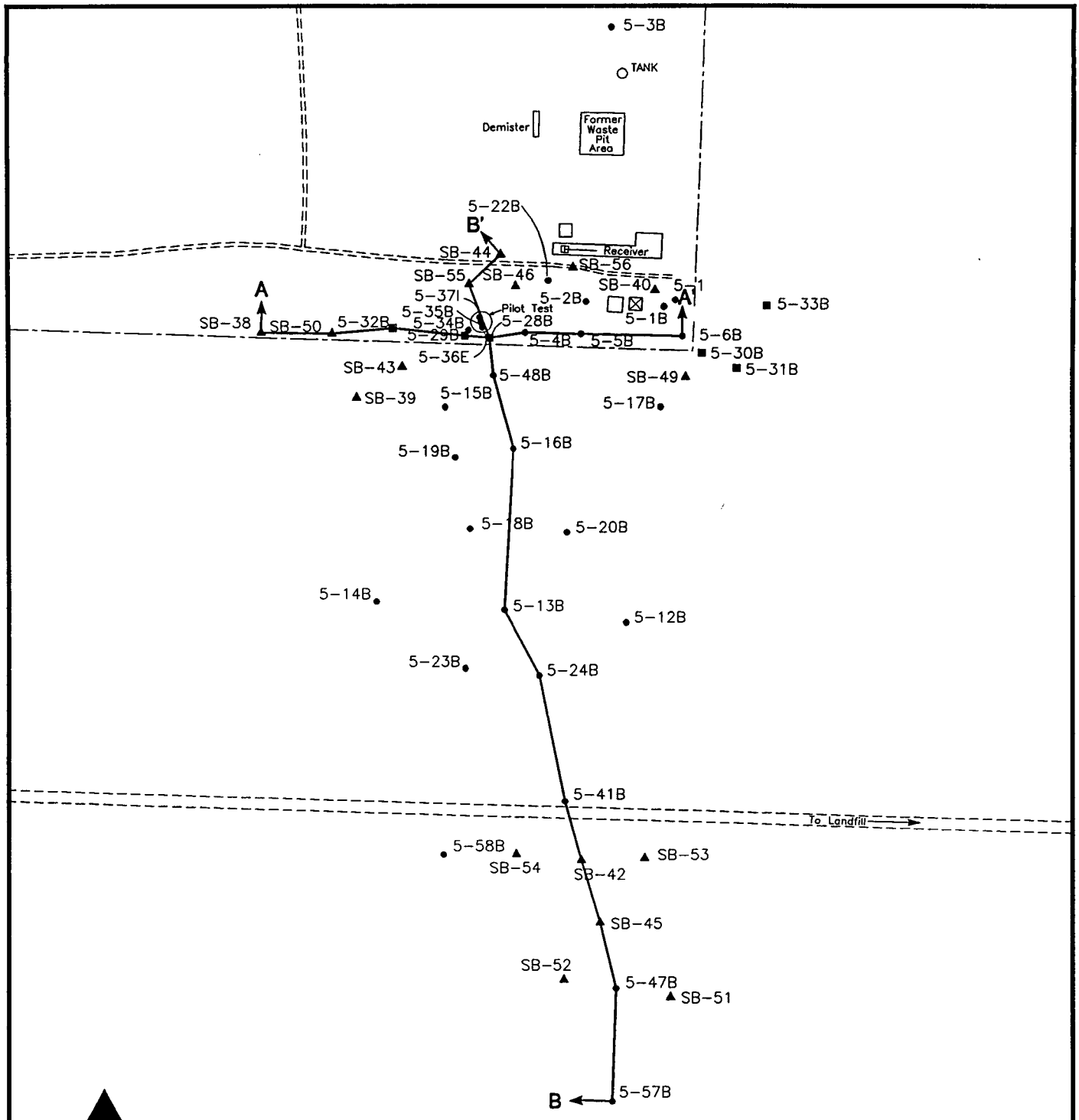
- Monitor Well
- Road
- Compressor Station Boundary
- Abandoned Regional Test Well
- Abandoned Monitor Wells/Exploratory Boring Drilled 1989/1990
- Abandoned Exploratory Boring Drilled May 1991
- Abandoned Exploratory Boring Drilled July/August 1992

THOREAU COMPRESSOR STATION

Locations of Monitor Wells and Exploratory Borings

DANIEL B. STEPHENS & ASSOCIATES, INC.
10-94 JN 2105

Figure 6



THOREAU COMPRESSOR STATION

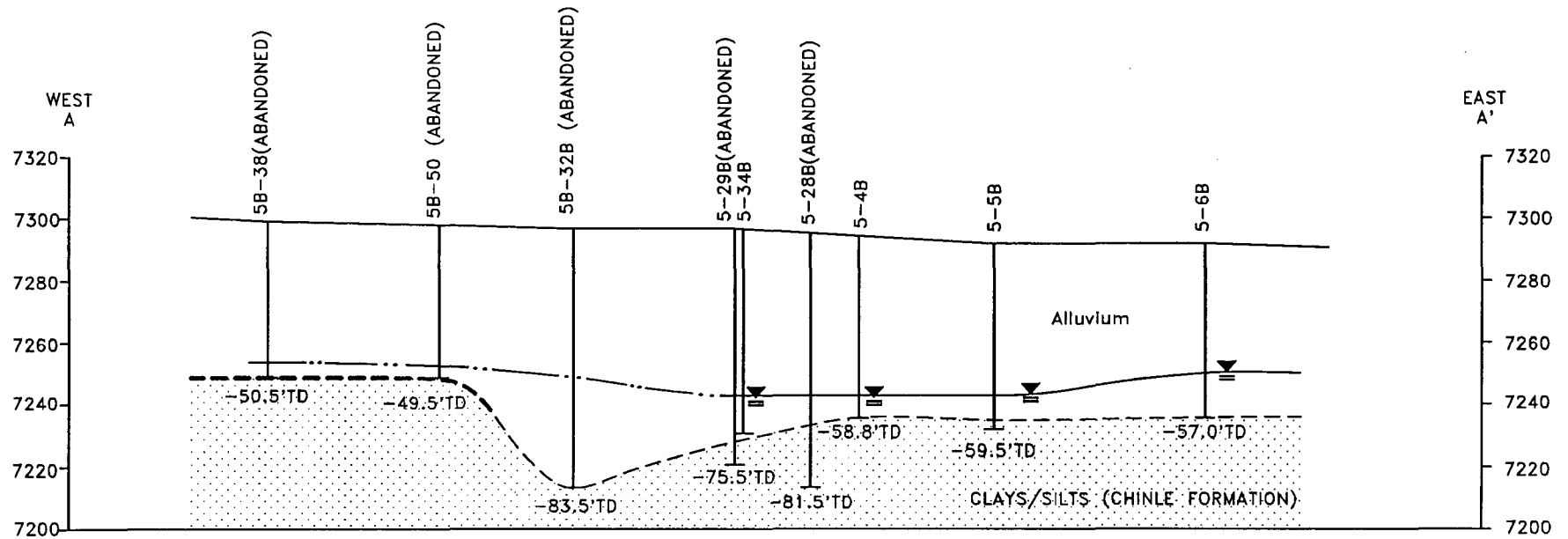
Hydrogeologic Cross-Section Location Map

DANIEL B. STEPHENS & ASSOCIATES, INC.

1-94 JN 2105

Figure 7

D\2105\2105AA.DWG



Vertical Exaggeration 2X

Explanation

- April 1993 Water Level
- Approximate Bedrock Surface
- Approximate Water Table

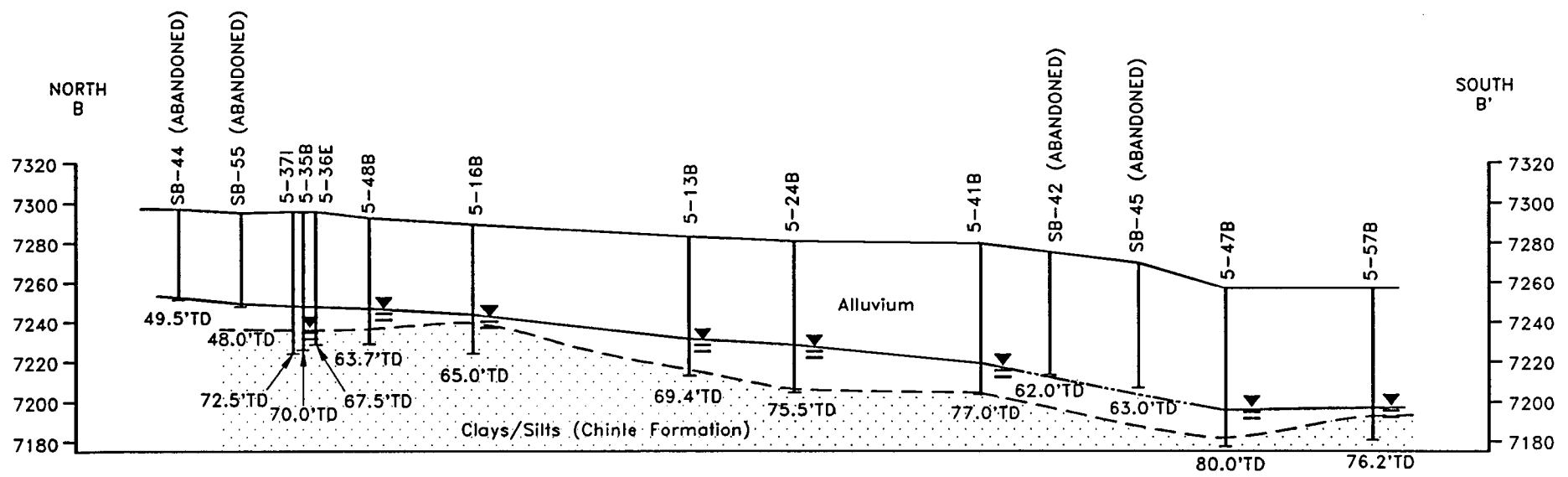
Figure 8

ENRON, THOREAU, NEW MEXICO

Hydrogeologic Cross-Section A-A'

DANIEL B. STEPHENS & ASSOCIATES, INC.

1/95 JN 2105



Explanation

- April 1993 Water Level
- Approximate Bedrock Surface
- Approximate Water Table

Vertical Exaggeration 2X

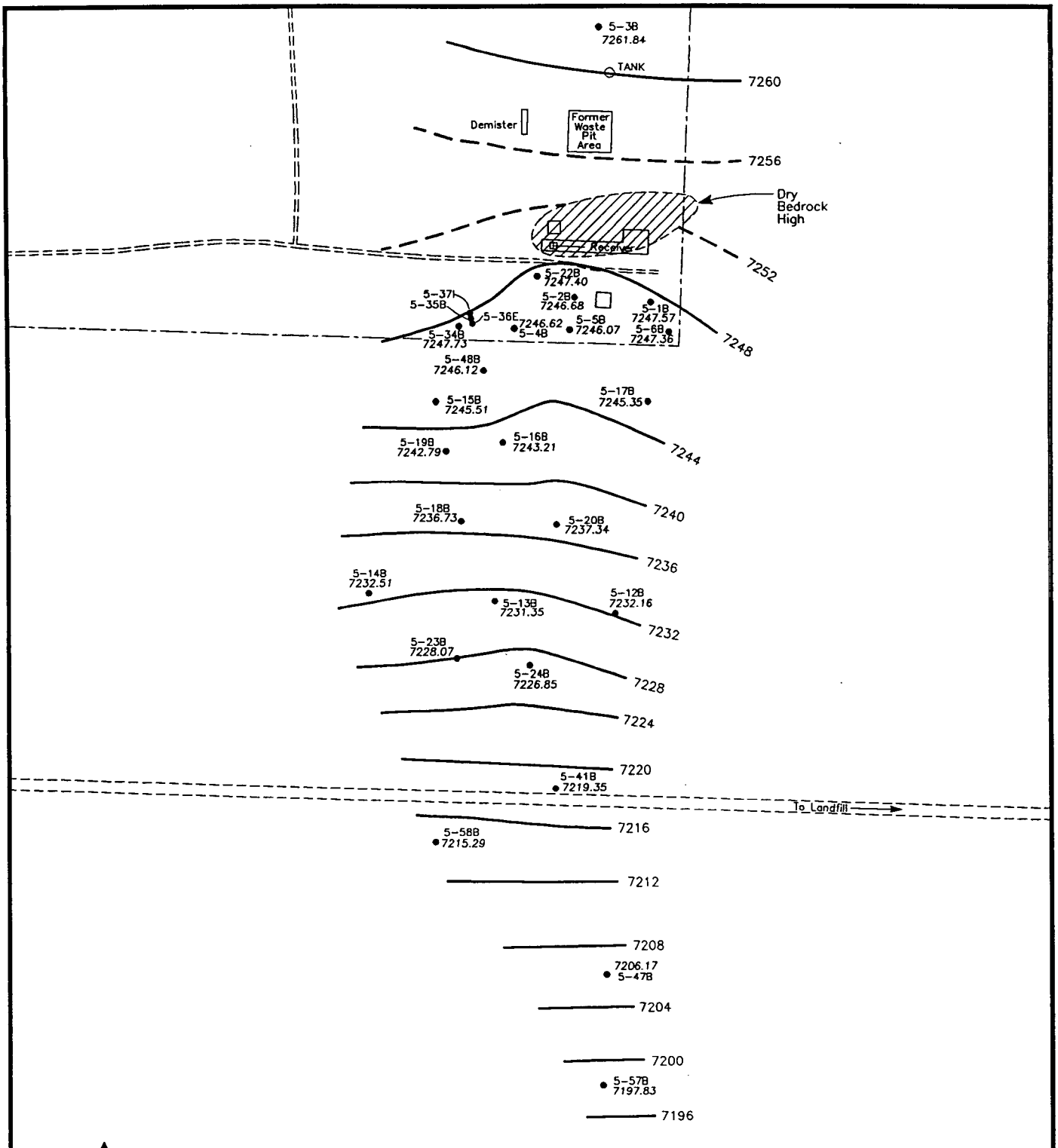
Figure 9

ENRON, THOREAU, NEW MEXICO

Hydrogeologic Cross-Section B-B'

DANIEL B. STEPHENS & ASSOCIATES, INC.

