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TECHNICAL MEMORANDUM NO. 3A
REMEDIAL INVESTIGATION
PHASE 1, TASK 2

LENZ OIL SERVICES, INC.
LEMONT, ILLINOIS

REVISION: 0

SUBMITTED BY:

LENZ OIL SETTLING RESPONDENTS

JULY 2, 1991

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1.0 INTRODUCTION

Technical Memorandum No. 3 (TM3) is being submitted on behalf of the Lenz Oil (Lenz Oil) Settling Respondents in accordance with Section IX, Part A of the Administrative Order by Consent (USEPA, 1989) and Section 5.2.11 of the Work Plan for the Remedial Investigation and Feasibility Study (RI/FS) of the Lenz Oil Service, Inc. site (ERM-North Central, Inc., 1990a). To ensure that TM3 is submitted in accordance with the approved Lenz Oil RI/FS schedule, it is being submitted in two parts, designated Part A and Part B. Part A, which was prepared by ERM-North Central, Inc. (ERM-North Central), describes the methods, results, and interpretations of the Phase I, Task 2 ground water investigation. Part B, which was prepared by EBASCO Environmental, Inc. (EBASCO) on behalf of the Illinois Environmental Protection Agency (IEPA), contains the methods, results, and interpretations of the Phase I, Task 2 soil, sediment, and surface water investigations. The Technical Memorandum is being submitted in two parts because a recent change in the IEPA's Project Manager for the Lenz Oil RI/FS caused the IEPA to be behind schedule for submittal of their portions of TM3. Rather than delaying the schedule in order to combine the materials into a single document, the IEPA proposed the submittal of the Technical Memorandum in two parts. The United States Environmental Protection Agency (USEPA) verbally approved the proposal during telephone conversations with the IEPA Project Manager and ERM-North Central personnel. If necessary, the two parts of TM3 will be combined into a single document at a later date.

This Technical Memorandum presents the results of the Phase I, Task 2 ground water investigation of the Lenz Oil RI/FS. The overall purpose of the Phase I, Task 2 activities was to characterize the site and its potential hazard to human health and the environment. The specific objectives of the site investigation, as presented in the Lenz Oil Work Plan, are as follows:

- Evaluate the nature and extent of residual contamination present on the Lenz Oil site.

- Evaluate the nature and extent of surface water and sediment contamination attributable to the Lenz Oil site.

- Evaluate the vertical and horizontal extent of ground water contamination potentially originating from the Lenz Oil site.

- Evaluate the nature and magnitude of ground water, surface water, and sediment contamination that has migrated off site and is attributable to the Lenz Oil site.

- Identify and evaluate potential contaminant migration characteristics.

- Collect sufficient data to support an Endangerment Assessment, a Feasibility Study, and an ASTDR Public Health Assessment of the Lenz Oil site.

The following site investigation activities were performed to meet the ground water portion of these objectives: (1) the installation of 15 additional monitoring wells, (2) abandonment of three damaged or unusable monitoring wells, (3) collection of four soil samples for geotechnical testing, (4) in situ permeability testing of the aquifer materials below the site, (5) surveying of the monitoring well locations and elevations, (6) collection and analysis of ground water, and

(7) measuring ground water and surface water elevation samples. All site investigation activities pertaining to the ground water investigation were performed by ERM-North Central personnel and its subcontractors, including: Fox Drilling, Inc. (Itasca, Illinois); ARDL (Mt. Vernon, Illinois); ATEC and Associates, Inc. (Indianapolis, Indiana); and Patrick Engineering, Inc. (Glen Ellyn, Illinois). Regulatory coordination of field activities was provided by the USEPA and the IEPA.

The investigative methods used during the ground water investigation are described in Section 2.0 of this Technical Memorandum. Section 2.0 also contains a description of any deviations from the methods specified in the approved Lenz Oil RI/FS Work Plan and the rationale for the modification. Site-specific geological and hydrogeological data, as well as a conceptual model of ground water flow and the ground water/surface water interaction at the site, are presented and interpreted in Section 3.0. The analytical results from the ground water samples collected during the site investigation are described in Section 4.0 and interpreted in Section 5.0. The magnitude and extent of ground water contamination is discussed in Section 5.0 in terms of the site-specific hydrogeologic data contained in Section 3.0.

2.0 METHODS OF INVESTIGATION

This section contains the: (1) methodology followed during the completion of each ground water investigation activity, (2) a description of the monitoring well network, and (3) the rationale used for changing several of the preliminary monitoring well cluster locations and selecting the geotechnical samples. Any deviations from the methodologies specified in the approved Lenz Oil RI/FS Work Plan are indicated, and detailed descriptions of investigative activities that were nonspecific in the Work Plan are presented as necessary.

2.1 Monitoring Well Network Construction

According to Section 5.1 of the Lenz Oil Sampling and Analysis Plan (ERM-North Central, 1990b), one deep replacement monitoring well and seven monitoring well clusters, each consisting of a shallow and a deep monitoring well, were to be installed at the site during Phase 1, Task 2. These new wells were to supplement and extend the existing monitoring well network at the site.

The Phase I, Task 2 monitoring well network was established downgradient and surrounding the primary contamination source area to assess the magnitude, extent, and fate of ground water contamination, if any, at and downgradient of the site. Preliminary locations of the monitoring wells were first proposed in the Lenz Oil Work Plan (ERM-North Central, 1990a).

After reviewing the soil gas investigation results presented in Technical Memorandum No. 2 (ERM-North Central, 1991b), the proposed locations of monitoring well clusters MW-03 and MW-06 were moved farther south. The USEPA and IEPA approved these modified monitoring well locations in a letter dated February 22, 1991. The location of monitoring well cluster MW-

07 was modified in the field because numerous underground utilities were identified in the immediate vicinity of the proposed well location. The USEPA and IEPA approved moving the MW-07 cluster approximately 60 feet west of its proposed location in a letter, dated April 1, 1991. All of the other monitoring well location clusters (MW-01, MW-02, MW-04, MW-05, and G106DR) were installed at the preliminary locations specified in the Work Plan.

2.1.1 Deep Monitoring Well Installation

A total of eight deep monitoring wells were installed at the site by ERM-North Central and Fox Drilling, Inc. between February 27, 1991 and April 30, 1991. The locations of the monitoring wells are shown on Figure 2-1. Boring logs and monitoring well construction logs for all of the new monitoring wells are included in Appendices A and B, respectively. Table 2-1 presents a summary of the monitoring well construction details.

In general, the deep monitoring wells were installed in accordance with the procedures presented in Section 5.1 of the approved Sampling and Analysis Plan (ERM-North Central, 1990b). However, difficult drilling conditions required that the actual drilling procedures deviate slightly from the approved procedures for some of the monitoring wells. Therefore, a detailed description of the entire drilling and monitoring well installation procedure is presented below.

- Borings were advanced to bedrock using a CME-75 drilling rig and hollow-stem augers (HSA). Several changes were made in the size (diameter) of the HSAs used for the first few boreholes because of problems drilling through or around large subsurface boulders. Monitoring well MW-05D was initially drilled with a 6.25-inch I.D. HSA and then overdrilled with an 8-inch I.D. HSA. Monitoring well MW-01D

was drilled with only an 8-inch I.D. HSA, and all of the other deep monitoring wells were drilled with a 5-inch I.D. HSA.

- Soil was continuously sampled ahead of the HSA using a 2-inch diameter split-spoon sampler (24 inch length). The soil was sampled and soil screened in accordance with the procedures outlined in the approved Sampling and Analysis Plan (ERM-North Central, 1990b).

- To minimize drilling fluid loss at the bedrock surface, the HSAs were either seated several feet into the bedrock, or a temporary casing was driven into the bedrock.

- Continuous bedrock cores were drilled and collected using an NX size core barrel with a clean water wash. The bedrock cores were retained for analysis and logged by an ERM-North Central geologist, per the approved Sampling and Analysis Plan (ERM-North Central, 1990b).

- The top of the deep monitoring well screen was to be set approximately 30 feet below the water table. Depending on the size, frequency, and location of the bedrock fractures, the top of the screen was set several feet from the target depth to place the screen opposite a major set of bedrock fractures.

- After the well screen interval was selected, the borehole was reamed to 4.875 inches using a tricone bit and a water wash rotary drilling system. All drilling water used during the coring and reaming activities was

supplied by the DuPage County municipal water system and drawn from a fire hydrant on Jeans Road. Water usage was monitored to determine the total volume of drilling fluid lost to the formation. Any residual fluids and cuttings generated during drilling were containerized in 55-gallon drums and stored on site in the secured drum storage area.

- The well screens consisted of 2-inch-diameter, #316 stainless steel pipe with No. 10 (0.010-inch) continuous slot openings. Each deep monitoring well was constructed with a 5-foot screen and a 5.35-foot stainless steel sump. Riser pipe composed of #316 stainless steel was connected above the screen and extended to approximately 2.5 feet above grade.

- The annular space around each well screen was filled with clean No. 5 quartz sand to approximately 2 feet above the top of the well screen. A 2-foot, No. 12 silica sand collar was then placed on top of the sand pack.

- A bentonite slurry was tremied into place above the silica sand collar to a depth of 8 feet below grade. A Portland cement/bentonite powder mixture was placed from 2 feet to 8 feet below grade.

- A 4-inch-diameter steel protective casing with a locking steel cover was cemented into place around the riser pipe. The cement was sloped away from the casing to promote drainage away from the monitoring well. A vented PVC cap was fitted over the riser, and the steel protector casing was fitted with a case-hardened steel lock.

- All equipment and well construction materials were decontaminated with a steam cleaner between each boring.

2.1.2 Shallow Monitoring Well Installation

Following the installation of the deep monitoring well at each well cluster, a shallow monitoring well was constructed as near as possible to the completed deep well. Detailed descriptions of the well installation procedures are shown in the well construction logs included in Appendix B. All of the shallow monitoring wells, with the exception of MW-07S, were constructed with 10-foot well screens that straddle the water table. The well screen for MW-07S was set opposite the first water encountered in the borehole, which was just below an impermeable confining layer of compacted fill. Because the first ground water encountered in the borehole was under confined conditions, a 5-foot well screen was set at the top of the aquifer instead of a 10-foot well screen as specified in the Sampling and Analysis Plan (ERM-North Central, 1990b). Therefore, MW-07S is not a shallow monitoring well that intersects the water table, but an intermediate monitoring well that is screened at the top of a confined portion of the aquifer. The IEPA was notified of the screen length modification.

Because ground water was very shallow at most of the monitoring well locations and the shallow monitoring well screens were to intersect the water table, the construction details of the shallow monitoring wells were modified to accommodate the shallow well screens. In most cases, the thickness of the bentonite seal and the sand filter pack was reduced slightly to accommodate the placement of the overlying well materials. The water table at MW-06S was sufficiently shallow to permit a conventional above-ground protective casing to extend below the top of the well screen and prevent the well from intercepting the uppermost ground water. A short, flush-mounted protective casing was installed over this well to allow the well screen to be open to the

uppermost ground water. The IEPA was notified of these minor deviations from the shallow monitoring well construction procedures.

The following procedures, which deviate slightly from the procedures presented in the Sampling and Analysis Plan (ERM-North Central, 1990b), were used to construct the shallow monitoring wells.

- A 6.25-inch I.D. HSA was advanced through the unconsolidated aquifer until bedrock was encountered unless the unconsolidated portion of the aquifer was thick enough that the well screen could be set entirely in unconsolidated deposits. If bedrock drilling was necessary to set the well screen opposite the water table, a temporary steel casing was driven into the bedrock, and a 4.875-inch borehole was drilled using a rotary drill bit and a clear water wash.

- Soil and bedrock samples were not collected during the drilling of the shallow monitoring well boreholes unless the well was set entirely in unconsolidated deposits. In that case, a geotechnical sample was collected from the aquifer using 2- and 3-inch diameter split-spoon samplers.

- In general, a 10-foot, #316 stainless steel well screen with No. 10 (0.010-inch) continuous slot openings was set with 3 feet of the screen above the water table. Several wells were constructed with less screen above the water table because the water table was too

shallow. A #316 stainless steel riser pipe was fitted above the well screen and extended to approximately 2.5 feet above grade.

- The annular space around the well screen was filled with clean No. 5 quartz sand to approximately 2 feet above the top of the well screen. In the wells constructed entirely in unconsolidated deposits, the sand pack was placed around the screen as the HSAs were withdrawn from the boring. For several wells, the thickness of the sand pack was reduced in order to accommodate a sufficient bentonite surface seal.

- Two (2) feet of bentonite pellets were placed above the sand pack to seal the annular space around the casing. In several of the wells where the water table was near the surface, the thickness of the bentonite seal was reduced to fill the available space.

- If space was available, a bentonite/cement grout seal was prepared from a mixture of Portland cement, bentonite powder, and clean municipal water. The grout was placed above the bentonite pellet seal using a tremie pipe.

- A 4-inch-diameter steel protective casing with a locking steel cover was cemented into place around the riser pipe. The cement was sloped away from the casing to promote drainage away from the monitoring well. A vented PVC well cap was placed over the

riser, and the steel protector casing was fitted with a case-hardened steel lock.

- All equipment and well construction materials were decontaminated with a steam cleaner between each boring.

2.1.3 Monitoring Well Abandonment

Monitoring wells G105S, G105D, and G106D were abandoned in accordance with the procedures required by the DuPage County Department of Public Health. These wells were abandoned per the approved Lenz Oil Work Plan, because they no longer served a useful purpose in the monitoring well network and represented potential conduits for contaminant migration. Monitoring wells G105S and G105D were apparently damaged during remediation activities associated with the excavation and incineration of soil surrounding the well cluster and well. G106D apparently was never completed as a monitoring well. A 4-inch PVC surface casing, which had been previously grouted, was installed at G106D. However, the well was not completed, and the steel protective casing was never removed.

The following procedures were used to abandon the three monitoring wells:

- ERM-North Central notified the DuPage County Department of Public Health of the intent to abandon the wells at the site.