1/94 JN2105

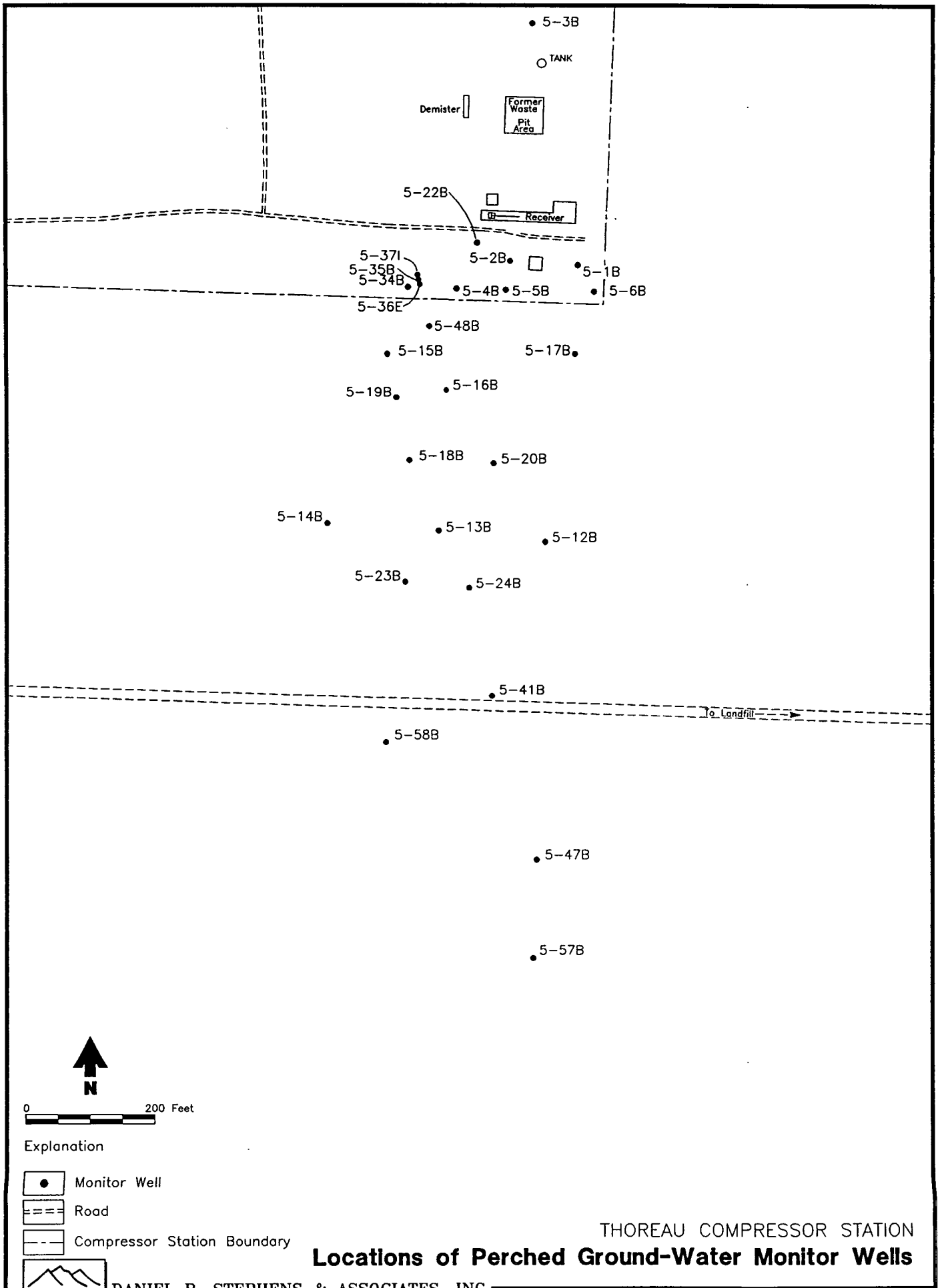


THOREAU COMPRESSOR STATION

Water Table Elevation for the Perched Ground Water, April 19, 1993

DANIEL B. STEPHENS & ASSOCIATES, INC.
10-94 JN 2105

Figure 10

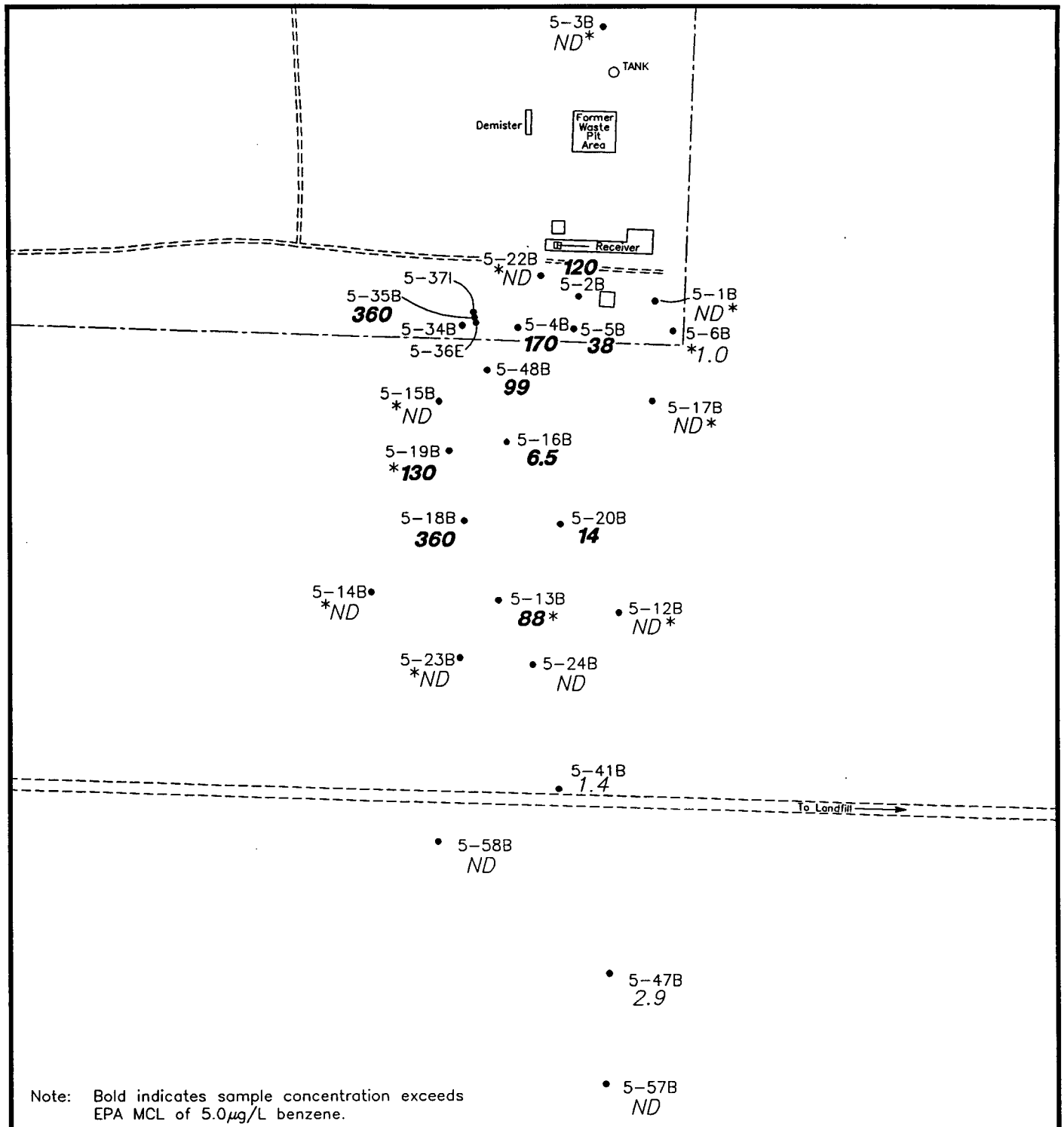


THOREAU COMPRESSOR STATION

Locations of Perched Ground-Water Monitor Wells

DANIEL B. STEPHENS & ASSOCIATES, INC.
10-94
JN 2105

Figure 11



Note: Bold indicates sample concentration exceeds EPA MCL of 5.0μg/L benzene.

N

0 200 Feet

Explanation

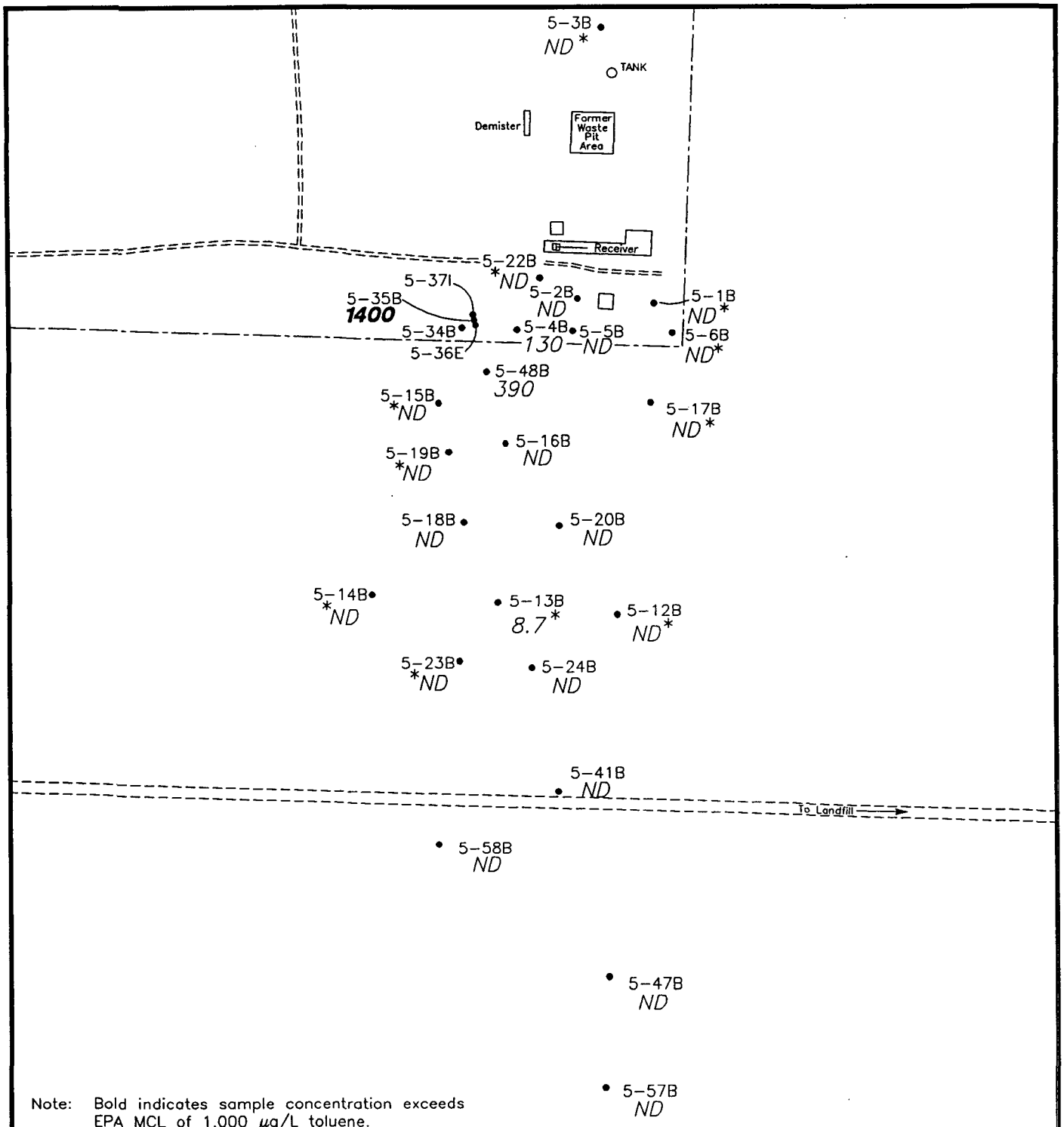
- • 82 — Monitor Well Showing Benzene Concentration (μg/L) Sampled 4/93
- * — Sampled 10/92
- ND — Not Detected
- Compressor Station Boundary

THOREAU COMPRESSOR STATION

Benzene Concentrations in Ground Water, 1992/1993

DANIEL B. STEPHENS & ASSOCIATES, INC.
10-94 JN 2105

Figure 12



Note: Bold indicates sample concentration exceeds EPA MCL of 1,000 μg/L toluene.

N

0 200 Feet

Explanation

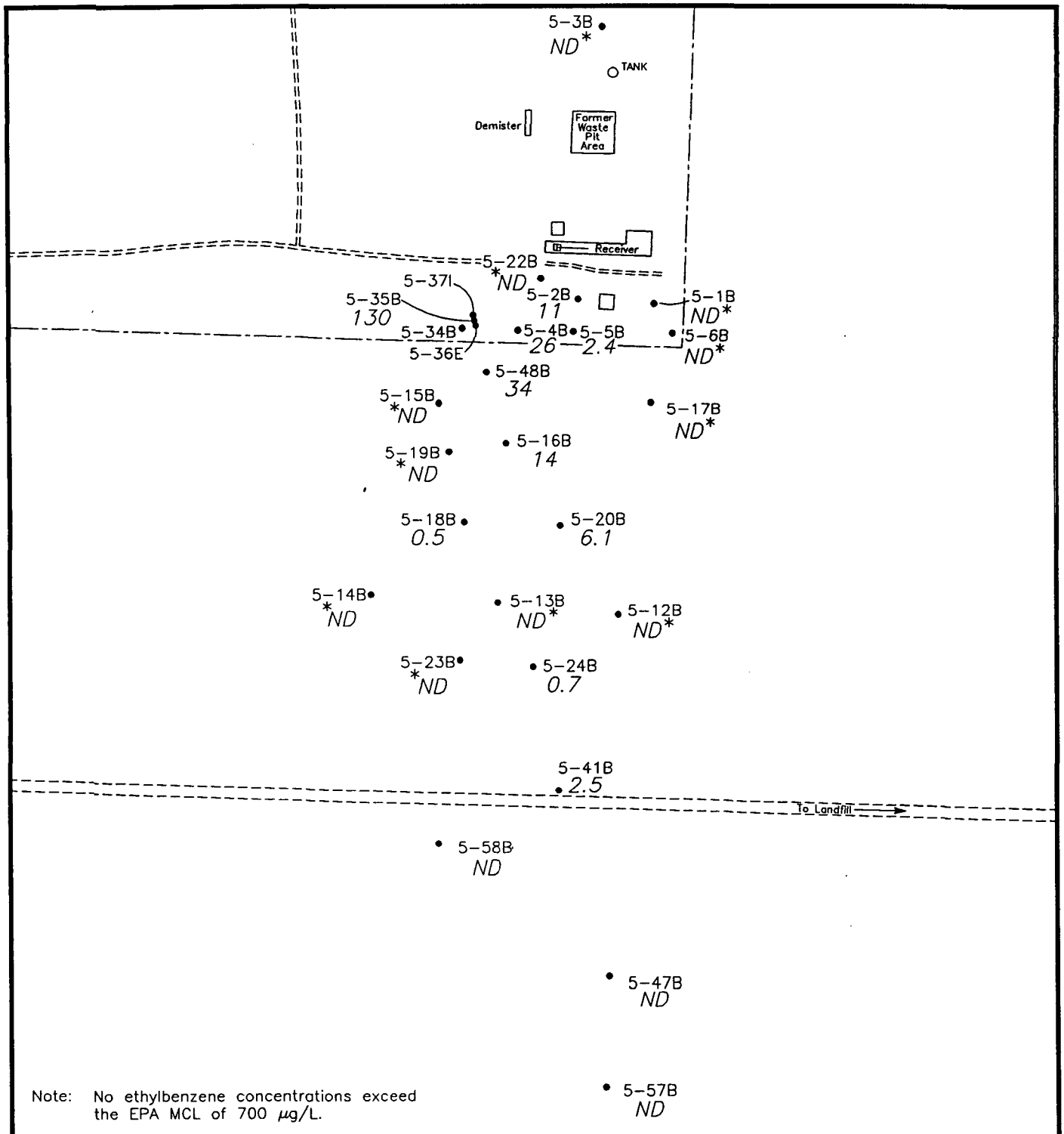
- 82 — Monitor Well Showing Toluene Concentration (μg/L) Sampled 4/93
- * — Sampled 10/92
- ND — Not Detected
- Compressor Station Boundary

THOREAU COMPRESSOR STATION

Toluene Concentrations in Ground Water, 1992/1993

DANIEL B. STEPHENS & ASSOCIATES, INC.
10-94 JN 2105

Figure 13

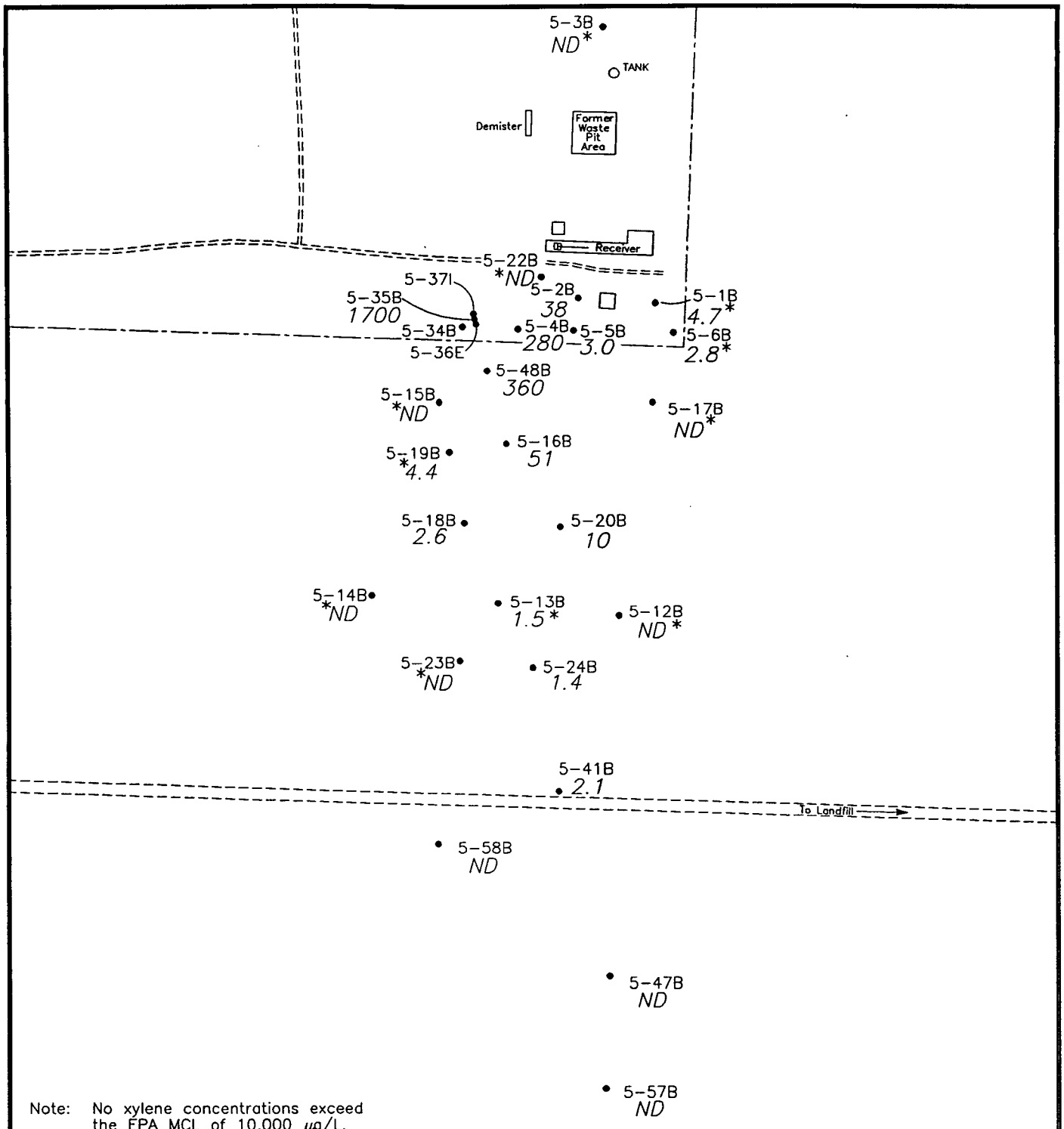


THOREAU COMPRESSOR STATION

Ethylbenzene Concentrations in Ground Water, 1992/1993

DANIEL B. STEPHENS & ASSOCIATES, INC.
10-94
JN 2105

Figure 14



Note: No xylene concentrations exceed the EPA MCL of 10,000 μg/L.

N

0 200 Feet

Explanation

- 82 — Monitor Well Showing Xylene Concentration (μg/L) Sampled 4/93
- * — Sampled 10/92
- ND — Not Detected
- Compressor Station Boundary

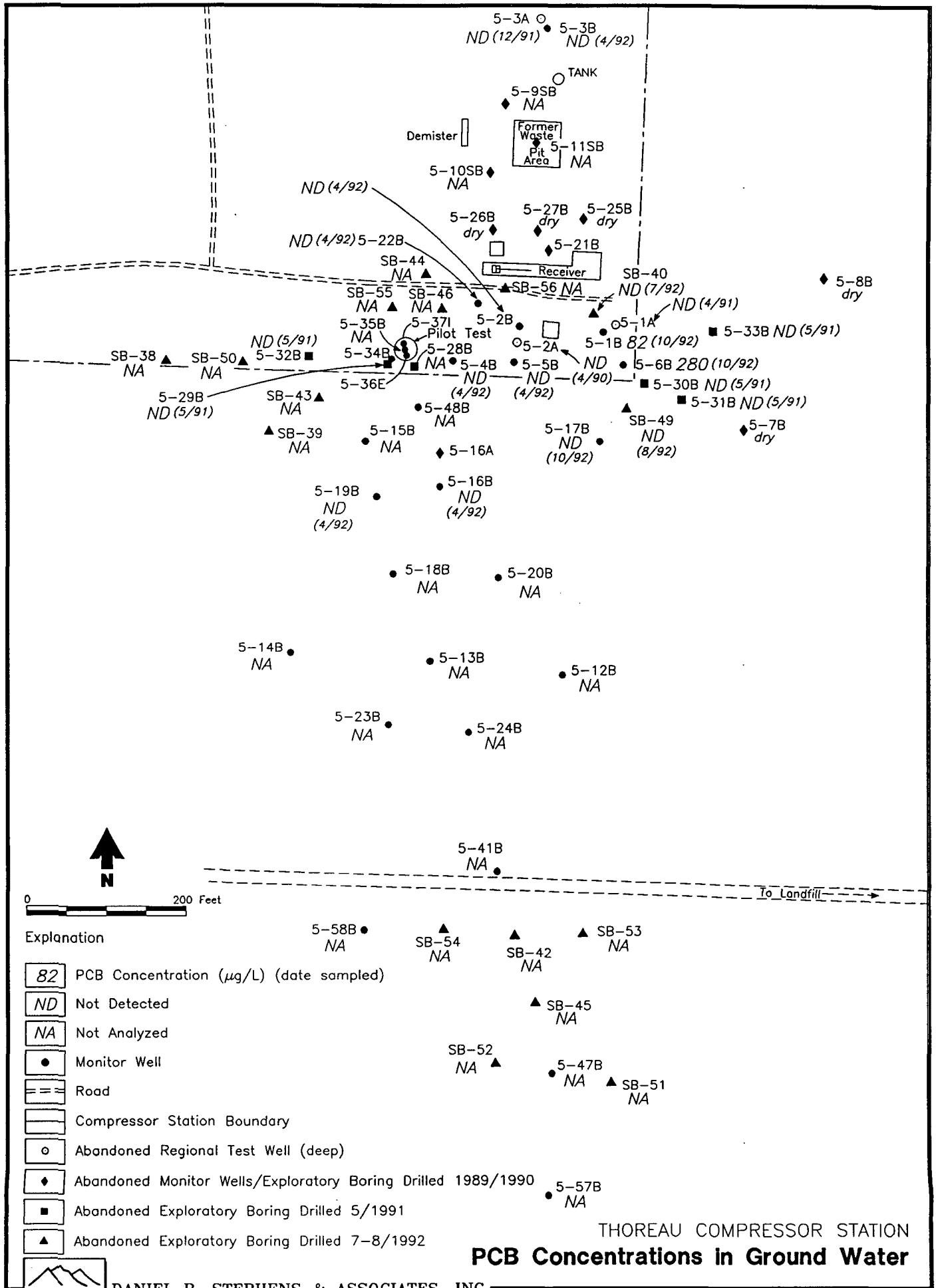
THOREAU COMPRESSOR STATION

Xylene Concentrations in Ground Water, 1992/1993

DANIEL B. STEPHENS & ASSOCIATES, INC.