- Using the drilling rig, a cable was attached to the well, and the entire length of the casing, riser, and screen was pulled out of the ground.

- The riser and screen were measured and checked with well construction diagrams to ensure that the entire monitoring well was removed.

- A tape measure was lowered into the hole to determine if the sides of the borehole had collapsed.

- A grout mixture composed of Portland cement, bentonite powder, and municipal water was tremied into place to cover the full length of the former well.

- Well abandonment forms were submitted to the DuPage County Department of Public Health as required by local regulations.

These procedures were performed in accordance with the guidance given to ERM-North Central by the DuPage County Department of Public Health.

2.1.4 Monitoring Well Development

Each of the monitoring wells installed during the Phase I, Task 2 field investigation was developed prior to sampling. The well development procedures specified in the Sampling and Analysis Plan (ERM-North Central, 1990b) were modified because of the large quantity of water that was required to be removed from each well before sampling (Table 2-2). The Sampling and Analysis Plan (ERM-North Central, 1990b) specified the use of surge blocks, hand pumps, or bailers for development. Because these methods are not efficient for the removal of large volumes of water, approval to use centrifugal pumps in lieu of the proposed methods was given

by USEPA on May 1, 1991. The following revised procedures were used to develop the new monitoring wells:

- All hoses or other equipment that were to be lowered into the wells were decontaminated by steam cleaning prior to use in wells.

- Static water level and total depth measurements were made on each well prior to development to ensure the optimum placement of the suction point of the hose and to document the removal of sediment from the base of the well.

- To remove the water from each well, a hose was inserted in the well casing and the intake was set at the screened interval. A centrifugal pump was connected to the hose, and the development water was pumped directly into a storage tanker. Each well was pumped until the volume of water removed was at least equal to the total amount of drilling water lost to the formation during the installation of the well. (See Table 2.2 for the total quantity of development water removed from each well.)

- An additional three static water volumes were purged from the well with a bailer, and the ground water was tested for stabilization using the pH, temperature, and conductivity methods specified in the Sampling and Analysis Plan (ERM-North Central, 1990b).

ERM-North Central attempted to develop monitoring wells MW-01S, MW-05S and MW-07S with a hand pump and a bailer. All of the other new wells were developed using a centrifugal pump. Monitoring well MW-07S was successfully developed with a hand pump and a bailer, but the other two wells were too silty to be developed by using this procedure. These wells were redeveloped with a centrifugal pump to remove the silt.

2.2 Aquifer Characterization

The following subsections describe the Phase I, Task 2 aquifer characterization activities conducted at the Lenz Oil site. These activities included a bedrock fracture analysis, geotechnical testing of the soil, and hydraulic conductivity testing of the aquifer materials.

2.2.1 Site-Specific Bedrock Fracture Analysis

After rock coring was completed at each boring, the core was logged by an ERM-North Central geologist according to the methods described in Section 5.1 of the Sampling and Analysis Plan (ERM-North Central, 1990b). The depth, thickness, and apparent angle of each bedrock fracture were noted on the boring logs, and a summary presentation of all the fracture data was prepared to permit an interpretation of the nature and extent of the fractures. A graphic presentation of the bedrock fractures data, and an interpretation of these data is presented in Section 3.1.

2.2.2 Geotechnical Sampling and Testing

Geotechnical samples were collected from monitoring well locations MW-01S, MW-02S, MW-04S, and MW-05S. Samples were taken from the unconsolidated soil in the screened interval

of each well according to the procedures specified in Section 5.1 of the Sampling and Analysis Plan (ERM-North Central, 1990b). The samples were tested for grain size, total porosity, and total organic carbon by ATEC and Associates, Inc., using the methods specified in Appendix E of the Quality Assurance Project Plan (ERM-North Central, 1990c). Because MW-03S, MW-06S, and MW-07S were screened in bedrock, geotechnical samples could not be collected from these monitoring well borings. The results of the geotechnical testing are presented in Appendix C and are discussed in Section 3.2.

2.2.3 Hydraulic Conductivity Testing

ERM-North Central performed in situ hydraulic conductivity testing of all of the monitoring wells at the Lenz Oil site with the exception of G104L and G106L. G104L was not tested because of casing deformities that prevented the air pressure testing equipment from sealing correctly. G106L was not tested because of the presence of free product in the monitoring well. The testing began on May 23, 1991 and was completed on May 30, 1991.

Rising head and falling head slug tests were performed in all of the monitoring wells in which the water table was within 4 feet of the well screen. Specifically, falling head slug tests were conducted in monitoring wells MW-01S, MW-02S, MW-03S, MW-04S, G101M, G101D, G101L, G102L, MW-05S, MW-06S, and MW-07S. The following procedures were used for performing the falling head slug tests in these wells:

- The pretest static water level was measured in the well.
- A pressure transducer was inserted below the static water level, sufficiently deep to avoid contact with the slug upon insertion.

- A slug (calibrated cylinder of known volume) was instantaneously inserted into the well below the static water table for the falling head test and instantaneously removed from below the water table for the rising head test.

- Data pairs of time versus water level were recorded using a pressure transducer and a computer data collection system.

- Readings were taken at the following time intervals: 0.2 seconds from 0 to 2 seconds; 1 second from 2 to 20 seconds; 5 seconds from 20 to 120 seconds; 0.5 minutes from 2 to 10 minutes; and 2 minutes from 10 to 100 minutes.

- Results were analyzed in the field to determine if data were sufficient and reliable to enable computation of hydraulic conductivity.

Rising head pressure tests were performed in all of the monitoring wells whose well screens were submerged at least 2 feet below the water table. Specifically, rising head tests were conducted in monitoring wells MW-01D, MW-02D, MW-03D, MW-04D, MW-05D, MW-06D, MW-07D, G106DR, G102D, and G104D. This method was selected because published hydraulic conductivity values for the Silurian dolomite aquifer were generally too high to be effectively measured using conventional slug test methods. The pressure test introduces a larger initial change in head than the slug test and, thus, allows recovery data to be collected over a longer period of time than a slug test. However, this method can only be used on air-tight wells in which the static water level can be depressed using air pressure. Leaky wells and wells

screened opposite the water table cannot be tested using the air pressure method. The pressure test procedures include the following:

- The pretest static water level was measured in the well.
- An air-tight well head adaptor was inserted into the well.
- A calibrated pressure transducer was set at least 4.5 feet below the static water level in the well.
- The well was pressurized with air to displace the static water level by up to 4 feet of head.
- The data collection computer program was started.
- The pressure was instantaneously released in the well.
- The change in water level with time was recorded by using the computer data collection system.
- The results were analyzed in the field to determine if data are sufficient and reliable.

The data collection equipment was calibrated each day, and a span check was performed before each test. All of the test data was stored on a computer disk for later analysis. The testing equipment that was inserted in the wells (i.e., the transducer, downhole cable, and well head

adaptor) was decontaminated prior to and between each test, using an Alconox wash and a distilled water rinse.

The results of the in situ hydraulic conductivity testing were analyzed by the Bower and Rice (1976) method. Three of the monitoring wells were retested to examine the precision of the calculated hydraulic conductivity values.

The results of the hydraulic conductivity testing are presented and discussed in Appendix D and Section 3.2.

2.3 Monitoring Well Location and Elevation Surveys

Patrick Engineering Inc. conducted surveys of the site to determine ground surface elevations, grid locations, and top-of-casing elevations for all of the monitoring wells installed at the site. The surveys were conducted in accordance with Section 5.1.5 of the Work Plan (ERM-North Central, 1990a) to locate and provide elevations of: (1) the existing wells on January 11, 1991, and (2) the new monitoring wells installed as a part of the Phase I, Task 2 investigation on May 30, 1991. The survey information was used to calculate the elevations of static water levels in the wells. The grid locations and measuring point elevations of three surface water gages (i.e., one on the Des Plaines River and two on the drainage ditch) were surveyed on May 30, 1991.

2.4 Ground Water Elevation Measurements

As described in Section 5.1.8 of the Work Plan (ERM-North Central, 1990a), static water level measurements were taken from all of the monitoring wells during the sampling episode and once a month during the RI field activities (i.e., January through June, 1991). The measurements

were taken in accordance with the procedures described in Section 6.1 of the Quality Assurance Project Plan (ERM-North Central, 1990c). The results of the water level measurements are presented on Table 2-3 and discussed in Section 3.2 and Appendix E.

2.5 Ground Water Sampling and Analysis

One round of ground water samples was collected at the Lenz Oil site during the Phase I, Task 2 activities. Twenty-three investigative ground water samples, three field blank samples, and three duplicate samples were collected between May 6, 1991 and May 9, 1991. The sample designations and analyses conducted for the Round One samples are shown on Table 2-4.

2.5.1 Sample Collection Procedures

The ground water samples were collected in accordance with the procedures specified in Section 5.2 of the approved Sampling and Analysis Plan (ERM-North Central, 1990b). Prior to sampling, static water level measurements were obtained, and standing water was removed by purging each well until stabilization of temperature, pH, and specific conductance was achieved. Dedicated Teflon bailers were used for purging and sample collection. The bailers were first decontaminated by using either steam cleaning or an Alconox wash, followed by a rinse with potable water and a double rinse with distilled water.

Ground water samples were transferred directly from the dedicated bailer to bottles that were provided by ARDL Laboratories. Sample containers were filled at each well in the following sequence: volatile organic compounds (VOCs), followed by semivolatile organic compounds (SVOCs), polychlorinated byphenols (PCBs)/pesticides, total metals, dissolved metals, and cyanide.

Field blank samples were collected by pouring distilled water through a decontaminated, dedicated bailer prior to filling the sample containers in the contamination reduction area of the site.

2.5.2 Sample Preservation and Identification

Immediately after the sample containers were filled, the containers were placed in a cooler and maintained at a temperature of 4° C. Glass vials for Target Compound List (TCL) VOC analysis were filled with zero headspace (i.e., no air bubbles). Samples collected for Target Analyte List (TAL) dissolved metals were field-filtered by using a Geotech disposable filter with a pore size of 0.45 microns. The chemicals added to sample containers for preservation are listed on Table 2-5.

Ground water samples collected during round one were identified with the following information:

- Name of the Site (LO);
- Sampling Round Number (1, 2);
- Monitoring Well Identification (e.g., MW01);
- Depth Modifier (e.g., S for shallow well, D for deep well, etc.);
- Sample Matrix (GW for ground water); and
- QA/QC Modifiers (FB for field blank or FD for field duplicate).

For example, the duplicate sample collected from monitoring well MW-04S was identified as: LO-1MW04S-FD. Field data forms were completed for each ground water sample collected, as indicated in Section 2.2 of the Data Management Plan (ERM-North Central, 1990d). Copies of the completed forms for ground water sampling are included in Appendix F.

Chain-of-custody, sample tracking, and sample analysis request forms were completed for each sample cooler shipped to the laboratory. These forms were used to ensure correct sample custody and analyses, as described in the Data Management Plan (ERM-North Central, 1990d). All sample container labels and other sample tracking forms were completed in accordance with Section 3.0 of the Data Management Plan (ERM-North Central, 1990d).

2.5.3 Sample Analysis

All ground water samples were analyzed for TCL organics and TAL inorganics in a manner consistent with Routine Analytical Service (RAS) Contract Laboratory Program (CLP) procedures. The complete list of CLP TCL and TAL parameters along with their Contract Required Quantitation Limits is presented in Table 1-1 of the Quality Assurance Project Plan (ERM-North Central, 1990c). Tentatively Identified Compounds (TICs) were included with the TCL volatile and semivolatile organic analyses. The TCL and TAL analyses were conducted by ARDL Laboratories using the RAS methods specified in the 2/88 SOW for organics and the 7/88 SOW for inorganics.

3.0 PHYSICAL CHARACTERISTICS OF THE SITE

This section describes the site-specific geology, ground water hydrology, and ground water/surface water interaction pertinent to the Lenz Oil Site RI/FS.

3.1 Geology

The near surface geology of the Lenz Oil site consists of a thick sequence of Silurian dolomite overlain by a thin veneer of Quaternary unconsolidated deposits and fill materials. Based on detailed descriptions of the bedrock, soil, and fill materials encountered during the Phase I, Task 2 drilling activities, the following facies have been defined to describe the stratigraphy of the site:

- Silty-clay,
- Excavation backfill,
- Silty-sand backfill,
- Silty-gravel, and
- Racine Dolomite

The vertical and lateral stratigraphic relationships of these geologic facies are displayed on three cross-sections of the site as shown on Figures 3-1 through 3-3. A map showing the location of each cross-section is presented on Figure 3-4.

Silty-Clay Facies

The silty-clay facies is generally a mottled light grey and moderate olive-brown color that is occasionally stained black near the main excavation area. The facies consists of silt and silty-clay with a trace of well-rounded to subangular dolomite pebbles. The upper few feet of the

facies has been reworked in several areas of the site and commonly contains traces of wood, incinerator ash, sand, and oil.

The silty-clay facies mantles the surface of the Lenz Oil site and ranges from 3 to 13 feet in thickness. The lower portion of the facies is below the water table in many areas of the site. Based on its stratigraphic position and its lithologic character, the silty-clay facies is probably either alluvial deposits from the Des Plaines River or part of the Mackinaw Member of the Henry Formation. In most portions of the site, it overlies the silty-gravel facies.

Excavation-Backfill Facies

This facies consists of the backfill placed in the main excavation area on the Lenz Oil site. Based on IEPA's descriptions of this material, the facies is characterized by dark brown to black sand, gravel, and incinerator ash. The facies is approximately 12 feet thick and is underlain by a visqueen liner. The lower portion of the facies is below the water table. According to IEPA, the excavation-backfill facies overlies Silurian dolomite and laterally juxtaposes the silty-clay facies and/or the silty-gravel facies.