10-94 JN 2105

Figure 15



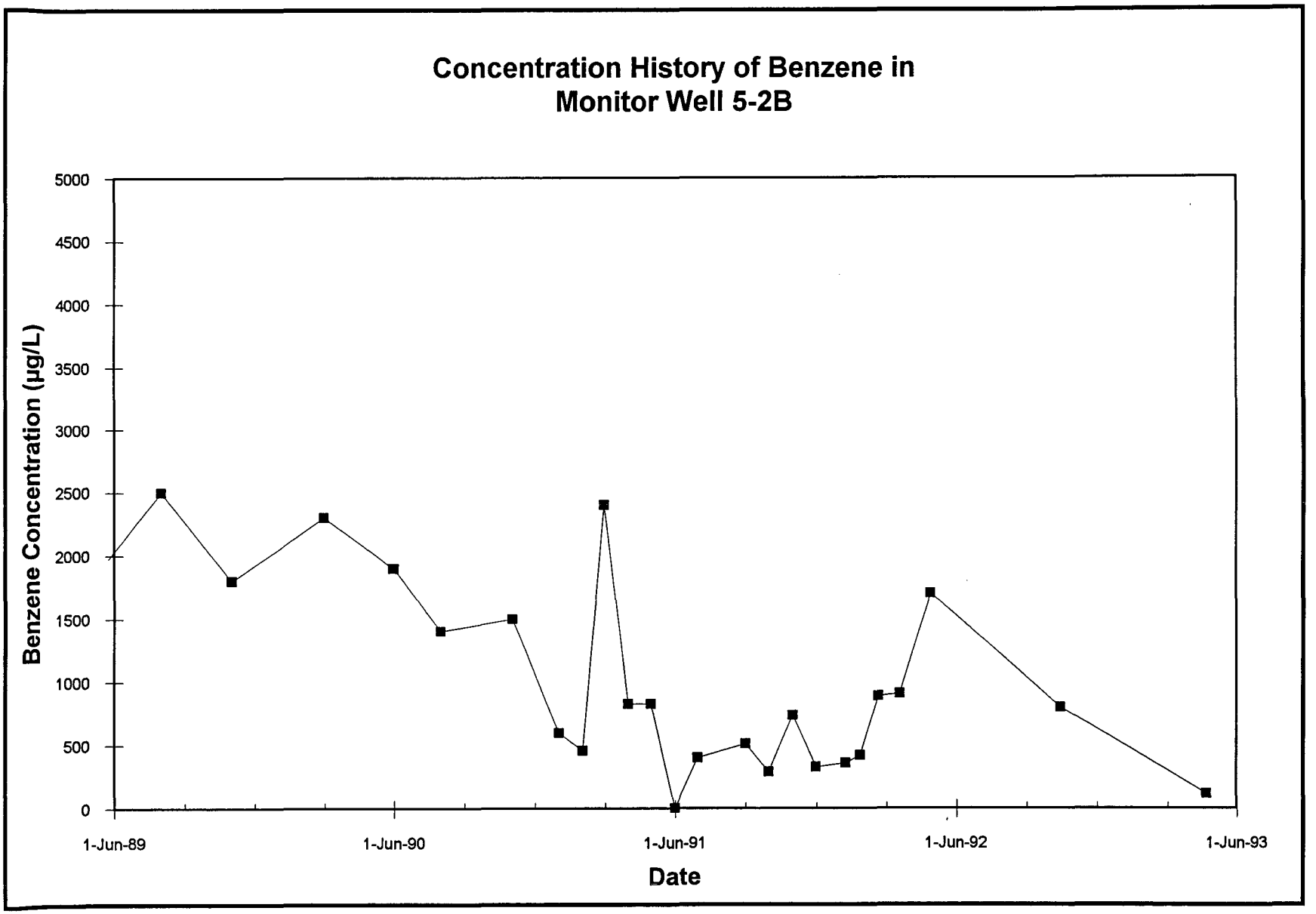
THOREAU COMPRESSOR STATION

PCB Concentrations in Ground Water

DANIEL B. STEPHENS & ASSOCIATES, INC.

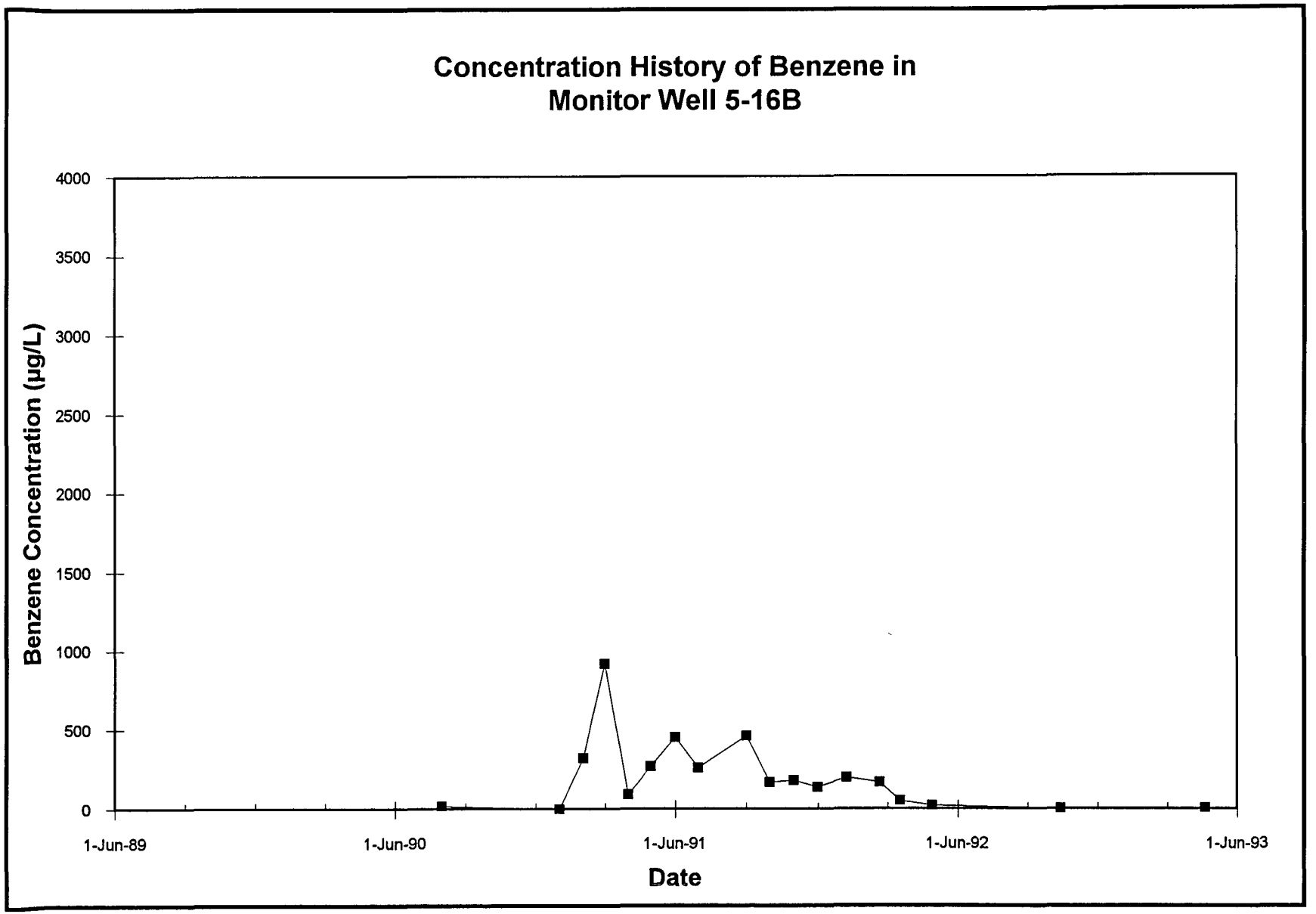
10-94 JN 2105

Figure 16



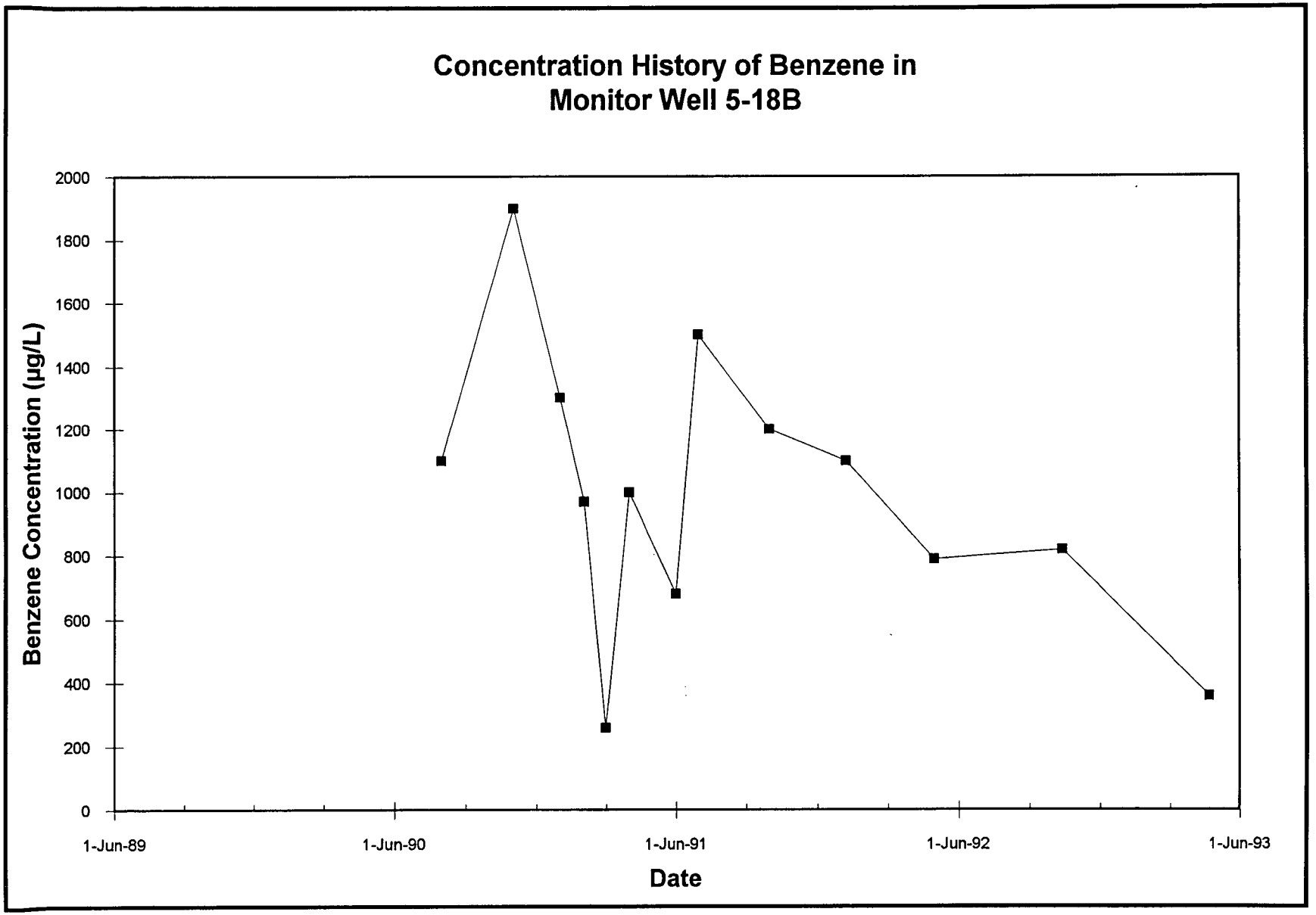
THOREAU COMPRESSOR STATION NO. 5

Figure 17



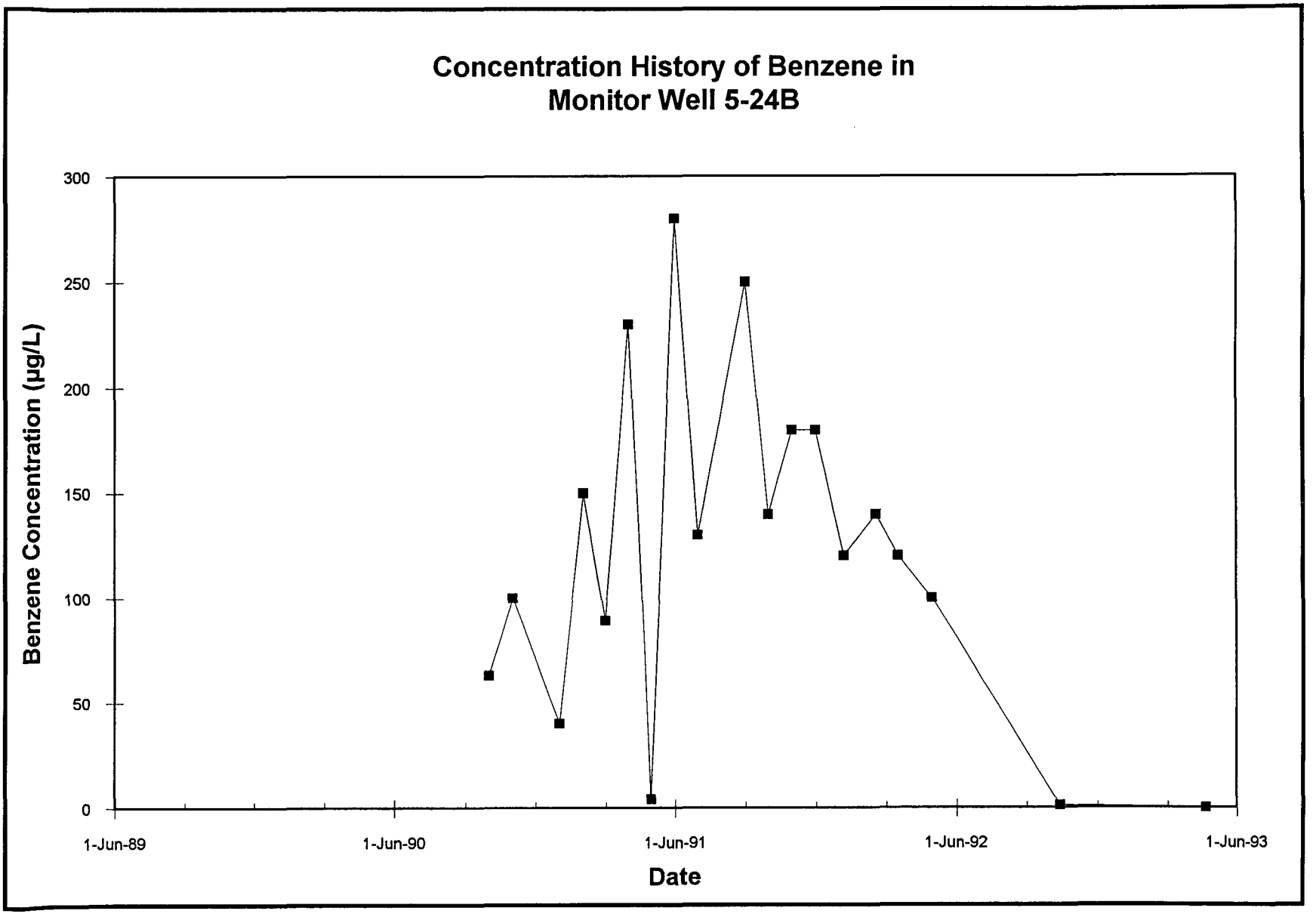
THOREAU COMPRESSOR STATION NO. 5

Figure 18



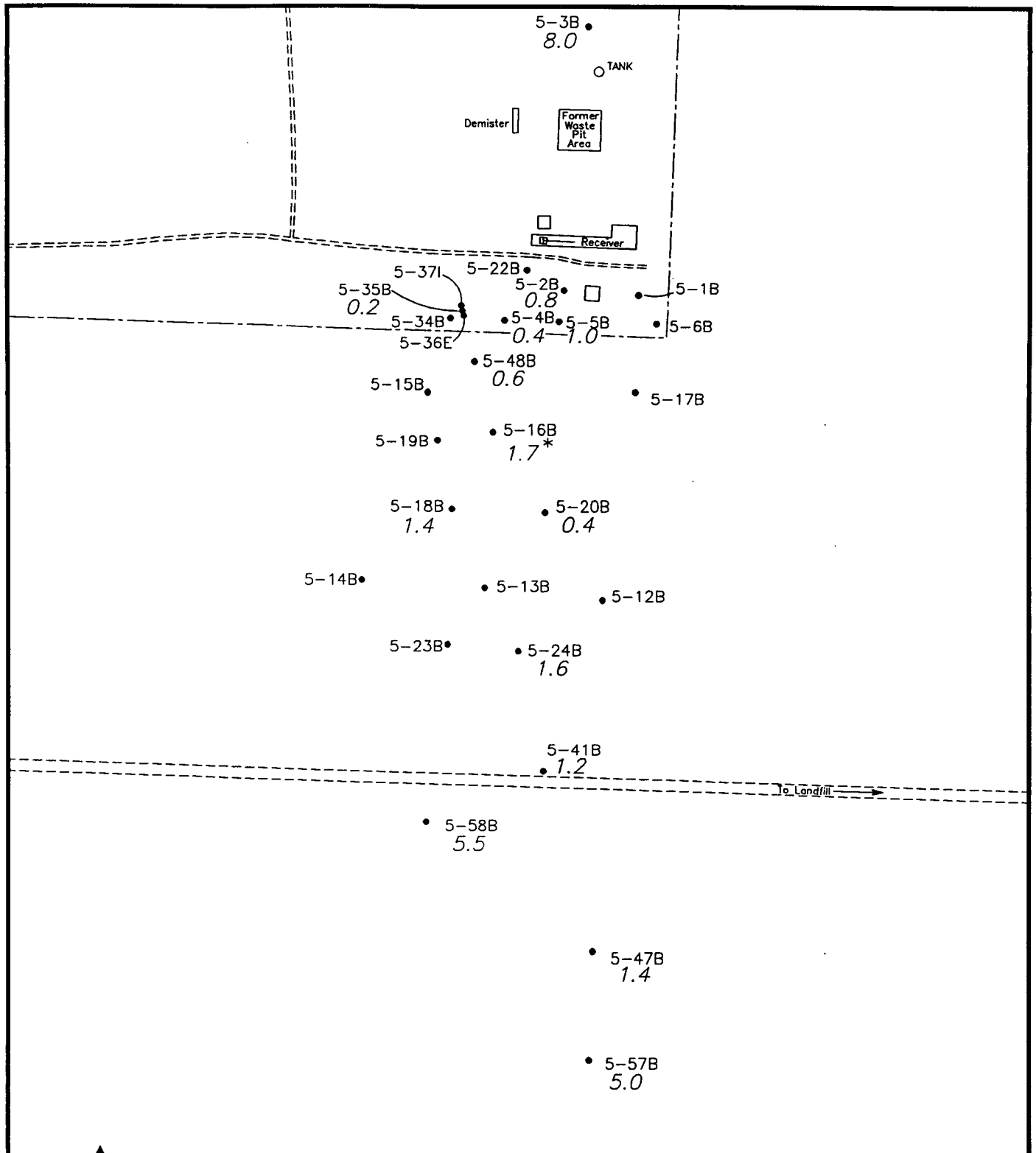
THOREAU COMPRESSOR STATION NO. 5

Figure 19



THOREAU COMPRESSOR STATION NO. 5

Figure 20



THOREAU COMPRESSOR STATION

Dissolved Oxygen Concentrations In Ground Water, April 1993

DANIEL B. STEPHENS & ASSOCIATES, INC.

10-94

JN 2105

Figure 21

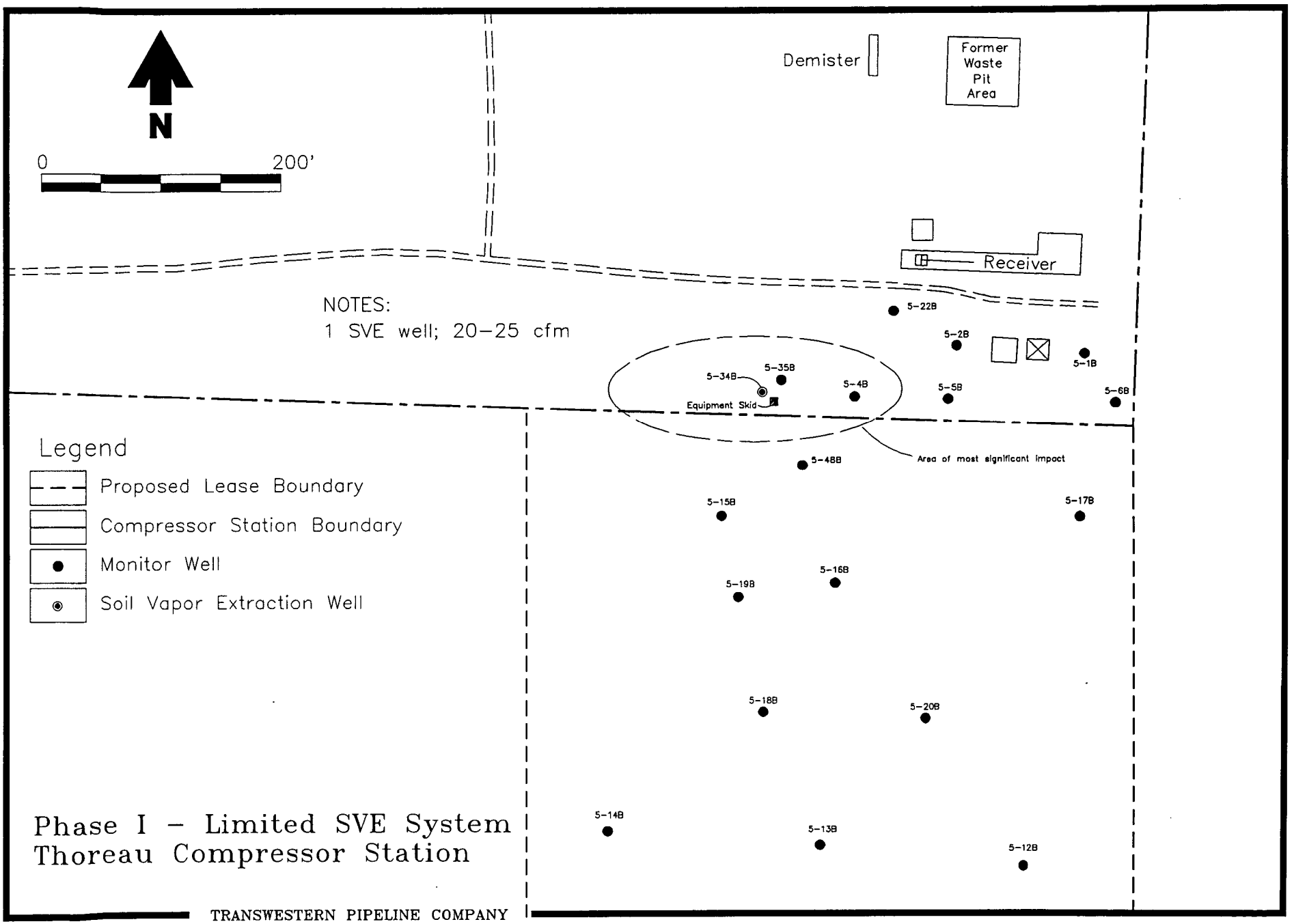

N
0
200'
Demister
Former Waste Pit Area
Receiver
NOTES:
1 SVE well; 20–25 cfm
5-22B
5-2B
5-1B
5-34B
5-35B
5-4B
5-5B
5-6B
Equipment Skid
Area of most significant impact
5-48B
5-15B
5-17B
5-16B
5-19B
5-18B
5-20B
5-14B
5-13B
5-12B
Legend
Proposed Lease Boundary
Compressor Station Boundary
Monitor Well
Soil Vapor Extraction Well
Phase I – Limited SVE System
Thoreau Compressor Station
TRANSWESTERN PIPELINE COMPANY

Figure 22

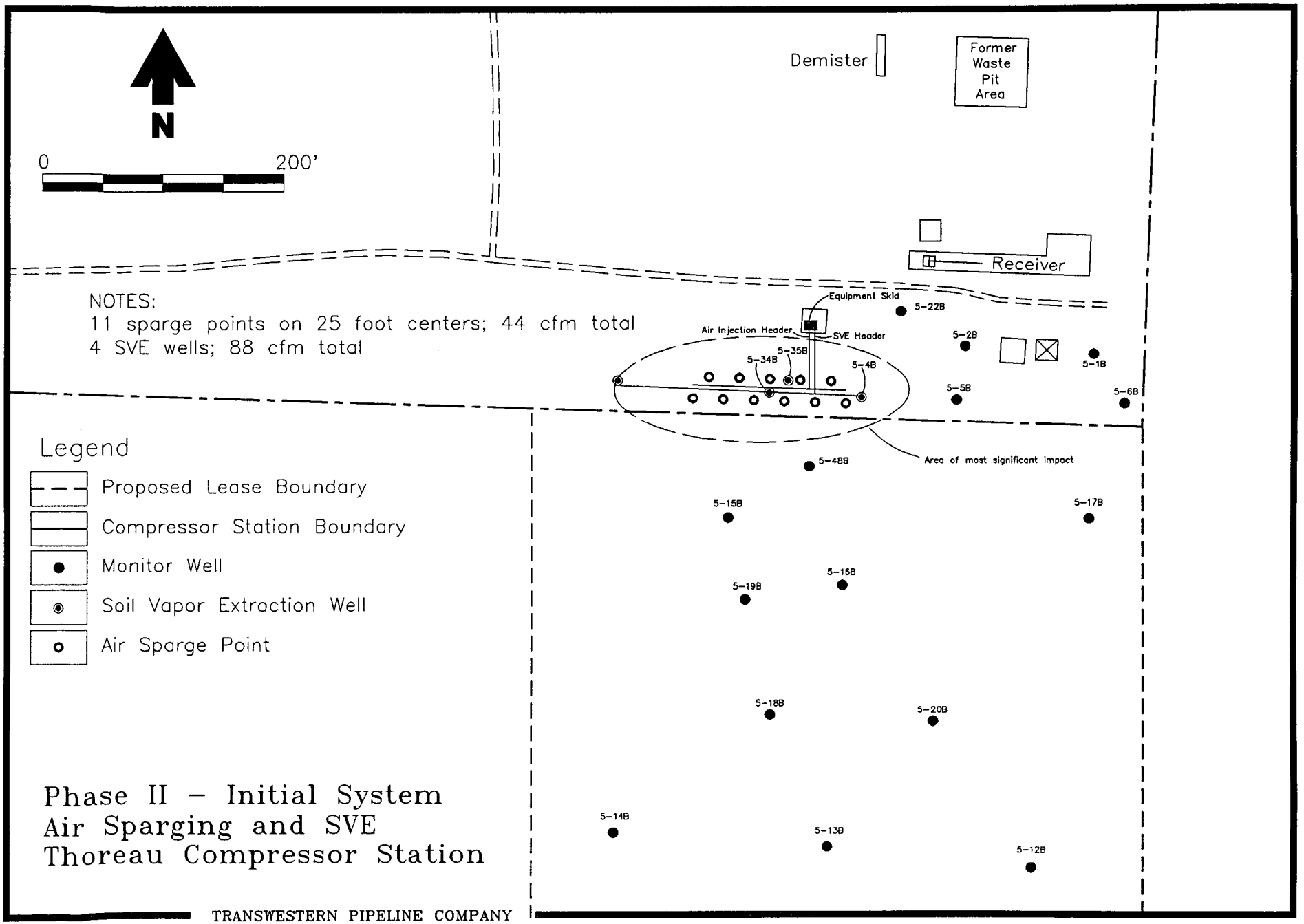
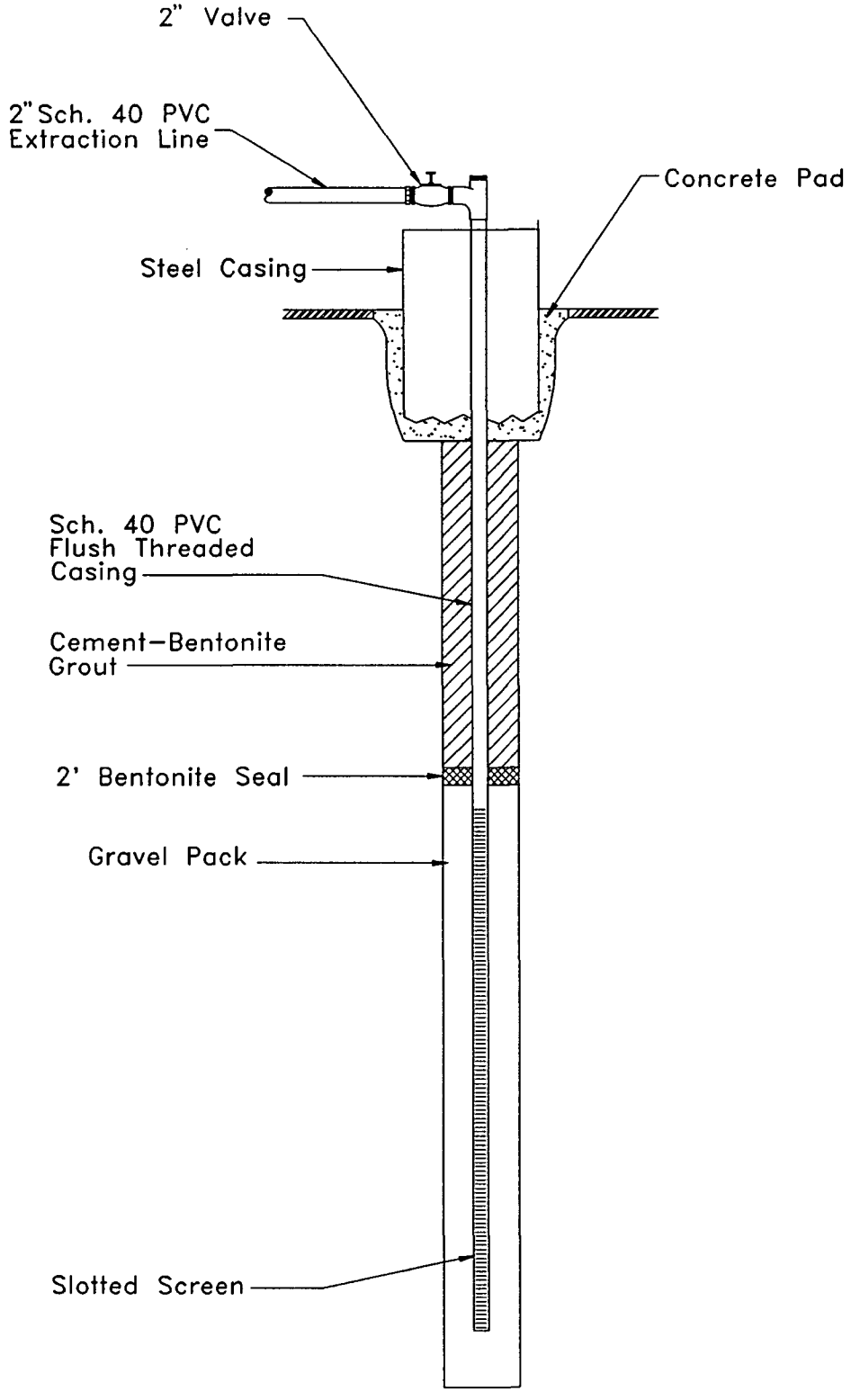

N
0
200'
Demister
Former Waste Pit Area
Receiver
NOTES:
11 sparge points on 25 foot centers; 44 cfm total
4 SVE wells; 88 cfm total
Equipment Skid
Air Injection Header
SVE Header
5-22B
5-2B
5-1B
5-34B
5-35B
5-4B
5-5B
5-6B
Area of most significant impact
5-48B
5-15B
5-17B
5-16B
5-19B
5-18B
5-20B
5-14B
5-13B
5-12B
Legend
Proposed Lease Boundary
Compressor Station Boundary
Monitor Well
Soil Vapor Extraction Well
Air Sparge Point
Phase II – Initial System
Air Sparging and SVE
Thoreau Compressor Station
TRANSWESTERN PIPELINE COMPANY

Figure 23



ENRON, THOREAU, NEW MEXICO

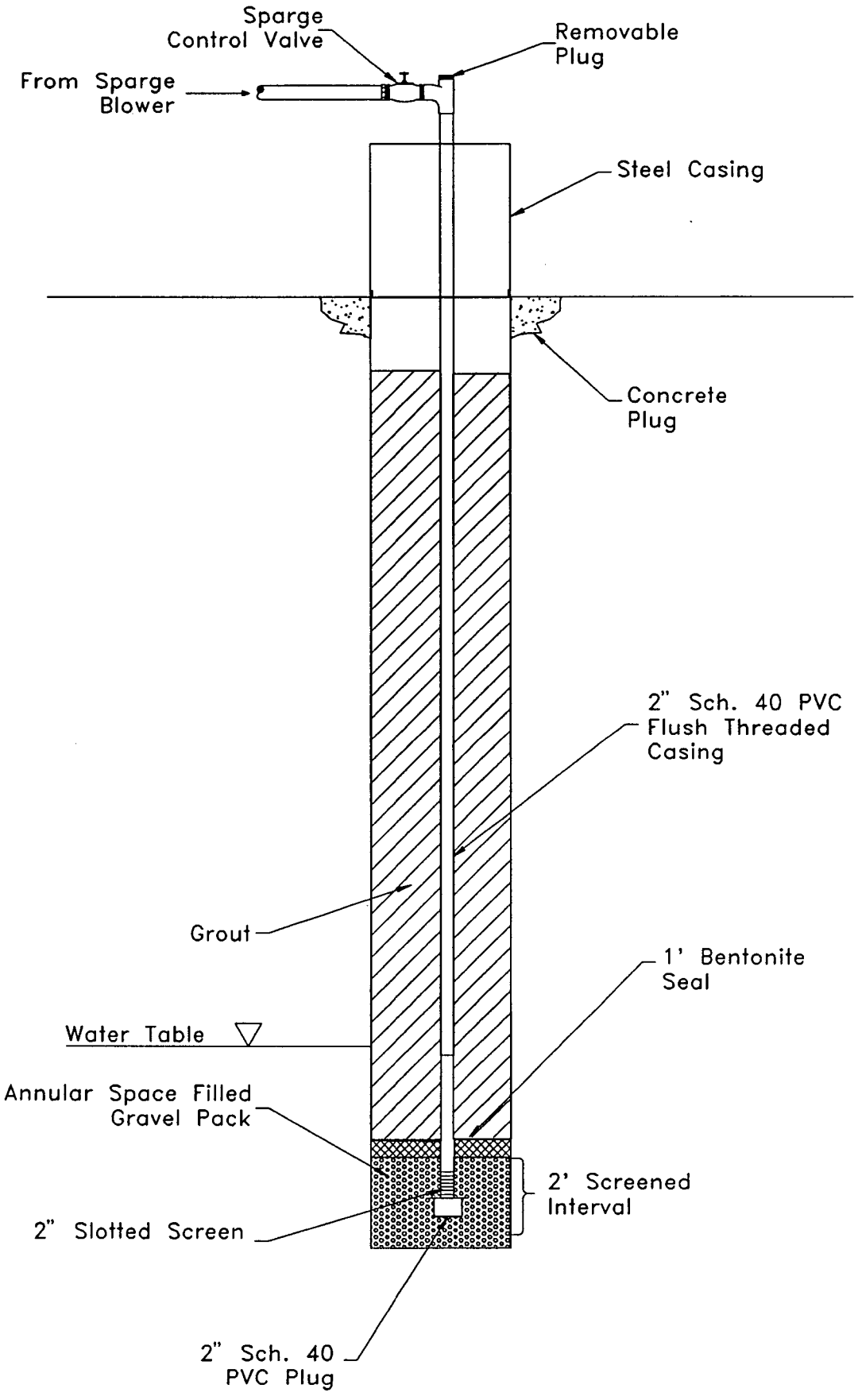
Typical Soil Vapor Extraction Well Construction

Not to Scale

DANIEL B. STEPHENS & ASSOCIATES, INC.