Silty-Sand-Backfill Facies

The silty-sand-backfill facies is composed of moderate yellowish-brown to grayish-yellow silty sand and gravelly clay backfill. Because this facies forms the road base for Route 83, the facies has been extensively compacted and consequently is very hard and only slightly permeable. The facies is limited in extent to the area adjacent to Route 83 and forms a continuous layer over the surficial aquifer. Dolomite bedrock underlies the facies, and the silty-clay facies and the silty-gravel facies are laterally adjacent to it. The facies is 24 feet thick at MW-07, the only location where it was encountered.

Silty-Gravel Facies

The silty-gravel facies is characterized by medium-light-grey silty dolomite gravel with varying amounts of sand and clay. The facies contains large dolomite boulders, cobbles, and pebbles that are very angular. It is always underlain by Silurian dolomite and is generally overlain by the silty-clay facies. The thickness of the facies varies from 1 foot to approximately 18 feet in the vicinity of the site. In most portions of the site, the silty-gravel facies is saturated. The facies is interpreted to be a layer of weathered dolomite that has escaped erosion and redeposition.

Racine-Dolomite Facies

The entire site is underlain by the Silurian Racine Dolomite Formation. In general, the facies is a yellowish-gray, finely crystalline dolomite with some intraclasts and peloids. It occasionally contains wavy laminae, thin sand beds, and fossiliferous zones. The dolomite is extensively fractured in some areas. Most of the fractures are horizontal and appear to be bedding planes, but high-angle fractures are also present. Some of the fractures are open, but most contain clay, calcite, and/or heavy mineral infillings. The dolomite facies is generally below the water table.

The bedrock surface is irregular and varies as much as 16 feet in elevation over the site. In general, the bedrock becomes shallower toward the west and deeper toward the east. In borings MW-06 and MW-03, which are located near the Des Plaines River, bedrock is only 2 to 3 feet below ground surface. However, the bedrock located on the site is up to 21 feet below ground surface.

As discussed in Technical Memorandum No. 1, the Racine Dolomite contains three mutually orthogonal sets of joints (or fractures). Two of these sets are vertical, and one is horizontal. The primary set of vertical joints has an average azimuth of 135°, and the secondary set has an

average azimuth of 45°. A tertiary set of vertical joints with an average azimuth of 20° was also detected by ERM-North Central during the regional fracture analysis.

The bedrock fractures encountered during the coring of the monitoring well borings were recorded and analyzed to determine the presence of any potential fracture patterns. An analysis of the horizontal and vertical fracture data from the new borings (Figure 3-5) revealed the presence of several discrete fracture zones that can be correlated between cores. The shallowest fracture zone occurs in borings MW-03, MW-06, and G106DR at an average elevation of 587 feet. This fracture zone does not appear in the other cores, because the top of the bedrock is below 587 feet at the other boring locations. The fracture zone ranges from 0.5 to 1.4 feet in thickness and is composed primarily of horizontal fractures.

The next major fracture series occurs in the cores from MW-03, MW-04, MW-06 and possibly MW-07 and G106DR. The fracture zone varies in thickness from 0.3 to 0.8 feet and is composed of a combination of horizontal and high-angle fractures. Because the rock quality in MW-07 and G106DR is very poor at the elevation of this fracture series, positive identification of the fracture series in these cores was not possible.

At an elevation of 574 feet, a minor fracture zone was identified in three of the four cores that intersected this elevation. The fracture zone appeared in MW-04, MW-05 and MW-06 with a thickness of 0.6 to 1.2 feet. The fracture zone is not obvious in MW-03; however, four horizontal bedding planes were logged at the same elevation in MW-03. Because weathered rubble was present in MW-07 and G106DR at an elevation of 574 feet, the fracture zone could not be identified.

A major fracture zone with a thickness between 1.0 and 2.8 feet was encountered at an elevation between 568 and 571 feet in all of the cores, except MW-03. Three horizontal fractures are, however, present in the MW-03 core at this elevation. This fracture zone probably represents

one of the major regional fracture zones identified by Nicholas and Healy (1988), who reported the presence of a major horizontal fracture zone at an elevation of 565 feet (see Section 2.7.3 of Technical Memorandum No. 1).

The deepest set of major horizontal and vertical fractures that was observed during Phase I, Task 2 is located at an elevation of 562 to 563 feet. This fracture zone, which was identified in cores from MW-01, MW-03, MW-04 and MW-05, is composed primarily of high-angle fractures with thicknesses that range from 1.1 to 1.7 feet.

As shown on Figure 3-5, minor fracture zones occur at elevations of 551, 555, and 559 feet. These minor fracture zones are generally thin and not as laterally persistent as the major fracture zones.

3.2 Ground Water Hydrology

The shallow subsurface geology in the vicinity of the Lenz Oil site consists of a thin (0- to 15-foot) veneer of Holocene alluvium overlying approximately 150 to 200 feet of Silurian dolomite. These geologic units are partially hydraulically connected and act as a single unconfined aquifer with a total saturated thickness of approximately 150 to 200 feet. This aquifer is recharged primarily by precipitation and exhibits seasonal fluctuations in the water table elevation (Appendix E). The regional ground water flow in this aquifer is generally toward the south, where it discharges into the Des Plaines River.

The unconsolidated portion of the surficial aquifer is composed of the silty-clay facies, silty-gravel facies, and excavation-backfill facies. In most portions of the study area, the silty-gravel facies is saturated, and the overlying silty-clay facies is partially saturated or unsaturated. The excavation-backfill facies is partially saturated, but it is largely hydraulically isolated from the rest of the surficial aquifer by a visqueen liner. The integrity of the liner was recently

potentially compromised when an IEPA drilling crew punctured it in several locations while performing Phase I, Task 2 soil sampling. Therefore, the saturated portion of the excavation backfill facies may be partially interconnected with the rest of the aquifer. The saturated thickness of the unconsolidated deposits thins from approximately 20.5 feet near MW-05S to less than 1.0 foot near the Des Plaines River (Figure 3-2). The variability in the saturated thickness of the unconsolidated deposits results from the irregular nature of the underlying bedrock surface.

The results of hydraulic conductivity tests performed on the unconsolidated deposits (i.e., primarily the silty-gravel facies, but also some silty-clay deposits) show that the hydraulic conductivity of these deposits varies from 52 to 1,200 gal/day/ft^2. The lower hydraulic conductivity values generally correspond with tests conducted in wells screened opposite the silty-clay facies, whereas the higher values correspond with tests performed in wells screened opposite the silty-gravel facies. The high hydraulic conductivity results from the silty-gravel facies support the conclusions of Nicholas and Healy (1988) and Zeizel and others (1962) that substantial ground water flow occurs in the weathered zone above the bedrock. The bedrock portion of the surficial aquifer consists of fractured Silurian dolomite. Boring logs show the presence of several extensively fractured zones in the bedrock. As previously noted by Zeizel and others (1962) and Nicholas and Healy (1988), most of these fracture zones are horizontal bedding planes that have been enlarged by solution activity. These horizontal fractures are probably the main conduits for ground water flow. Vertical fractures probably also influence ground water flow, but they are less common and more difficult to trace or correlate in the subsurface.

The results of hydraulic conductivity tests performed in wells screened in the upper 40 feet of the fractured dolomite indicate that hydraulic conductivity values range from 12 to 240 gal/day/ft^2. These values are probably too low because of the violation of the assumption of flow through a porous medium and the limited zone of influence created by slug and air pressure

tests. Pump test data from Argonne National Laboratory indicate hydraulic conductivity values in the range 250 - 400 gal/day/ft^2 (Nicholas and Healy, 1988). Based on an aquifer thickness map by Zeizel and others (1962), the saturated thickness of the fractured dolomite is between 150 and 200 feet.

The shallow well piezometric surface map (Figure 3-6) shows that shallow ground water in the surficial aquifer flows southeast, toward the Des Plaines River. Based on the elevation of wells G101L and MW-03S, the average horizontal hydraulic gradient is approximately 0.0048 ft/ft toward the southeast. It is apparent that the shallow ground water flow direction shifts to the south near the ditch, along the northwestern part of the site. In addition, the horizontal hydraulic gradient steepens slightly near the well G102L, most likely because of sharp changes in topography and near the Des Plaines River discharge zone. An anomalously high ground water level around well G104L has been observed throughout the investigation. Whether this high level is the result of perched water, poor well construction, or actual aquifer conditions is uncertain at this time.

Piezometric surface maps for intermediate and deep portions of the surficial aquifer also demonstrate that ground water generally flows southeast toward the Des Plaines River (Figure 3-7 and 3-8). It is apparent that ground water has a localized southeast to east flow direction on the northwest portion of the Lenz Oil site, which may be the result of the presence of vertical joint sets oriented in a southeast direction beneath the Lenz Oil site. At depths of 15 to 35 feet below the water table, the hydraulic gradient is somewhat smoother across the study area than in shallower parts of the aquifer.

Differences in hydraulic head between the shallow and deep monitoring wells generally show a slight downward component of flow with the vertical hydraulic gradient ranging from 0.0087 ft/ft to 0.0096 ft/ft. This difference in hydraulic head ranges from 2.38 feet at location MW-02 to 2.74 feet at location MW-04 and indicates good potential for recharge of the fractured

dolomite portion of the aquifer. However, localized variations in the vertical gradient and ground water flow direction are present at the Lenz Oil site. For example, at monitoring well cluster G101, a small upward vertical component of flow is present in the upper part of the aquifer. This probably indicates the potential for discharge of ground water into the drainage ditch on the northwestern part of the site. An upward component flow is also present at monitoring well cluster MW-03. Because of the proximity of this well cluster to the Des Plaines River, the upward flow gradient probably reflects ground water discharge to the river. These upward vertical gradients range from 0.014ft/ft to 0.023ft/ft. Partially confined conditions are present at the MW-07 location because of local infilling of the area with silty-sand-backfill. The backfill material is very hard and only slightly permeable and, thus, forms a local confining layer over the surficial aquifer. The upward vertical hydraulic gradient between wells MW-07S and MW-07D is 0.011 ft/ft.

Ground water velocity in the unconsolidated part of the surficial aquifer varies spatially because of the presence of heterogeneities. Flow rates are most likely highest in the more permeable weathered dolomite and silty-gravel zones at the base of the unconsolidated deposits. Using a value of 0.0048 ft/ft for the average horizontal hydraulic gradient, a geometrically averaged hydraulic conductivity value of 45.6 ft/day, and an average effective porosity of 0.25 (Appendix C), the average horizontal ground water velocity is calculated to be 0.88 ft/day in the unconsolidated portion of the aquifer.

The ground water flow velocity in the fractured dolomite portion of the surficial aquifer also varies spatially as a result of the varying interconnectedness, orientation, and width (or aperture) of joints and fractures. Ground water flow rates are probably much higher in individual fractures and may be nonlaminar. Although extensive joints and fractures were encountered during rock coring, the interconnected systems of fractures probably cannot be considered an equivalent porous medium. Therefore, ground water flow rates cannot be calculated for the dolomite.

3.3 Ground Water/Surface Water Interaction

The surface water bodies on and near the Lenz Oil site include a small ephemeral drainage ditch on the northwest border of the site and the Des Plaines River to the south of the Lenz Oil property. The drainage ditch receives surface water drainage from the northern half of the site and from the area northwest of the site. This ditch meanders through an auto wrecking facility southwest of the site, and then discharges into the Des Plaines River. Surface water on the southern half of the Lenz Oil site discharges by overland flow into the Des Plaines River, which flows southwest and eventually drains into the Mississippi River. The surface water hydrology in the vicinity of the site is discussed further in Technical Memorandum No. 1.

As discussed in Section 3.2, the upward gradient between monitoring wells G101L and G101D indicates that shallow portions of the unconfined aquifer discharge into the drainage ditch northwest of site. The surface water elevations at two points in this ditch measured on May 9, 1991, indicate that surface water flows slowly southwest with a general slope of 5.9×10^{-4} ft/ft along the northwest border of the Lenz Oil site. The flow of water in the drainage ditch apparently causes a slight southwesterly change in shallow ground water flow direction near the ditch (Figure 3-6). Depending on the relative rates of precipitation and infiltration, the drainage ditch may switch between recharging the aquifer and receiving water that is discharged from the aquifer.

The Des Plaines River is a regional discharge zone for the unconfined surficial aquifer. The upward gradient between monitoring wells MW-03S and MW-03D confirm that at least the shallow portion of the unconfined aquifer discharges into the Des Plaines River. Figures 3-7, 3-8, and 3-9 also indicate a southwest component of ground water flow near the Des Plaines River.

4.0 GROUND WATER ANALYTICAL RESULTS

This section presents the laboratory analytical results for the ground water samples collected during the Phase I, Task 2 investigation. All of the ground water samples were analyzed for TCL, VOCs, SVOCs, and pesticide/PCBs, as well as TAL dissolved metals, and total metals and cyanide. Summaries of the ground water analytical results are presented on Tables 4-1 through 4-6. ARDL Laboratories performed the ground water analyses, as well as the in-house analytical data reduction and validation under the direction of their laboratory Quality Assurance Officers. The laboratory review included checks for quality control criteria, as outlined in CLP procedures and established USEPA methods. The validity of the analytical data was assessed by comparing the analytical results of replicates and blanks. Additionally, the laboratory critiqued its own analytical programs by using spike additions and their recoveries, establishing detection limits, precision and accuracy control charts, and keeping accurate records of the calibration of instruments.

4.1 Data Validation

Environmental Standards, Inc. validated the laboratory analytical data to ensure that Quality Assurance/Quality Control (QA/QC) had been maintained throughout the analytical program. The data validation report is presented as Appendix G. The data validation was conducted in accordance with the USEPA guidelines for evaluating organic analyses (USEPA, 1988a) and inorganic analyses (USEPA, 1988b).

According to the Data Validation Report prepared by Environmental Standards, Inc., the overall quality of the organic data is good and the quality of the inorganic data is fair. A portion of the data was qualified or rejected during validation. Contractual criteria and reporting requirements were met, with the exception of the deficiencies described in Appendix G. It should be noted

that many of the deficiencies identified in Appendix G are contractual in nature and do not necessarily affect data usability. All of the analytical data summaries presented in the Technical Memorandum are based on valid or estimated analytical results. All unusable results have been eliminated from the summary tables and figures.