1-94 JN2105

Figure 24



Not to Scale

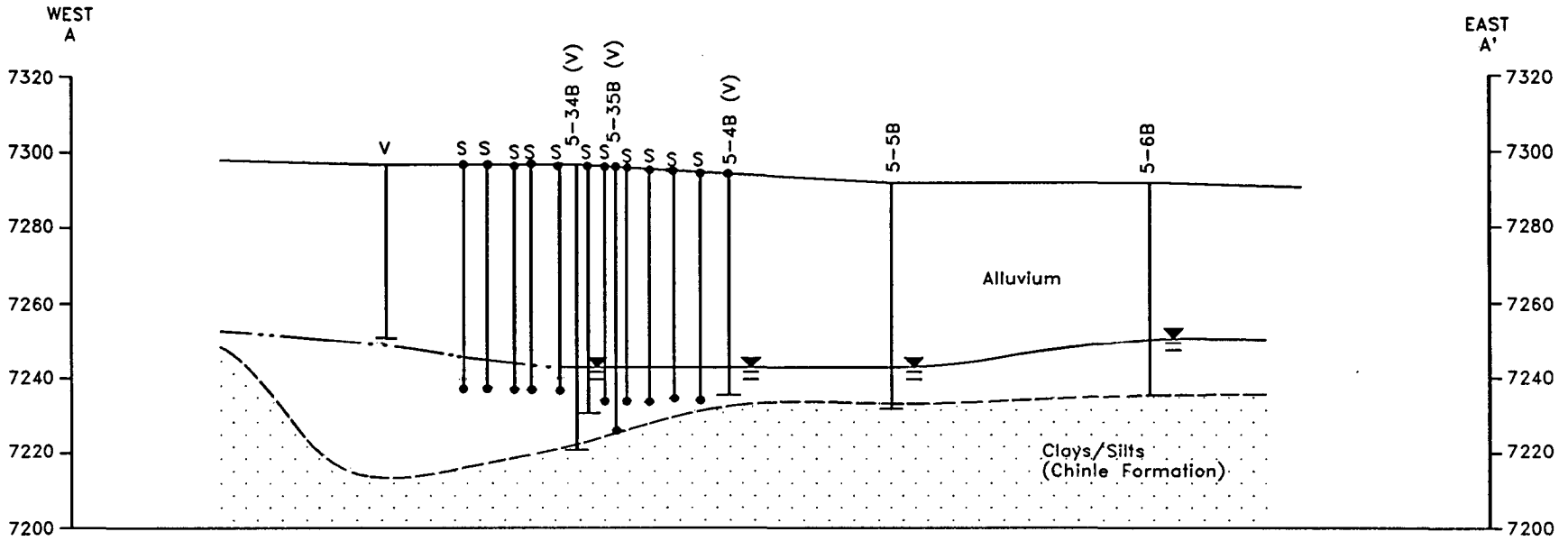
ENRON, THOREAU, NEW MEXICO

Typical Air Sparge Point Construction

DANIEL B. STEPHENS & ASSOCIATES, INC.

1-94 JN2105

Figure 25



Vertical Exaggeration 2X

April 1993 Water Level

Approximate Bedrock Surface

Approximate Water Table

S — Sparge Well (to be installed)

V — SVE Well (to be installed)

Note:
Sparge Wells to be Screened
8 to 12 ft. Below the
Water Table

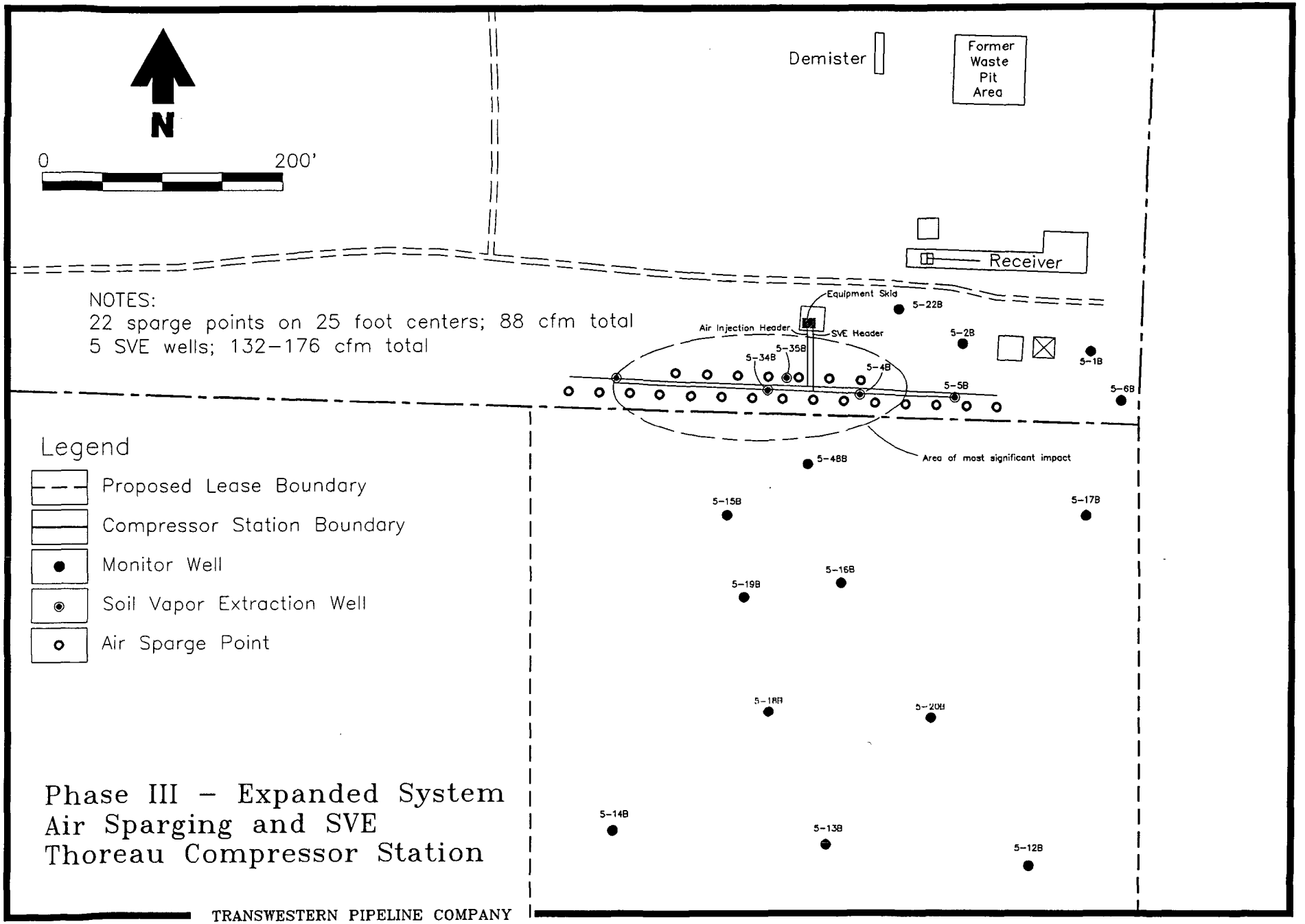
ENRON, THOREAU, NEW MEXICO

Phase II Sparge Points and SVE Wells in Cross-Section

Figure 26

DANIEL B. STEPHENS & ASSOCIATES, INC.

1/94 JN2105



Phase III – Expanded System
Air Sparging and SVE
Thoreau Compressor Station

TRANSWESTERN PIPELINE COMPANY

Figure 27

A WETLANDS STUDY

AND A THREATENED/ENDANGERED SPECIES SURVEY

FOR A PROPOSED 15-ACRE LEASE ADDITION

TO TRANSWESTERN PIPELINE'S COMPRESSOR STATION #5

AT THOREAU, NEW MEXICO

CONDUCTED FOR

ENRON OPERATIONS CORPORATION
P. O. BOX 1188
HOUSTON, TEXAS

Prepared by

Ecosphere Environmental Services

Farmington, New Mexico

NAVAJO FISH & WILDLIFE PERMIT #940406-027

APRIL 8, 1994

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INTRODUCTION

ENRON Operations Corporation (ENRON), P. O. Box 1188, Houston, Texas 77251-1188 contracted Ecosphere Environmental Services Inc. (EESI) to conduct a wetlands and threatened and endangered (T&E) species survey at Transwestern Pipeline's Thoreau Compressor Station No. 5 near Thoreau in McKinley County, New Mexico (Figure 1). ENRON has installed and has been monitoring 16 ground water monitor wells on 14.95 acres on two (2) tracts of land south of the existing Thoreau Compressor Station #5 (Figure 2). Tract #1 consists of 7.268 acres and tract #2 has 7.682 acres (Figures 3). The sites are located on Navajo lands. The surveyed area included a 10-foot buffer zone around the perimeter of the project sites.

The objectives of this Wetland and T & E species assessment are as follows:

1. Conduct a clearance survey for all species on the Federal, Navajo and State listed species of concern.

2. Assess potential impacts of the action and associated activities on these species.

3. Develop mitigation measures where appropriate.

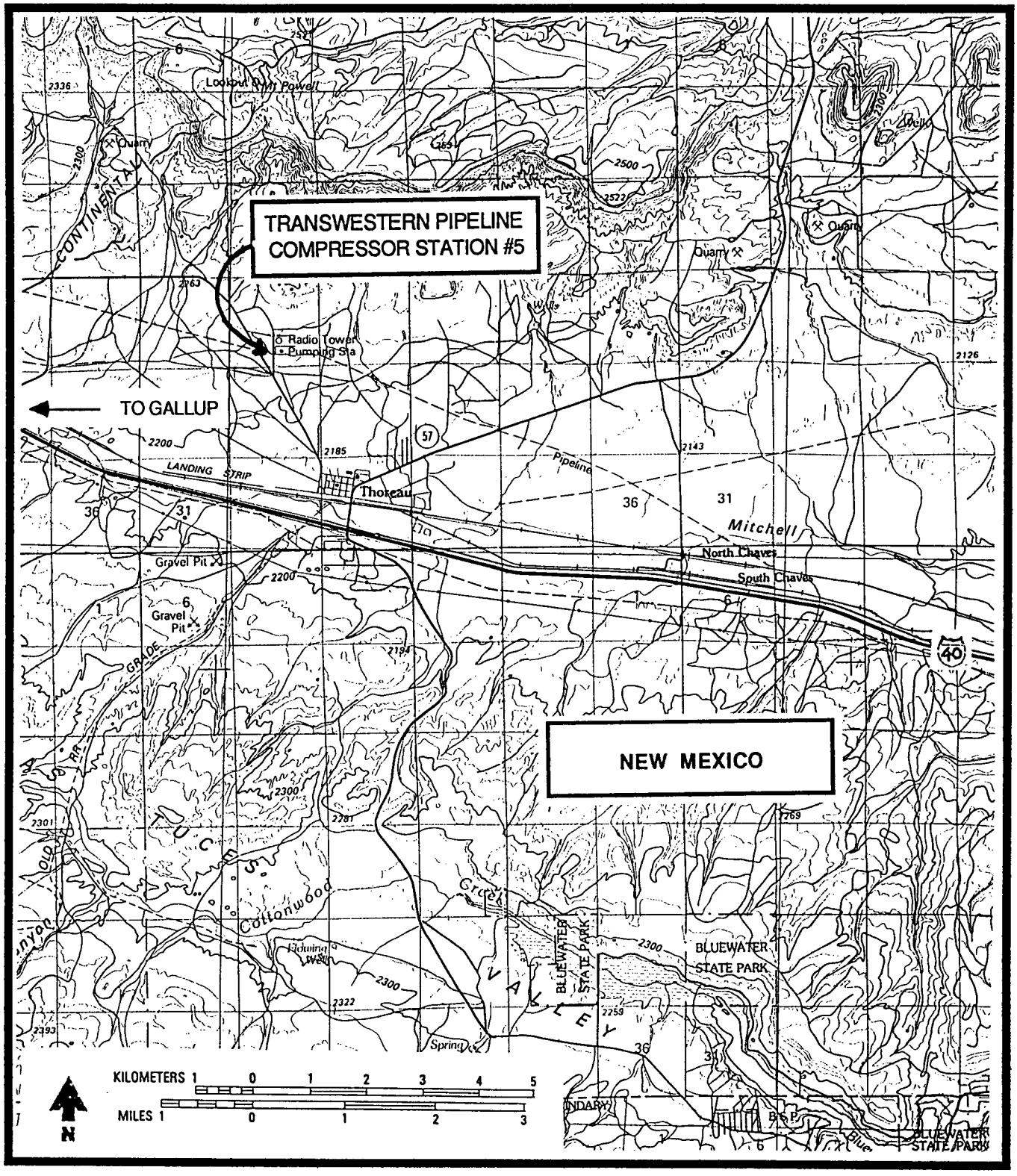
4. Make a determination of jurisdictional wetlands and waters of the United States, in accordance with Section 404 of the Clean Water Act (CWA).

LOCATION OF STUDY AREA

The proposed project area is located in T14N, R13W, S20,29 approximately 1.5 miles north of Thoreau on the Transwestern Pipeline Right-of-way. The project site is found on the Thoreau 7.5 minute quadrangle.

1:100 000 SCALE
USGS TOPOGRAPHIC MAP

ZUNI QUADRANGLE
NEW MEXICO



PROJECT LOCATION

TRANSWESTERN PIPELINE CORPORATION
THOREAU COMPRESSOR STATION

FIGURE 1
OVERVIEW MAP

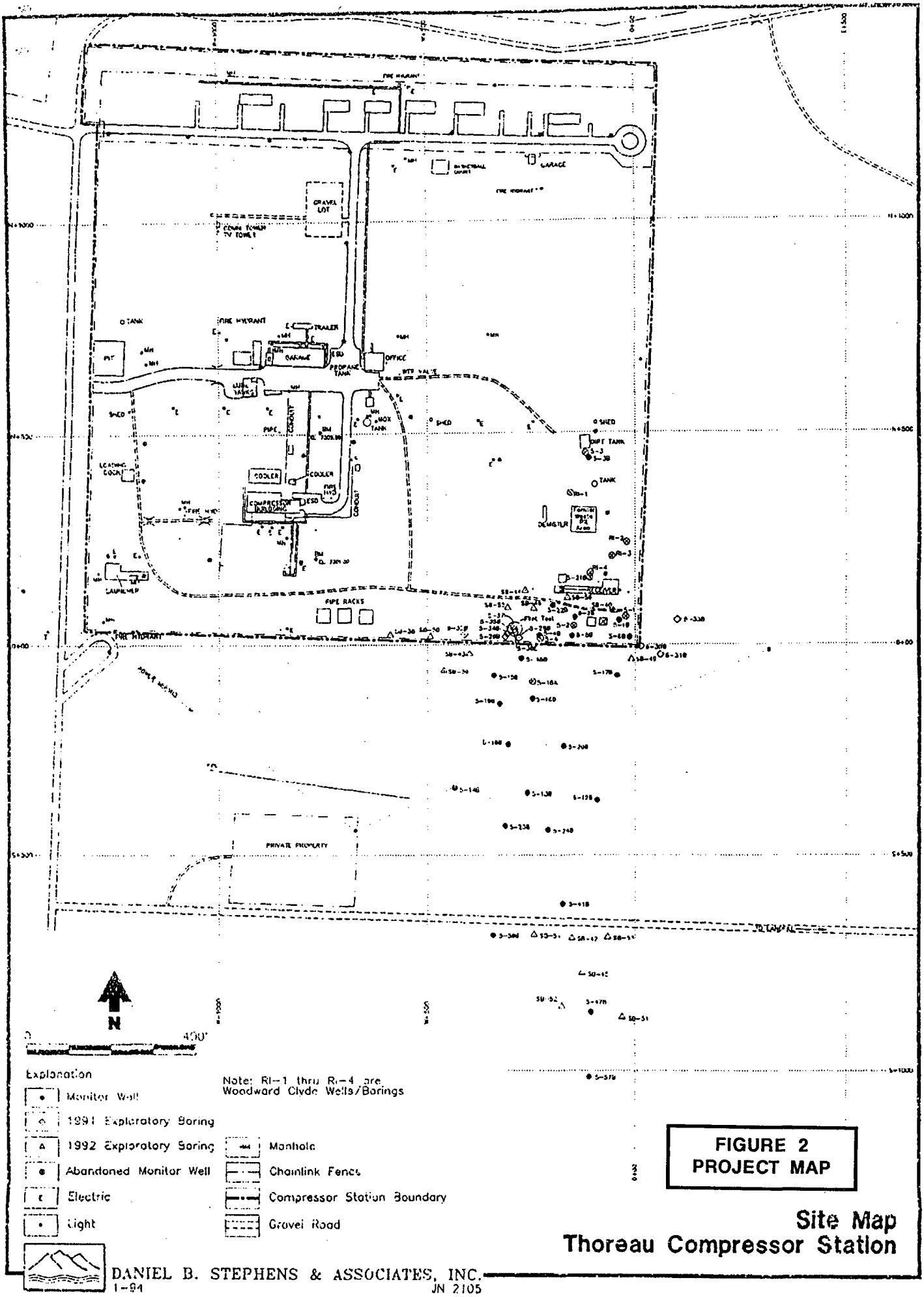
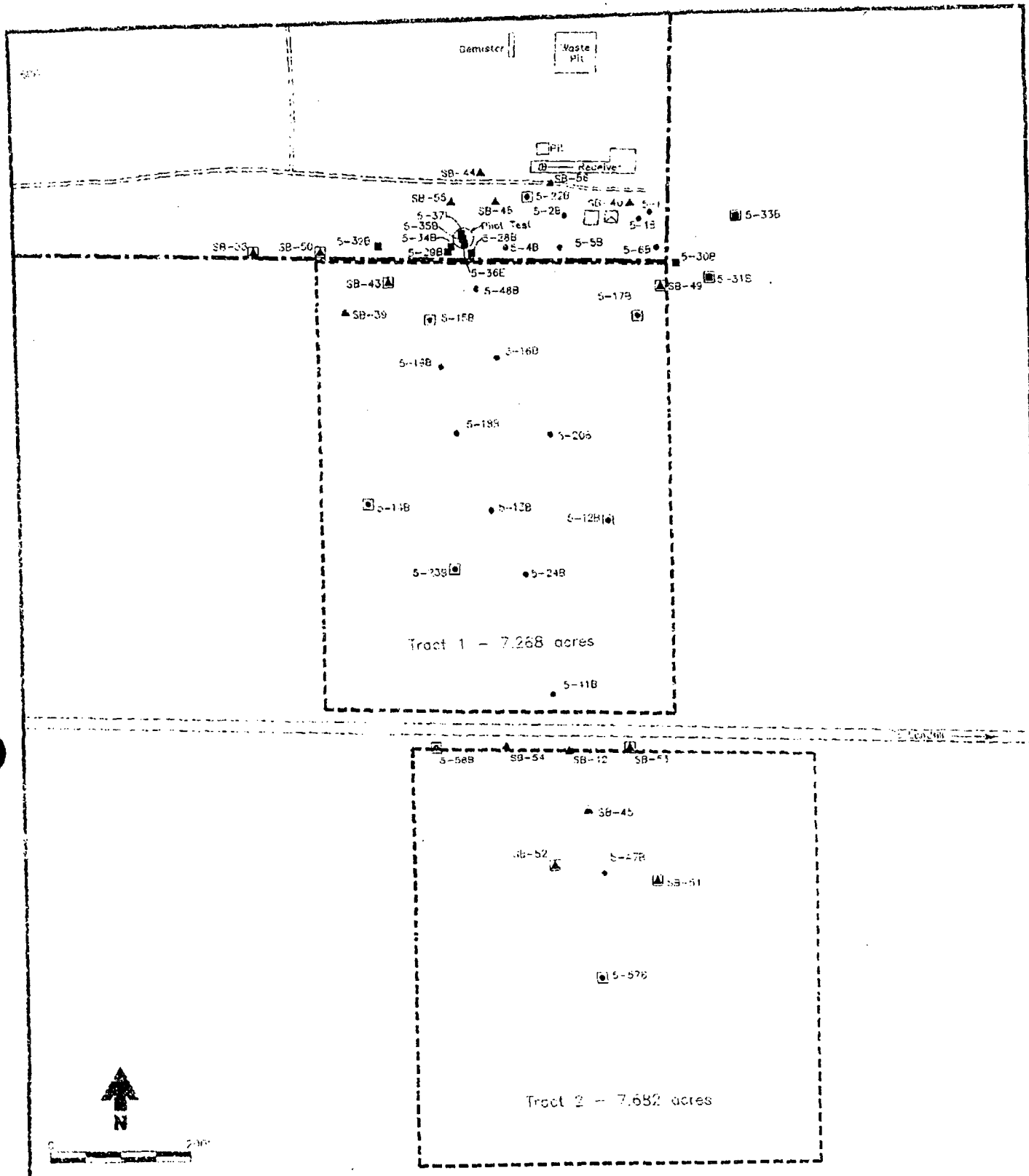