4.2 Field and Trip Blank Sample Results

In accordance with the approved Quality Assurance Project Plan (ERM-North Central, 1990c), field blank samples were submitted to the laboratory at a frequency of one per 10 or fewer investigative samples. Trip blank samples were submitted at rate of one per daily shipment of samples. Three field banks, labeled LO-1GW1-FB, LO-1GW2-FB, and LO-1GW3-FB, and four trip blanks, labeled LO-GW6-TB, LO-1GW-TB1, LO-1GW-TB, and LO-1GW-TB3, were submitted to the laboratory with this set of samples.

Trace levels of methylene chloride, toluene, total xylenes, butylbenzyl phthalate, aluminum, iron, lead, manganese, and zinc were detected in the laboratory, field, and/or trip blanks. The reported presence of these compounds and analytes should be considered "not detected" for some samples and, thus, have been labeled "U" on the appropriate data tables. A detailed discussion of the blank contaminants and the associated qualified samples is presented in Appendix G.

4.3 Duplicate Sample Results

Per the approved Quality Assurance Project Plan (ERM-North Central, 1990c), field duplicate pairs were submitted to the laboratory at a frequency of one per 10 or fewer investigative samples. Duplicate pairs from monitoring wells MW-03S, MW-04S, and MW-05S were submitted to the laboratory with the following set of ground water samples: (1) LO-1MW03S-

GW and LW-1MW03S-FD, (2) LO-1MW04S-GW and LO-1MW04S-FD, and (3) LO-1MW05S-GW and LO-1MW05S-FD.

As indicated in Appendix G, positive results were not detected for any VOCs, SVOCs, or pesticides/PCBs in either of the duplicate pairs from monitoring wells MW-03S or MW-04S, with the exception of benzoic acid in LO-1MW04S-GW. However, high percent differences were observed for several target VOCs, SVOCs, and pesticides/PCBs detected in the duplicate pair collected from MW-05S. Therefore, positive results were flagged "J" and negative, results were flagged "UL" for the following compounds: 1,1-dichloroethane, chloroform, total xylenes, 1,2-dichloroethane, dibenzofuran, phenanthrene, anthracene, fluoranthene, and bis(2-ethylhexyl) phthalate. High percent differences were also obtained for the following analytes in at least one of the field duplicate pairs: arsenic, beryllium, copper, aluminum, lead, potassium, iron, zinc, and cyanide. The positive results for these analytes have been flagged "J" for the appropriate samples on the data tables. A detailed discussion of the duplicate sample results is presented in Appendix G.

4.4 Background Sample Results

Ground water samples from three upgradient, off-site monitoring wells were collected during the Phase I, Task 2 activities. These monitoring wells (G101L, G101M, and G101D) are located north of the Lenz Oil site, beyond the Atchison, Topeka, and Santa Fe railroad tracks (Figure 2-1). Because of their upgradient location, monitoring wells G101M, G101G, and G101D are considered background wells for the shallow, intermediate, and deep sets of the monitoring wells, respectively.

No VOCs, SVOCs, or pesticides/PCBs were detected in the ground water samples from G101M or G101L. However, trace concentrations (2 to 3 ppb) of 1,1-dichloroethene, chloroform,

1,1,1-trichloroethane, carbon tetrachloride, and tetrachloroethene were detected in the ground water sample from G101D. These compounds were qualified with a "J" because they were reported at concentrations below the quantitation limit.

Several naturally occurring dissolved metals (i.e., aluminum, calcium, iron, magnesium, potassium, and sodium) were detected in the background monitoring wells at concentrations above the quantitation limit. Although the concentrations of some of the detected analytes have been labeled "J" because of various laboratory contractual or procedural deficiencies, the metals detected and their associated concentrations are considered to be usable background analyte data.

Because the surficial aquifer is composed of two discrete types of aquifer materials, unconsolidated silty dolomite gravel and dolomite bedrock, the background analyte concentrations in the ground water samples are affected by the aquifer material. Therefore, background analyte concentrations have been identified for both types of aquifer materials. Because monitoring wells G101M and G101L are screened in the unconsolidated portion of the surficial aquifer, ground water analyte concentrations from these wells are characteristic of the unconsolidated aquifer materials. Specifically, aluminum (970 ppb), calcium (87,000 to 110,000), iron (270 ppb), magnesium (44,000 to 54,000 ppb), potassium (1,600 to 3,600 ppb), and sodium (3,800 to 1,300,000 ppb) are the dissolved metals attributable to background water quality in the unconsolidated aquifer materials.

Monitoring well G101D is screened in the dolomite bedrock and, therefore, yields dissolved metals data characteristic of background water quality in the bedrock portion of the aquifer. Many of the metals detected in the unconsolidated portion of the aquifer were also detected in the bedrock portion of the aquifer, but generally at higher concentrations. Specifically, calcium (120,000 ppb), iron (820 ppb), magnesium (61,000 ppb), potassium (2,600 ppb), and sodium

(7,900 ppb) are the dissolved metals attributable to background water quality in the bedrock portion of the aquifer.

The dissolved metals detected in the background wells are common constituents of natural ground water found in carbonate aquifer materials. The concentrations of the metals detected in the background wells are consistent with other natural water samples and are generally lower than the downgradient wells. Therefore, all of the dissolved metals detected in the background wells are attributed to natural ground water chemistry.

4.5 Investigative Sample Results

The analytical data for the investigative samples have been grouped by analytical parameter (organic and inorganic) and by the sampling depth (shallow, intermediate, and deep). All of the shallow monitoring wells (i.e., MW-01S, MW-02S, MW-03S, MW-04S, MW-05S, MW-06S, G101M, G102L, G104L, and G106L) have screens that straddle, or nearly straddle, the ground water table. The intermediate monitoring wells (i.e., MW-07S, G101L, G102D, and G104D) are screened at approximately 6 to 18 feet below the water table, and the deep monitoring wells (i.e., MW-01D, MW-02D, MW-03D, MW-04D, MW-05D, MW-06D, MW-07D, G101D, and G106DR) are screened at approximately 22 to 37 feet below the water table. The analytical results have been grouped into these three categories to facilitate the discussion of the nature and extent of contamination at the site.

4.5.1 Organic Results

Several TCL VOCs, SVOCs, and PCBs were detected in ground water samples collected during Phase I, Task 2 of the Lenz Oil RI. Tentatively identified compounds (TICs), including numerous benzene derivations, several alkanes, and unknowns, were also found in the ground

water samples, but generally at concentrations below the quantitation limit. A detailed analysis of the TICs is not presented in this Technical Memorandum because similar TCL compounds were detected in the ground water samples at equivalent or higher concentrations. Therefore, the nature and extent of ground water contamination can be adequately described by using target compounds without adding the uncertainties of TICs.