FIGURE 2
PROJECT MAP

Site Map
Thoreau Compressor Station

DANIEL B. STEPHENS & ASSOCIATES, INC.
1-94 JN 2105



Explanation

- Proposed Lease Addition
- Compressor Station Boundary
- Monitor Well
- Exploratory Boring Drilled May 1991
- Exploratory Boring Drilled July/August 1992
- Well or Boring with no Significant Level of Condensate Detected

FIGURE 3
PROJECT MAP

Proposed Lease Addition
Compressor Station No. 5

TRANSWESTERN PIPELINE COMPANY

DESCRIPTION OF STUDY AREA

The study area is relatively flat and gently slopes towards the south. No surface water or ephemeral drainages are located at the project site. The area is dominated by sandy soil eroded from the Wingate Sandstone to the north. The three criteria necessary to establish wetland presence (hydrophytic vegetation, hydric soils, wetland hydrology) were all lacking within the study area.

The project area is found within the Plains and Great Basin Grasslands Community (Brown & Lowe, 1982). The dominant plants in the area are *Pinus edulis* (Pinyon pine), *Juniperus monosperma* (One-seed Juniper) *Chrysothamnus nauseosus* (Rabbitbrush) and *Bouteloua gracilis* (Blue grama). Rabbitbrush is the dominant plant found in the southwestern corner of Tract #1 whereas pinyon-juniper dominates the north and east portions of the tract. Tract #2 has pinyon, juniper, rabbitbrush and blue gramma grass evenly distributed over its area.

A list of the plants observed during the field visit are provided below:

TREES AND SHRUBS:

Chrysothamnus greenii (Gray.) Greene. Rabbitbrush
Chrysothamnus nauseosus (Pall.) Britt. Rubber rabbitbrush
Coryphantha vivipera (Nutt.) Britt.& Rose Escobaria
Gutierrezia sarothrae (Pursh) Britt. & Rusby Broom snakeweed
Juniperus monosperma (Engelm.) Sarg. One-seed Juniper
Opuntia polyacantha Haw. Prickly pear cactus
Pinus edulis Engelm. Pinyon pine

FORBS

Astragalus sp.
Cordylanthus wrightii Gray Cordylanthus
Coynza canadensis (L.) Cronq. Horseweed
Cymopterys purpurascens (Gray) Jones Biscuitroot
Erodium cicutarium (L.) L'Her. Filare
Haplopappus spinulosus (Pursh) DC. Spiny goldenweed
Heterotheca villosa (Pursh.) Shiners. Goldenaster
Hymenoxys richardsonii (Hook.) Cockerell Actinea
Kochia scoparia (L.) Schrad. Summer cypress

Leucelene ericoides (Torr.) Green. Roseheath
Orobanche corymbosa (Rydb.) Ferris. Flat-topped broomrape
Phoradendron juniperinum Engelm. Mistletoe
Salsola iberica Sennen & Pau Russian thistle
Sisymbrium altissimum L. Tumblemustard

GRASSES

Aristida purpurea Nutt. Red three-awn
Bouteloua gracilis (H.B.K.) Lag. Blue grama
Sporobolus cryptandrus Torr. Sand dropseed
Bromus tectorum L. Cheatgrass

MATERIAL AND METHODS

A field survey of the study site was conducted on April 7, 1994 by Bob Melton of EESI. The project area was covered by walking parallel transects spaced approximately 5 meters apart throughout the project areas. All identifiable plant and animal species were recorded.

The wetland determination was accomplished by using the "routine determinations" guidelines set forth in the COE Wetlands Delineation Manual (Environmental Laboratory, 1987). The COE guidelines for the delineation of wetlands requires the presence of three criteria: hydrophytic vegetation, hydric soils, and wetland hydrology. A combination of on-site inspections and examination of reference materials such as soil maps and National Wetland Inventory (NWI) maps of the project area were used. The indicator status of vegetation was determined by using the National List of Plant Species That Occur in Wetlands Southwest, Region 7 (U.S. Fish and Wildlife Service, 1988).

SPECIES OF CONCERN

Tribal and federal status for species of concern are listed as follows: Navajo Endangered Species List (NESL), Endangered Species Act (USESA), Migratory Bird Treaty Act (MBTA), and Bald Eagle Act (BEA). Species for which the field survey were made included those known to occur or have potential to occur on or adjacent to the project site. Seven (7) species have been identified.

Astragalus accumbens Sheld. (Zuni milkvetch). Status: USESA category 3C; State Rare and Sensitive.

Astragalus micromerius Barneby (Chaco milkvetch). Status: State Rare and Sensitive.

Erigeron acomanus Spellenberg & Knight (Acoma fleabane). Status: NESL group 3; USESA C2 Candidate; State Rare and Sensitive.

Erigeron rhizomatus Cronq. (Zuni fleabane). Status: NESL group 4; USESA Threatened: State Endangered.

Erigeron sivinskii Nesom (Sivinski's fleabane). Status: NESL group 4; USESA C2 candidate; State Rare and Sensitive.

Buteo regalis (Ferruginous hawk). Status: NESL group 3; USESA C2 candidate; MBTA.

Mustela nigripes (Black-footed ferret). Status: NESL group 2; USESA endangered.

RESULTS AND CONCLUSIONS

No wetlands and none of the species of concern were found during the field survey of the above described project areas. No raptors or prairie dog burrows were found. It is the opinion of EESI that no wetlands or threatened/endangered species exist within or adjacent to the proposed project area.

Bob Melton

Bob Melton, Projects Coordinator
Ecosphere Environmental Services, Inc.

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(602) 871-7603

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P. O. Box 1480
Window Rock, Navajo Nation 86515
(602) 871-6451

APPENDIX A

NAVAJO FISH AND WILDLIFE PERMIT #940406-027

AND

NAVAJO ENDANGERED SPECIES LIST

NAVAJO FISH & WILDLIFE BRANCH
NAVAJO NATION
P.O. BOX # 1480, WINDOW ROCK, ARIZONA 86515

FISH AND WILDLIFE PERMIT # 940406-027

PERMITTEE: Charles Melton Ecosphere Env. Services 24 Road 3812 Farmington, NM 87402	AUTHORITY 17 NTC; 23 NTC NUMBER: 16 USC; 18 USC EFFECTIVE DATE: Apr. 6, 1994 EXPIRES: May 27, 1994
NAME & TITLE OF PRINCIPAL OFFICER IF BUSINESS: Charles Melton	TYPE OF PERMIT: Biological Investigation

LOCATION WHERE AUTHORIZED ACTIVITY MAY BE CONDUCTED:

Thoreau, New Mexico.

CONDITIONS AND AUTHORIZATIONS:

A. GENERAL CONDITIONS SET OUT IN FEDERAL REGULATIONS AND NAVAJO TRIBAL CODE CITED IN BLOCK ABOVE:
Are hereby made a part of this permit. All activities authorized herein must be carried out in accord with and for the purposes described in the application submitted. Continue validity or renewal of this permit is subject to complete and timely compliance with all applicable conditions including the filing of all required information and reports.

B. The validity of this permit is also conditioned upon strict observance of all applicable foreign, federal and tribal laws.

C. Valid for use by permittee named above.

D. Permit is for the purpose of gathering information for the preparation of an environmental assessment.

E. Permittee does not hold a U.S. Fish & Wildlife Service permit.

f. Collection or disturbance of plants or animals is not authorized.

FISH & WILDLIFE

[X] Additional conditions and authorizations on reverse also apply.

Reporting Requirements: One final report, along with copies of field notes, shall be submitted to the Director, Navajo Fish & Wildlife within thirty days of permit expiration.

ISSUED BY: Larry Benallie, Sr.	TITLE: Director	DATE: 4-6-94

G. Any significant findings (e.g. threatened or endangered species) shall be reported to the Navajo Fish & Wildlife office. No news releases or other public announcements shall be made concerning said significant findings without prior approval by the Director, Navajo Fish & Wildlife.

H. Permittee is authorized, upon approval by the land users, to enter onto and stay within the area for the duration of the study.

THE
NAVAJO
NATION

P. O. BOX 308 • WINDOW ROCK, ARIZONA 86515 • (602) 871-4941

PETERSON ZAH
PRESIDENT

MARSHALL PLUMMER
VICE PRESIDENT

3 March 1994

Fenley Ryther, Jr., PE, Manager of Permits
ENRON Operations Corp.
Environmental Affairs, Ste. 3AC3137
P.O. Box 1188
Houston, TX 77251
(713) 646-7327

SUBJECT: TRANSWESTERN PIPELINE COMPANY'S GROUNDWATER MONITORING WELL TRACTS NORTH OF THOREAU, NM (SECTIONS 20 & 29, T14N, R13W)

Mr. Ryther;

The following information on species of concern is provided in response to your 17 January 1994 request concerning the subject project. This information was identified by the Navajo Natural Heritage Program's biologists and computerized database, and consists of (1) species known to occur on or near the potential project site, and (2) species having the potential to occur **anywhere** on the USGS 7.5-minute quadmap containing the project boundaries.

This quad-specific species list represents a departure from the way the Natural Heritage Program previously responded to information requests. Due to the volume of requests received at this office, we are no longer able to provide project-specific species lists. Your project biologist should have the expertise to determine which of the species listed below have the potential to occur at the project site.

Furthermore, for at least the next several months, species lists will consist only of federally endangered, threatened, and category 1 candidate species, and Navajo Endangered Species List (NESL) group 2 and group 3 species. NESL group 4 species and other species with no legal protection will only be included in our responses on an irregular basis. However, we request that you continue to be on the lookout for these lower-priority species during your surveys and inform the NNHP of any observations. Documentation that these species are more numerous than currently believed contributes to ensuring that they will not be uplisted to group 2 or group 3 in the future. Please refer to the NESL for a list of group 4 species; contact me if you need a copy.

Tribal and federal status for each species is indicated as follows: Navajo Endangered Species List (NESL), Endangered Species Act (USESA), Migratory Bird Treaty Act (MBTA), and Bald Eagle Act (BEA). Information is not provided on state listing. Species included below which do not occur on any Navajo, federal, or state listing or species with only USESA candidate or NESL group 4 status have no legal protection and are included for project planning and information gathering purposes only.

Species known to occur on or near the project site include:

1. Astragalus accumbens (Zuni milk-vetch); USESA category 3C. Known from section 24, T14N, R15W.
2. Astragalus micromerius (a milk-vetch). Known from section 17, T14N, R12W.
3. Erigeron acomanus (Acoma fleabane); NESL group 3; USESA category 2 candidate. Known from sections 13 & 24, T14N, R13W.
4. Erigeron sivinskii (Sivinski's fleabane); NESL group 4; USESA category 2 candidate. Known from Sixmile Canyon, north of I-40.
5. Erigeron rhizomatus (rhizome fleabane); NESL group 4; USESA threatened. Known from several sites on the Cinizia 7.5' quad.

Additional species with potential to occur anywhere on the 7.5-minute Thoreau quadmap include:

6. Buteo regalis (ferruginous hawk); NESL group 3; USESA category 2 candidate; MBTA.
7. Mustela nigripes (black-footed ferret); NESL group 2; USESA endangered. The potential for black-footed ferret should be evaluated if prairie-dog towns of sufficient size (per Navajo Fish & Wildlife Department guidelines) occur in the project area.

Areas classified as wetlands according to the U.S. Fish & Wildlife Service's National Wetlands Inventory (NWI) maps may be present at or near this site. NWI maps must be examined to determine whether wetlands are present or absent and in cases where the maps are inconclusive due to their small scale, field surveys must be completed. When wetlands are present, potential impacts must be addressed in an environmental assessment and the Army Corps of Engineers, Phoenix office, must be contacted.

NWI maps are available for examination at the Natural Heritage office, or may be purchased through the U.S. Geological Survey (order forms are available through our office). Our office has complete coverage of the Navajo Nation, except for Utah, at 1:100,000 scale; and we have coverage at 1:24,000 scale in the southwestern part of the Navajo Nation. Also, for your information, the Navajo Nation is in the process of developing regulations regarding impacts to wetlands; therefore, the procedures for handling wetlands issues may change in the near

future.

Surveys should be conducted during the appropriate season for the species listed above. Surveyors on the Navajo Nation must be permitted by the Director, Navajo Fish & Wildlife Department. If you have questions pertaining to biological assessments, contact John Nystedt, Environmental Assessment Reviewer, Navajo Fish & Wildlife Department, at (602) 871-7060.

The information in this report is based on existing data known to the Heritage Program at this time. It should not be regarded as the final statement on the occurrence of any species of concern, nor should it substitute for on-site surveys for these species. Also, because the Heritage database is continually updated, any given information response is only wholly appropriate for its respective request.

An invoice for this information response is forthcoming from the Navajo Division of Finance.

If you have any questions I may be reached at (602) 871-7603.

Annette Polt

Annette Polt, Data Manager
Navajo Natural Heritage Program
Fish & Wildlife Department
P.O. Box 1480
Window Rock, Navajo Nation 86515

C O N C U R R E N C E

Larry Benallie, Sr., Director
Fish & Wildlife Department

xc: file/chrono
State Supervisor, USFWS, NM Ecological Services State Office

BRUCE KING
GOVERNOR

State of New Mexico
ENVIRONMENT DEPARTMENT
AIR POLLUTION CONTROL BUREAU
Harold Runnels Building
1190 St. Francis Drive, P.O. Box 26110
Santa Fe, New Mexico 87502
(505) 827-0075

JUDITH M. ESPINOSA
SECRETARY

RON CURRY
DEPUTY SECRETARY

July 25, 1994

CERTIFIED MAIL NO. Z 766 602 491
RETURN RECEIPT REQUESTED

Fenley "Ted" Ryther, Jr., P.E.
Manager, Permits Group Envr. Aff.
Transwestern Pipeline Company
P.O. Box 1188
Houston, TX 77251

Air Quality Permit No. 1507
Soil Vapor Extraction Unit
at Compressor #5

Dear Mr. Ryther:

Air Quality Permit No. 1507 is issued by the Air Pollution Control Bureau of the New Mexico Environment Department ("Department") to Transwestern Pipeline Company pursuant to the Air Quality Control Act ("Act") and regulations adopted pursuant to the Act including Air Quality Control Regulation 702, Permits ("AQCR 702") and is enforceable pursuant to the Act and the air quality control regulations applicable to this source. This permit authorizes the construction and operation of the **Soil Vapor Extraction Unit at Compressor #5** located in Township 14N, Range 13W, Section 20, approximately 2.4 miles NNW of Thoreau, New Mexico in McKinley County.

No New Source Performance Standards (NSPS) or National Emission Standards for Hazardous Air Pollutants (NESHAP) apply to this facility. During any asbestos demolition or renovation work 40 CFR 61, Subpart M would apply.

The Department has reviewed the permit application for the proposed construction and has determined that the provisions of the Act and ambient air quality standards will be met. Conditions have been imposed in this permit to assure continued compliance. AQCR 702, Part Two K.4 states that any term or condition imposed by the Department on a permit is enforceable to the same extent as a regulation of the Environmental Improvement Board. Pursuant to AQCR 702, the facility is subject to the following conditions:

CONDITIONS

1. Construction and Operation

a) The plant shall be constructed and operated in accordance with all representations in the permit application dated March 31, 1994 and received April 7, 1994, unless modified by conditions of this permit.

b) The facility shall consist of one vapor filter assembly, one water knockout assembly, one 30 gallon reservoir tank, two vacuum gauges, one vapor flowmeter and one electric 1/2 HP regenerative blower during the first phase and one electric 5 HP regenerative blower during the second and third phases.

c) This facility is authorized to operate 24 hours per day, 7 days per week, and 52 weeks per year for a total of 8760 hours per year.

d) Changes in plans, specifications, and other representations stated in the application documents shall not be made if they cause a change in the method of control of emissions or in the character of emissions, or will increase the discharge of emissions. Any such proposed changes shall be submitted as a revision or modification as provided in Revisions and Modifications of this permit.

Condition 1 has been placed in the permit in accordance with AQCR 702, Part Two K.1, which provides that the contents of the application specifically identified shall become terms and conditions of the permit, and to meet the requirements of the Air Quality Control Act.

Compliance with condition 1 will be based on Department inspections of the facility or other means to verify that the equipment specified in the permit application is installed and operated in accordance with both the application and the terms and conditions of this permit.

2. Emission Rates

a) Volatile Organic Compound Emissions

The total volatile organic compound emissions from the facility shall not exceed 6.75 pounds per hour and shall not exceed 4.3 tons per year.

Condition 2 has been placed in the permit in accordance with AQCR 702, Part Two K.1 and K.2.a(ii), which provides that the contents of the application and the emission rates specifically identified shall become terms and conditions of the permit, and in accordance with the requirements of the Air Quality Control Act.

Compliance with condition 2 will be based on Department inspections of the facility and appropriate compliance tests.

3. Performance Test Methods

An initial performance test is required on the soil vapor extraction unit. The test will measure the total gaseous organic concentration by using a flame ionization analyzer. Compliance tests may be reimposed if Department inspections indicate possible noncompliance with permit conditions subject to such testing, or noncompliance during the initial compliance or subsequent compliance tests, or if the tests were technically unsatisfactory.

The tests shall be conducted within thirty (30) days after startup of the Phase I operation. The test must be conducted during Phase I of the operation.

The tests shall be conducted in accordance with EPA Reference Methods 1-4, and 25(A-B) contained in the Code of Federal Regulations, Title 40, Part 60, Appendix A, and with the requirements of Subpart A, General Provisions, 60.8(f).

The Department shall be notified of the date and time of the compliance testing at least thirty (30) days prior to the anticipated test date so that the Department may have the opportunity to have an observer present during testing. The permittee shall arrange a pre-test meeting with the Department at least thirty (30) days prior to the anticipated test date and shall observe the following pre-testing and testing procedure:

a) The permittee shall provide for the Department's approval a written test protocol at least one (1) week prior to the anticipated pre-test meeting date. The protocol shall describe the test methods to be used (including sampling methods and calibration procedures), shall list the equipment or devices to be tested (including sample locations), and shall describe data reduction procedures. Any variation from established sampling and analytical procedures or from facility operating conditions shall be presented for Department approval.

b) The test protocol and performance test report shall conform to the standard format specified by the Department. The latest version of the format may be obtained from the Surveillance and Enforcement Section of the Air Pollution Control Bureau.

c) The permittee shall provide (a) sampling ports adequate for the test methods applicable to the facility, (b) safe sampling platforms, (c) safe access to sampling platforms and (d) utilities for sampling and testing equipment.

e) During performance tests, vacuum suction, blower discharge pressures, suction volume rate, and horsepower output, shall be monitored and recorded. This information shall be included with the test report that is required to be furnished to the Department.

g) The tests shall be conducted at 90% of full suction volume rate or greater, and at additional suction volume rates as specified by Department personnel at the time of the test or pre-test meeting.

h) Two copies of the performance test report shall be submitted to the Department within thirty (30) days after completion of testing. One copy shall be sent to the Technical Analysis and Permit Section and one to the Surveillance and Enforcement Section.

Condition 3 has been placed in the permit in accordance with AQCR 702, Part Two, Section N.

Compliance with Condition 3 will be based on satisfactory completion of the compliance tests and submittal of the results to the Department within the time periods specified.

4. Revisions and Modifications

Any future physical changes or changes in the method of operation may constitute a modification as defined by AQCR 702, Permits, and shall be preceded by the submittal of a permit application for review by the Department. No modification shall begin prior to issuance of a permit.

Modifications or revisions to this permit shall be processed in accordance with AQCR 702.

Condition 4 has been placed in the permit in accordance with AQCR 702, Part Two A.1.a.(ii), A.4, and K.2.d to enable the Department to review proposed changes to the facility which may constitute a permit modification prior to such changes.

Compliance with condition 4 will be based on Department inspections of the facility and the submittal of appropriate application for permit modifications or revisions.

5. Notification to Subsequent Owners

The permit and conditions apply in the event of any change in control or ownership of the facility. No permit modification is required in such case. However, in the event of any such change in control or ownership, the permittee shall notify the succeeding owner of the permit and conditions and shall notify the Department of the change in ownership within fifteen (15) days of that change.

Condition 5 has been placed in the permit in accordance with AQCR 702, Part One 19(1), Part Two K.2.d and M.3 to ensure that new owners are aware of the permit and its conditions.

Compliance with condition 5 will be based on the permittee's notification of the permit and its conditions to any succeeding owner and the Department.

6. Right to Access Property and Review Records

The Department shall be given the right to enter the facility at all reasonable times to verify the terms and conditions of this permit. The company, upon either a verbal or written request from an authorized representative of the Department, shall produce any records or information necessary to establish that the terms and conditions of this permit are being met.

Condition 6 has been placed in the permit in accordance with AQCR 702, Part Two K.2.d and K.5 and AQCR 703.1, Part Two D to allow the Department to determine compliance with the terms and conditions of the permit.

Compliance with condition 6 will be based on Department inspections of the facility, production of records and information required to be maintained, and non-restricted entry to the property.

7. Posting of the Permit

A copy of this permit shall be posted and in view at the plant site at all times and shall be made available to Department personnel for inspection upon request.

Condition 7 has been placed in the permit in accordance with AQCR 702, Part Two K.2.d to allow Department personnel to identify the

equipment that constitutes the plant and to identify the permit conditions that apply to the facility.

Compliance with condition 7 will be based on Department inspections of the facility which show that a copy of the permit has been posted.

8. Reporting

The permittee shall notify the Surveillance & Enforcement Section, Air Pollution Control Bureau in writing of:

a) the anticipated date of initial startup of each new or modified source not less than thirty (30) days prior to the date;

b) the equipment serial number and the actual date of initial startup of each new or modified source within fifteen (15) days after the startup date;

c) the date when each new or modified emission source reaches the maximum production rate at which it will operate within fifteen (15) days after that date;

d) any change of operators within fifteen (15) days of such change;

e) any necessary update or correction no more than sixty (60) days after the operator knows or should have known of the condition necessitating the update or correction of the permit.

Condition 8 has been placed in the permit in accordance with AQCR 702, Part Two K.2 and K.5, and Part Two M to allow the Department to determine compliance with the terms and conditions of the permit.

Compliance with condition 8 will be based upon the timely submittal of the required reports.

ADDITIONAL REQUIREMENTS

AQCR 702, Part Two L, Permit Cancellations, requires that:

1. the Department shall automatically cancel any permit for any source which ceases operation for five (5) years or more, or permanently. Reactivation of any source after the five (5) year period shall require a new permit.

2. the Department may cancel a permit if the construction or modification is not commenced within two (2) years from the date of issuance or if, during the construction or modification, work is suspended for a total of one (1) year.

AQCR 703.1 contains requirements related to Notice of Intent and Emission Inventory. Please refer to that regulation for details. Compliance test results and applications for permit revisions and modifications shall be submitted to:

Program Manager, Technical Analysis and Permit Section
New Mexico Environment Department
Air Pollution Control Bureau
1190 St. Francis Drive, Runnels Bldg.
P.O. Box 26110
Santa Fe, New Mexico 87502

Compliance test protocols, test notifications, the second copy of test results, excess emission reports, and all other compliance related information shall be submitted to:

Program Manager, Surveillance and Enforcement Section
New Mexico Environment Department
Air Pollution Control Bureau
1190 St. Francis Drive, Runnels Bldg.
P.O. Box 26110
Santa Fe, New Mexico 87502

REVOCATION

The Department may revoke this permit if the applicant or permittee has knowingly and willfully misrepresented a material fact in the application for the permit. Revocation will be made in writing, and an administrative appeal may be taken to the Secretary of the Department within thirty (30) days. Appeals will be handled in accordance with the Department's Rules Governing Appeals From Compliance Orders.

APPEAL PROCEDURES

The New Mexico Air Quality Control Regulation 702, Part Two, Section H provides that any person who participated in a permitting action before the Department and who is adversely affected by such permitting action, may file a petition for hearing before the Environmental Improvement Board. The petition shall be made in writing to the Environmental Improvement Board within thirty (30) days from the date notice is given of the Department's action and shall specify the portions of the permitting action to which the petitioner objects, certify that a copy of the petition has been

mailed or hand-delivered and attach a copy of the permitting action for which review is sought. Unless a timely request for hearing is made, the decision of the Department shall be final. The petition shall be copied simultaneously to the Department upon receipt of the appeal notice. If the petitioner is not the applicant or permittee, the petitioner shall mail or hand-deliver a copy of the petition to the applicant or permittee. The Department shall certify the administrative record to the board. Petitions for a hearing shall be sent to:

Environmental Improvement Board
1190 St. Francis Drive, Runnels Bldg.
P.O. Box 26110
Santa Fe, New Mexico 87502

If you have questions about this permit please call Daren K. Zigich of the Technical Analysis and Permits Section in Santa Fe at (505) 827-0070.

Sincerely,

Bill Blankenship
Bureau Chief
Air Pollution Control Bureau

DZ

xc: Joseph Winkler, Environmental Supervisor, Gallup

Sample Medium	**Water**	**Water**	**Water**
Sample ID	**5-01B**	**5-01B**	**5-01B**
Sample or Screen Depth (ft bgs)	**38.0-51.5**	**38.0-51.5**	**38.0-51.5**
Date Collected	**10/92**	**04/92**	**03/92**
Units	**µg/L**	**µg/L**	**µg/L**
Blanks or Duplicates			

Chemical	RL	Concentration	Qualifier	RL	Concentration	Qualifier	RL	Concentration	Qualifier	Geometric Mean	Highest RL
Benzene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Ethylbenzene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Toluene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Xylenes (Total)	0.5	4.7		0.5	2.3		0.5	3.3		3.3	0.5
Aroclor 1016	5.0	5.0	U	0.5	0.5	U	2.5	2.5	U	1.8	5.0
Aroclor 1221	5.0	82		0.5	71		2.5	54		68.0	5.0
Aroclor 1242	5.0	5.0	U	0.5	0.5	U	2.5	2.5	U	1.8	5.0
Aroclor 1248	5.0	5.0	U	0.5	0.5	U	2.5	2.5	U	1.8	5.0
Aroclor 1254	5.0	5.0	U	0.5	0.5	U	2.5	2.5	U	1.8	5.0

RL = Reporting Limit
Qualifier "U" = Compound was analyzed for but not detected
Qualifier "Q" = No analytical result
Geometric mean calculated based on last 3 sampling events

Sample Medium	**Water**	**Water**	**Water**
Sample ID	**5-02B**	**5-02B**	**5-02B**
Sample or Screen Depth (ft bgs)	**37.5-51.0**	**37.5-51.0**	**37.5-51.0**
Date Collected	**04/93**	**10/92**	**04/92**
Units	**µg/L**	**µg/L**	**µg/L**
Blanks or Duplicates			

Chemical	RL	Concentration	Qualifier	RL	Concentration	Qualifier	RL	Concentration	Qualifier	Geometric Mean	Highest RL
Benzene	2.5	120		5.0	800		125	1700		546.5	125
Ethylbenzene	0.5	11		2.5	74		125	240		58.0	125
Toluene	0.5	0.5	U	5.0	700		125	3800		110.0	125
Xylenes (Total)	0.5	38		2.5	640		125	2200		376.8	125
Aroclor 1016			Q			Q	25	25	U	25.0	25
Aroclor 1221			Q			Q	25	25	U	25.0	25
Aroclor 1242			Q			Q	25	25	U	25.0	25
Aroclor 1248			Q			Q	25	25	U	25.0	25
Aroclor 1254			Q			Q	25	25	U	25.0	25

RL = Reporting Limit
Qualifier "U" = Compound was analyzed for but not detected
Qualifier "Q" = No analytical result
Geometric mean calculated based on last 3 sampling events

Sample Medium	**Water**	**Water**	**Water**
Sample ID	**5-03B**	**5-03B**	**5-03B**
Sample or Screen Depth (ft bgs)	**41.0-54.5**	**41.0-54.5**	**41.0-54.5**
Date Collected	**10/92**	**04/92**	**03/92**
Units	**µg/L**	**µg/L**	**µg/L**
Blanks or Duplicates			

Chemical	RL	Concentration	Qualifier	RL	Concentration	Qualifier	RL	Concentration	Qualifier	Geometric Mean	Highest RL
Benzene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Ethylbenzene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Toluene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Xylenes (Total)	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Aroclor 1016			Q	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Aroclor 1221			Q	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Aroclor 1242			Q	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Aroclor 1248			Q	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Aroclor 1254			Q	0.5	0.5	U	0.5	0.5	U	0.5	0.5

RL = Reporting Limit
Qualifier "U" = Compound was analyzed for but not detected
Qualifier "Q" = No analytical result
Geometric mean calculated based on last 3 sampling events

Sample Medium	**Water**	**Water**	**Water**
Sample ID	**5-04B**	**5-04B**	**5-04B**
Sample or Screen Depth (ft bgs)	**38.7-57.2**	**38.7-57.2**	**38.7-57.2**
Date Collected	**04/93**	**10/92**	**04/92**
Units	**µg/L**	**µg/L**	**µg/L**
Blanks or Duplicates			

Chemical	RL	Concentration	Qualifier	RL	Concentration	Qualifier	RL	Concentration	Qualifier	Geometric Mean	Highest RL
Benzene	5.0	170		2.0	230		2.5	86		149.8	5.0
Ethylbenzene	5.0	26		2.0	19		2.5	60		30.9	5.0
Toluene	5.0	130		2.0	40		2.5	80		74.7	5.0
Xylenes (Total)	25	280		2.0	260		2.5	570		346.2	25
Aroclor 1016			Q			Q	0.5	0.5	U	0.5	0.5
Aroclor 1221			Q			Q	0.5	0.5	U	0.5	0.5
Aroclor 1242			Q			Q	0.5	0.5	U	0.5	0.5
Aroclor 1248			Q			Q	0.5	0.5	U	0.5	0.5
Aroclor 1254			Q			Q	0.5	0.5	U	0.5	0.5

RL = Reporting Limit
Qualifier "U" = Compound was analyzed for but not detected
Qualifier "Q" = No analytical result
Geometric mean calculated based on last 3 sampling events

Sample Medium	Water	Water	Water
Sample ID	5-05B	5-05B	5-05B
Sample or Screen Depth (ft bgs)	39.5-58.0	39.5-58.0	39.5-58.0
Date Collected	04/93	10/92	04/92
Units	µg/L	µg/L	µg/L
Blanks or Duplicates			

Chemical	RL	Concentration	Qualifier	RL	Concentration	Qualifier	RL	Concentration	Qualifier	Geometric Mean	Highest RL
Benzene	0.5	38		5.0	770		0.5	0.5	U	24.5	5.0
Ethylbenzene	0.5	2.4		5.0	25		0.5	0.5	U	3.1	5.0
Toluene	0.5	0.5	U	5.0	110		0.5	0.5	U	3.0	5.0
Xylenes (Total)	0.5	3.0		5.0	160		0.5	0.5	U	6.2	5.0
Aroclor 1016			Q			Q	0.5	0.5	U	0.5	0.5
Aroclor 1221			Q			Q	0.5	0.5	U	0.5	0.5
Aroclor 1242			Q			Q	0.5	0.5	U	0.5	0.5
Aroclor 1248			Q			Q	0.5	0.5	U	0.5	0.5
Aroclor 1254			Q			Q	0.5	0.5	U	0.5	0.5

RL = Reporting Limit
Qualifier "U" = Compound was analyzed for but not detected
Qualifier "Q" = No analytical result
Geometric mean calculated based on last 3 sampling events

Sample Medium	Water	Water	Water
Sample ID	5-06B	5-06B	5-06B
Sample or Screen Depth (ft bgs)	37.5-56.0	37.5-56.0	37.5-56.0
Date Collected	10/92	04/92	03/92
Units	µg/L	µg/L	µg/L
Blanks or Duplicates			

Chemical	RL	Concentration	Qualifier	RL	Concentration	Qualifier	RL	Concentration	Qualifier	Geometric Mean	Highest RL
Benzene	0.5	1.0		0.5	1.4		0.5	0.9		1.1	0.5
Ethylbenzene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Toluene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Xylenes (Total)	0.5	2.8		0.5	3.6		0.5	2.3		2.9	0.5
Aroclor 1016	5.0	5.0	U	0.5	0.5	U	2.5	2.5	U	1.8	5.0
Aroclor 1221	5.0	280		0.5	150		2.5	140		180.5	5.0
Aroclor 1242	5.0	5.0	U	0.5	0.5	U	2.5	2.5	U	1.8	5.0
Aroclor 1248	5.0	5.0	U	0.5	0.5	U	2.5	2.5	U	1.8	5.0
Aroclor 1254	5.0	5.0	U	0.5	0.5	U	2.5	2.5	U	1.8	5.0

RL = Reporting Limit
Qualifier "U" = Compound was analyzed for but not detected
Qualifier "Q" = No analytical result
Geometric mean calculated based on last 3 sampling events

Sample Medium	**Water**	**Water**	**Water**
Sample ID	**5-12B**	**5-12B**	**5-12B**
Sample or Screen Depth (ft bgs)	**45.0-65.0**	**45.0-65.0**	**45.0-65.0**
Date Collected	**10/92**	**04/92**	**01/92**
Units	**µg/L**	**µg/L**	**µg/L**
Blanks or Duplicates			

Chemical	RL	Concentration	Qualifier	RL	Concentration	Qualifier	RL	Concentration	Qualifier	Geometric Mean	Highest RL
Benzene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Ethylbenzene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Toluene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Xylenes (Total)	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Aroclor 1016			Q			Q			Q	--	--
Aroclor 1221			Q			Q			Q	--	--
Aroclor 1242			Q			Q			Q	--	--
Aroclor 1248			Q			Q			Q	--	--
Aroclor 1254			Q			Q			Q	--	--

RL = Reporting Limit
Qualifier "U" = Compound was analyzed for but not detected
Qualifier "Q" = No analytical result
Geometric mean calculated based on last 3 sampling events

Sample Medium	Water	Water	Water
Sample ID	5-13B	5-13B	5-13B
Sample or Screen Depth (ft bgs)	49.3-69.4	49.3-69.4	49.3-69.4
Date Collected	10/92	05/92	01/92
Units	µg/L	µg/L	µg/L
Blanks or Duplicates			

Chemical	RL	Concentration	Qualifier	RL	Concentration	Qualifier	RL	Concentration	Qualifier	Geometric Mean	Highest RL
Benzene	0.5	88		0.5	76		25	150		100.1	25
Ethylbenzene	0.5	0.5	U	0.5	0.5	U	25	25	U	1.8	25
Toluene	0.5	8.7		0.5	8.0		25	25	U	12.0	25
Xylenes (Total)	0.5	1.5		0.5	67		25	570		38.5	25
Aroclor 1016			Q			Q			Q	--	--
Aroclor 1221			Q			Q			Q	--	--
Aroclor 1242			Q			Q			Q	--	--
Aroclor 1248			Q			Q			Q	--	--
Aroclor 1254			Q			Q			Q	--	--

RL = *Reporting Limit*

Qualifier "U" = Compound was analyzed for but not detected

Qualifier "Q" = No analytical result

Geometric mean calculated based on last 3 sampling events

Sample Medium	**Water**	**Water**	**Water**
Sample ID	**5-14B**	**5-14B**	**5-14B**
Sample or Screen Depth (ft bgs)	**42.3-72.3**	**42.3-72.3**	**42.3-72.3**
Date Collected	**10/92**	**04/92**	**01/92**
Units	**µg/L**	**µg/L**	**µg/L**
Blanks or Duplicates			

Chemical	RL	Concentration	Qualifier	RL	Concentration	Qualifier	RL	Concentration	Qualifier	Geometric Mean	Highest RL
Benzene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Ethylbenzene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Toluene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Xylenes (Total)	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Aroclor 1016			Q			Q			Q	--	--
Aroclor 1221			Q			Q			Q	--	--
Aroclor 1242			Q			Q			Q	--	--
Aroclor 1248			Q			Q			Q	--	--
Aroclor 1254			Q			Q			Q	--	--

RL = Reporting Limit
Qualifier "U" = Compound was analyzed for but not detected
Qualifier "Q" = No analytical result
Geometric mean calculated based on last 3 sampling events

Sample Medium	**Water**	**Water**	**Water**
Sample ID	**5-15B**	**5-15B**	**5-15B**
Sample or Screen Depth (ft bgs)	**45.6-65.6**	**45.6-65.6**	**45.6-65.6**
Date Collected	**10/92**	**04/92**	**01/92**
Units	**µg/L**	**µg/L**	**µg/L**
Blanks or Duplicates			

Chemical	RL	Concentration	Qualifier	RL	Concentration	Qualifier	RL	Concentration	Qualifier	Geometric Mean	Highest RL
Benzene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Ethylbenzene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Toluene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Xylenes (Total)	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Aroclor 1016			Q			Q			Q	--	--
Aroclor 1221			Q			Q			Q	--	--
Aroclor 1242			Q			Q			Q	--	--
Aroclor 1248			Q			Q			Q	--	--
Aroclor 1254			Q			Q			Q	--	--

RL = Reporting Limit
Qualifier "U" = Compound was analyzed for but not detected
Qualifier "Q" = No analytical result
Geometric mean calculated based on last 3 sampling events

Sample Medium		**Water**			**Water**			**Water**			
Sample ID		**5-16B**			**5-16B**			**5-16B**			
Sample or Screen Depth (ft bgs)		**34.6-64.6**			**34.6-64.6**			**34.6-64.6**			
Date Collected		**04/93**			**10/92**			**04/92**			
Units		**µg/L**			**µg/L**			**µg/L**			
Blanks or Duplicates											
Chemical	**RL**	**Concentration**	**Qualifier**	**RL**	**Concentration**	**Qualifier**	**RL**	**Concentration**	**Qualifier**	**Geometric Mean**	**Highest RL**
Benzene	0.5	6.5		0.5	5.1		2.5	23		9.1	2.5
Ethylbenzene	0.5	14		0.5	12		2.5	210		32.8	2.5
Toluene	0.5	0.5	U	0.5	2.3		2.5	3.3		1.6	2.5
Xylenes (Total)	0.5	51		0.5	63		2.5	1000		147.6	2.5
Aroclor 1016			Q			Q	10.0	10.0	U	10.0	10.0
Aroclor 1221			Q			Q	10.0	10.0	U	10.0	10.0
Aroclor 1242			Q			Q	10.0	10.0	U	10.0	10.0
Aroclor 1248			Q			Q	10.0	10.0	U	10.0	10.0
Aroclor 1254			Q			Q	10.0	10.0	U	10.0	10.0

RL = Reporting Limit
Qualifier "U" = Compound was analyzed for but not detected
Qualifier "Q" = No analytical result
Geometric mean calculated based on last 3 sampling events

Sample Medium	**Water**	**Water**	**Water**
Sample ID	**5-17B**	**5-17B**	**5-17B**
Sample or Screen Depth (ft bgs)	**33.9-63.9**	**33.9-63.9**	**33.9-63.9**
Date Collected	**10/92**	**04/92**	**03/92**
Units	**µg/L**	**µg/L**	**µg/L**
Blanks or Duplicates			

Chemical	RL	Concentration	Qualifier	RL	Concentration	Qualifier	RL	Concentration	Qualifier	Geometric Mean	Highest RL
Benzene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Ethylbenzene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Toluene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Xylenes (Total)	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Aroclor 1016	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Aroclor 1221	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Aroclor 1242	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Aroclor 1248	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Aroclor 1254	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5

RL = Reporting Limit
Qualifier "U" = Compound was analyzed for but not detected
Qualifier "Q" = No analytical result
Geometric mean calculated based on last 3 sampling events

Sample Medium	Water	Water	Water
Sample ID	5-18B	5-18B	5-18B
Sample or Screen Depth (ft bgs)	49.9-69.9	49.9-69.9	49.9-69.9
Date Collected	04/93	10/92	05/92
Units	µg/L	µg/L	µg/L
Blanks or Duplicates			

Chemical	RL	Concentration	Qualifier	RL	Concentration	Qualifier	RL	Concentration	Qualifier	Geometric Mean	Highest RL
Benzene	2.5	360		2.5	820		25	790		615.5	25
Ethylbenzene	0.5	0.5		0.5	1.0		0.5	0.5	U	0.6	0.5
Toluene	0.5	0.5	U	0.5	0.5	U	0.5	2.7		0.9	0.5
Xylenes (Total)	0.5	2.6		0.5	36		0.5	36		15.0	0.5
Aroclor 1016			Q			Q			Q	--	--
Aroclor 1221			Q			Q			Q	--	--
Aroclor 1242			Q			Q			Q	--	--
Aroclor 1248			Q			Q			Q	--	--
Aroclor 1254			Q			Q			Q	--	--

RL = Reporting Limit
Qualifier "U" = Compound was analyzed for but not detected
Qualifier "Q" = No analytical result
Geometric mean calculated based on last 3 sampling events

Sample Medium	**Water**	**Water**	**Water**
Sample ID	**5-19B**	**5-19B**	**5-19B**
Sample or Screen Depth (ft bgs)	**43.3-63.3**	**43.3-63.3**	**43.3-63.3**
Date Collected	**10/92**	**04/92**	**03/92**
Units	**µg/L**	**µg/L**	**µg/L**
Blanks or Duplicates			

Chemical	RL	Concentration	Qualifier	RL	Concentration	Qualifier	RL	Concentration	Qualifier	Geometric Mean	Highest RL
Benzene	1.0	130		2.5	190		5.0	140		151.2	5.0
Ethylbenzene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Toluene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Xylenes (Total)	0.5	4.4		0.5	4.3		0.5	5.9		4.8	0.5
Aroclor 1016			Q	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Aroclor 1221			Q	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Aroclor 1242			Q	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Aroclor 1248			Q	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Aroclor 1254			Q	0.5	0.5	U	0.5	0.5	U	0.5	0.5

RL = Reporting Limit
Qualifier "U" = Compound was analyzed for but not detected
Qualifier "Q" = No analytical result
Geometric mean calculated based on last 3 sampling events

Sample Medium	**Water**	**Water**	**Water**
Sample ID	**5-20B**	**5-20B**	**5-20B**
Sample or Screen Depth (ft bgs)	**33.9-63.9**	**33.9-63.9**	**33.9-63.9**
Date Collected	**04/93**	**10/92**	**05/92**
Units	**µg/L**	**µg/L**	**µg/L**
Blanks or Duplicates			

Chemical	RL	Concentration	Qualifier	RL	Concentration	Qualifier	RL	Concentration	Qualifier	Geometric Mean	Highest RL
Benzene	0.5	14		0.5	52		0.5	55		34.2	0.5
Ethylbenzene	0.5	6.1		0.5	4.4		0.5	4.9		5.1	0.5
Toluene	0.5	0.5	U	0.5	2.7		0.5	3.9		1.7	0.5
Xylenes (Total)	0.5	10		0.5	11		0.5	6.2		8.8	0.5
Aroclor 1016			Q			Q			Q	--	--
Aroclor 1221			Q			Q			Q	--	--
Aroclor 1242			Q			Q			Q	--	--
Aroclor 1248			Q			Q			Q	--	--
Aroclor 1254			Q			Q			Q	--	--

RL = Reporting Limit
Qualifier "U" = Compound was analyzed for but not detected
Qualifier "Q" = No analytical result
Geometric mean calculated based on last 3 sampling events

Sample Medium	**Water**	**Water**	**Water**
Sample ID	**5-22B**	**5-22B**	**5-22B**
Sample or Screen Depth (ft bgs)	**45.8-55.8**	**45.8-55.8**	**45.8-55.8**
Date Collected	**10/92**	**04/92**	**03/92**
Units	**µg/L**	**µg/L**	**µg/L**
Blanks or Duplicates			

Chemical	RL	Concentration	Qualifier	RL	Concentration	Qualifier	RL	Concentration	Qualifier	Geometric Mean	Highest RL
Benzene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Ethylbenzene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Toluene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Xylenes (Total)	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Aroclor 1016			Q	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Aroclor 1221			Q	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Aroclor 1242			Q	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Aroclor 1248			Q	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Aroclor 1254			Q	0.5	0.5	U	0.5	0.5	U	0.5	0.5

RL = Reporting Limit
Qualifier "U" = Compound was analyzed for but not detected
Qualifier "Q" = No analytical result
Geometric mean calculated based on last 3 sampling events

Sample Medium	**Water**	**Water**	**Water**
Sample ID	**5-23B**	**5-23B**	**5-23B**
Sample or Screen Depth (ft bgs)	**50.1-80.1**	**50.1-80.1**	**50.1-80.1**
Date Collected	**10/92**	**04/92**	**03/92**
Units	**µg/L**	**µg/L**	**µg/L**
Blanks or Duplicates			

Chemical	RL	Concentration	Qualifier	RL	Concentration	Qualifier	RL	Concentration	Qualifier	Geometric Mean	Highest RL
Benzene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Ethylbenzene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Toluene	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Xylenes (Total)	0.5	0.5	U	0.5	0.5	U	0.5	0.5	U	0.5	0.5
Aroclor 1016			Q			Q			Q	--	--
Aroclor 1221			Q			Q			Q	--	--
Aroclor 1242			Q			Q			Q	--	--
Aroclor 1248			Q			Q			Q	--	--
Aroclor 1254			Q			Q			Q	--	--

RL = Reporting Limit
Qualifier "U" = Compound was analyzed for but not detected
Qualifier "Q" = No analytical result
Geometric mean calculated based on last 3 sampling events

Sample Medium	**Water**	**Water**	**Water**
Sample ID	**5-24B**	**5-24B**	**5-24B**
Sample or Screen Depth (ft bgs)	**45.5-75.5**	**45.5-75.5**	**45.5-75.5**
Date Collected	**04/93**	**10/92**	**04/92**
Units	**µg/L**	**µg/L**	**µg/L**
Blanks or Duplicates			

Chemical	RL	Concentration	Qualifier	RL	Concentration	Qualifier	RL	Concentration	Qualifier	Geometric Mean	Highest RL
Benzene	0.5	0.5	U	0.5	1.2		0.5	100		3.9	0.5
Ethylbenzene	0.5	0.7		0.5	0.8		0.5	1.4		0.9	0.5
Toluene	0.5	0.5	U	0.5	0.5	U	0.5	2.1		0.8	0.5
Xylenes (Total)	0.5	1.4		0.5	0.8		0.5	2.2		1.4	0.5
Aroclor 1016			Q			Q			Q	--	--
Aroclor 1221			Q			Q			Q	--	--
Aroclor 1242			Q			Q			Q	--	--
Aroclor 1248			Q			Q			Q	--	--
Aroclor 1254			Q			Q			Q	--	--

RL = Reporting Limit
Qualifier "U" = Compound was analyzed for but not detected
Qualifier "Q" = No analytical result
Geometric mean calculated based on last 3 sampling events

Sample Medium	Water	Water	Water
Sample ID	5-35B	5-35B	5-35B
Sample or Screen Depth (ft bgs)	31.3-61.3	31.3-61.3	31.3-61.3
Date Collected	04/93	NA	NA
Units	µg/L	µg/L	µg/L
Blanks or Duplicates			

Chemical	RL	Concentration	Qualifier	RL	Concentration	Qualifier	RL	Concentration	Qualifier	Geometric Mean	Highest RL
Benzene	12.5	360								360.0	12.5
Ethylbenzene	12.5	130								130.0	12.5
Toluene	12.5	1400								1400.0	12.5
Xylenes (Total)	12.5	1700								1700.0	12.5
Aroclor 1016			Q							--	--
Aroclor 1221			Q							--	--
Aroclor 1242			Q							--	--
Aroclor 1248			Q							--	--
Aroclor 1254			Q							--	--

RL = Reporting Limit
Qualifier "U" = Compound was analyzed for but not detected
Qualifier "Q" = No analytical result
Geometric mean calculated based on last 3 sampling events

Sample Medium	Water	Water	Water
Sample ID	5-41B	5-41B	5-41B
Sample or Screen Depth (ft bgs)	55.0-72.0	55.0-72.0	55.0-72.0
Date Collected	04/93	10/92	NA
Units	µg/L	µg/L	µg/L
Blanks or Duplicates			

Chemical	RL	Concentration	Qualifier	RL	Concentration	Qualifier	RL	Concentration	Qualifier	Geometric Mean	Highest RL
Benzene	0.5	1.4		0.5	47					8.1	0.5
Ethylbenzene	0.5	2.5		0.5	0.7					1.3	0.5
Toluene	0.5	0.5	U	0.5	3.9					1.4	0.5
Xylenes (Total)	0.5	2.1		0.5	1.0					1.4	0.5
Aroclor 1016			Q			Q				--	--
Aroclor 1221			Q			Q				--	--
Aroclor 1242			Q			Q				--	--
Aroclor 1248			Q			Q				--	--
Aroclor 1254			Q			Q				--	--

RL = Reporting Limit
Qualifier "U" = Compound was analyzed for but not detected
Qualifier "Q" = No analytical result
Geometric mean calculated based on last 3 sampling events

Sample Medium	**Water**	**Water**	**Water**
Sample ID	**5-47B**	**5-47B**	**5-47B**
Sample or Screen Depth (ft bgs)	**59.5-76.5**	**59.5-76.5**	**59.5-76.5**
Date Collected	**04/93**	**10/92**	**NA**
Units	**µg/L**	**µg/L**	**µg/L**
Blanks or Duplicates			

Chemical	RL	Concentration	Qualifier	RL	Concentration	Qualifier	RL	Concentration	Qualifier	Geometric Mean	Highest RL
Benzene	0.5	2.9		0.5	1.0					1.7	0.5
Ethylbenzene	0.5	0.5	U	0.5	0.5	U				0.5	0.5
Toluene	0.5	0.5	U	0.5	0.5	U				0.5	0.5
Xylenes (Total)	0.5	0.5	U	0.5	0.5	U				0.5	0.5
Aroclor 1016			Q			Q				--	--
Aroclor 1221			Q			Q				--	--
Aroclor 1242			Q			Q				--	--
Aroclor 1248			Q			Q				--	--
Aroclor 1254			Q			Q				--	--

RL = Reporting Limit
Qualifier "U" = Compound was analyzed for but not detected
Qualifier "Q" = No analytical result
Geometric mean calculated based on last 3 sampling events

Sample Medium	**Water**	**Water**	**Water**
Sample ID	**5-48B**	**5-48B**	**5-48B**
Sample or Screen Depth (ft bgs)	**43.0-60.0**	**43.0-60.0**	**43.0-60.0**
Date Collected	**04/93**	**10/92**	**NA**
Units	**µg/L**	**µg/L**	**µg/L**
Blanks or Duplicates			

Chemical	RL	Concentration	Qualifier	RL	Concentration	Qualifier	RL	Concentration	Qualifier	Geometric Mean	Highest RL
Benzene	12.5	99		2.5	380					194.0	12.5
Ethylbenzene	12.5	34		25	84					53.4	25
Toluene	12.5	390		2.5	1100					655.0	12.5
Xylenes (Total)	12.5	360		2.5	840					549.9	12.5
Aroclor 1016			Q			Q				--	--
Aroclor 1221			Q			Q				--	--
Aroclor 1242			Q			Q				--	--
Aroclor 1248			Q			Q				--	--
Aroclor 1254			Q			Q				--	--

RL = Reporting Limit
Qualifier "U" = Compound was analyzed for but not detected
Qualifier "Q" = No analytical result
Geometric mean calculated based on last 3 sampling events

Sample Medium	**Water**	**Water**	**Water**
Sample ID	**5-57B**	**5-57B**	**5-57B**
Sample or Screen Depth (ft bgs)	**60.0-75.0**	**60.0-75.0**	**60.0-75.0**
Date Collected	**04/93**	**NA**	**NA**
Units	**µg/L**	**µg/L**	**µg/L**
Blanks or Duplicates			

Chemical	RL	Concentration	Qualifier	RL	Concentration	Qualifier	RL	Concentration	Qualifier	Geometric Mean	Highest RL
Benzene	0.5	0.5	U							0.5	0.5
Ethylbenzene	0.5	0.5	U							0.5	0.5
Toluene	0.5	0.5	U							0.5	0.5
Xylenes (Total)	0.5	0.5	U							0.5	0.5
Aroclor 1016			Q							--	--
Aroclor 1221			Q							--	--
Aroclor 1242			Q							--	--
Aroclor 1248			Q							--	--
Aroclor 1254			Q							--	--

RL = Reporting Limit
Qualifier "U" = Compound was analyzed for but not detected
Qualifier "Q" = No analytical result
Geometric mean calculated based on last 3 sampling events

Sample Medium	**Water**	**Water**	**Water**
Sample ID	**5-58B**	**5-58B**	**5-58B**
Sample or Screen Depth (ft bgs)	**61.2-76.2**	**61.2-76.2**	**61.2-76.2**
Date Collected	**04/93**	**NA**	**NA**
Units	**µg/L**	**µg/L**	**µg/L**
Blanks or Duplicates			

Chemical	RL	Concentration	Qualifier	RL	Concentration	Qualifier	RL	Concentration	Qualifier	Geometric Mean	Highest RL
Benzene	0.5	0.5	U							0.5	0.5
Ethylbenzene	0.5	0.5	U							0.5	0.5
Toluene	0.5	0.5	U							0.5	0.5
Xylenes (Total)	0.5	0.5	U							0.5	0.5
Aroclor 1016			Q							--	--
Aroclor 1221			Q							--	--
Aroclor 1242			Q							--	--
Aroclor 1248			Q							--	--
Aroclor 1254			Q							--	--

RL = Reporting Limit
Qualifier "U" = Compound was analyzed for but not detected
Qualifier "Q" = No analytical result
Geometric mean calculated based on last 3 sampling events

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

THOREAU QUADRANGLE

NEW MEXICO-MC KINLEY CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

Mapped, edited, and published by the Geological Survey

Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs taken 1958. Field checked 1963

Polyconic projection. 1927 North American datum
10,000-foot grid based on New Mexico coordinate system, west zone
1000-meter Universal Transverse Mercator grid ticks,
zone 12, shown in blue

To place on the predicted North American Datum 1983 move the projection lines 56 meters east as shown by dashed corner ticks

Revisions shown in purple compiled from aerial photographs taken 1978 and other source data. This information not field checked. Map edited 1980

UTM GRID AND 1980 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy-duty ——— Light-duty ———
Medium-duty ——— Unimproved dirt - - - -
Interstate Route U.S. Route State Route

THOREAU, N. MEX.
N3522.5-W10807.5/7.5

1963
PHOTOREVISED 1980
DMA 4354 I NW-SERIES V881