The TCL organic compounds detected in the ground water samples and the nonaqueous phase liquid (NAPL) sample collected from the shallow monitoring wells are listed on Table 4-1 and displayed on Figure 4-1. A total of 15 VOCs, 14 SVOCs, and 3 PCBs were detected in the shallow ground water and NAPL samples, and the NAPL sample from monitoring well G106L showed the presence of 9 SVOCs and one (1) PCB. The NAPL sample was not analyzed for VOCs because of inadequate sample ~~volume~~.

9 additional SVOC compounds yielded results that are qualified with "UD"

How about ~~Aroclor-1248~~ and Aroclor-1260

Ten of the 15 VOCs detected in the shallow monitoring wells are chlorinated solvents (i.e., vinyl chloride; chloroethane; 1,1-dichloroethene, 1,1-dichloroethane, total 1,2-dichloroethene, chloroform, 1,1,1-trichloroethane, carbon tetrachloride, trichloroethene, and tetrachloroethene), each having concentrations that range from 2 to ~~58 ppb~~ 150. Four of the VOCs were identified as aromatics (i.e., benzene, toluene, ethylbenzene, and xylenes), each with concentrations ranging from 6 to 2,400 ppb. Xylenes were found at the highest concentrations of the aromatics. An anomalous concentration (150 ppb) of acetone was also detected in the shallow ground water samples. ?

Nine of the 14 SVOCs detected in the shallow ground water samples are polynuclear aromatics (i.e., naphthalene, 2-methlynaphthalene, acenaphthalene, fluorene, phenanthrene, pyrene, anthracene, 2-fluoranthene, and dibenzofuran) with concentrations ranging from 4 to 6,000 ppb. The polynuclear aromatic with the highest concentration is 2-methylnaphthalene. The phenolic compounds (i.e., 2,4-dimethylphenol, n-nitrosodiphenylamine, and 4-methylphenol) were

identified at concentrations ranging from 2 to 24 ppb. Two other SVOCs (i.e., bis(2-ethylhexyl)phthalate and benzoic acid) were detected at concentrations ranging from 2 to 530 ppb.

The NAPL sample from monitoring well G106L contained 9 SVOCs of which 7 were polynuclear aromatics (i.e., naphthalene, 2-methylnapthalene, acenaphthalene, dibenzofuran, fluorene, phenanthrene, and pyrene), each detected at concentrations ranging from 47,000 to 820,000 ppb. Fluorene was detected at the highest concentration. Additionally, bis(2-ethylhexyl)phthalate and N-nitrosodiphenylamine, were detected at 170,000 ppb and 240,000 ppb, respectively.

Three PCBs, Aroclor 1242, 1248, and 1260, were detected in the shallow ground water sample from monitoring well MW-05S at concentrations of 645 ppb, 420 ppb, and 160 ppb, respectively. Aroclor 1242 was detected at 1,130 ppb in the NAPL sample from monitoring well G106L. Although other PCB compounds may have been present in this sample, they would have been masked by the Aroclor 1242 peak. No pesticides were detected in any of the ground water or NAPL samples.

Seven VOCs, but no SVOCs or pesticide/PCBs, were detected in the ground water samples from the intermediate monitoring wells (Table 4-2 and Figure 4-2). All of the VOCs detected in the intermediate monitoring wells are chlorinated solvents (i.e., 1,1,1-trichloroethane, 1,1-dichloroethane, chloroethane, trichloroethene, vinyl chloride, 1,1-dichloroethene, and total 1,1,1-trichloroethane). The concentrations of these VOCS range from 3 to 83 ppb, with 1,1,1-trichloroethane being detected at the highest concentration. Chloroethane, 1,1-dichloroethane, and trichloroethene were found in monitoring well G102D, and 1,1-dichloroethane was detected in monitoring well G104D below the quantitation limit.

Six of the eight deep monitoring wells showed no detectable organic compounds. Chloroethane, the only VOC detected in the deep monitoring wells, was present at a concentration of 53 ppb in the ground water sample from monitoring well G106DR. The only SVOC detected in the deep monitoring wells was 2-methylnaphthalene, which was detected in monitoring well MW-05D at a concentration of 2 ppb. Five chlorinated solvents were found in the deep background well G101D; however, none of the solvents were detected at concentrations above the quantitation limit. Table 4-3 and Figure 4-3 illustrate the analytical results for the deep monitoring wells.

4.5.2 Inorganic Results

Several valid TAL dissolved metals and total cyanide concentrations were detected in the ground water samples collected during Phase I, Task 2 of the Lenz Oil RI (Tables 4-4 through 4-6). The dissolved metals and total cyanide concentrations detected in the ground water samples collected from the shallow, intermediate, and deep monitoring wells are shown on Figures 4-4, 4-5 and 4-6, respectively.

Total TAL metals concentrations were also determined for the ground water samples, but they are not discussed in this Technical Memorandum because it is inaccurate to compare the total metal results of ground water samples. The reasons that direct comparisons are not advised include the following:

- The type of aquifer material opposite the well screened intervals affects the quantity and type of particulate matter present in the ground water sample.

- Various types of particulate matter have varying settling rates, which affect the uniformity of the total metals sample.

- Metals have differing absorption and element fixation abilities; therefore, one metal may be prevalent in a ground water sample because it has a high soil fixation ability, and not because it is actually present in the ground water at that concentration.

The total metals results for the ground water samples are presented in Appendix G, but are not compared or discussed in this Technical Memorandum.

For the following discussion of the inorganic results, the monitoring wells are categorized by the aquifer material (i.e., unconsolidated deposits or bedrock) in which they are screened rather than by depth. Calcium, magnesium, potassium, iron, and sodium were detected in both the background and the downgradient monitoring wells screened in unconsolidated aquifer materials. All occurrences of these analytes in the downgradient wells were at concentrations within one order of magnitude of the background concentrations, except for iron in monitoring well MW-07S, which is within two orders of magnitude of the background iron concentration. Manganese, a common soil constituent in this region, was detected in trace quantities in three of the five downgradient monitoring wells, but was not detected in the background well. Aluminum, another common soil constituent, was detected at 970 ppb in one of the background wells (G101L), but was not detected in any of the downgradient wells screened in unconsolidated deposits. A total of 7 other inorganic analytes (barium, arsenic, lead, cadmium, copper, zinc, and cyanide) were detected exclusively in downgradient monitoring wells. All of these other analytes are irregularly distributed on and downgradient of the site.

Arsenic was detected at concentrations of 8.3 ppb, 23 ppb and 34 ppb in monitoring wells MW-01S, MW-05S, and MW-04S, respectively. Barium, a common constituent of natural waters in the local carbonate aquifers, was detected in monitoring wells MW-01S, MW-04S, MW-05S, MW-07S, and G104L at concentrations ranging from 55 ppb to 100 ppb. Cadmium and/or lead were detected at trace concentrations (2.5 to 9 ppb) in monitoring wells MW-05S, MW-04S, AND MW-07S. Copper and cyanide were only detected in monitoring well MW-04S at concentrations of 610 ppb and 96 ppb, respectively. Zinc was detected in monitoring wells MW-04S, G104L, and MW-07S at concentrations ranging from 23 to 42 ppb.

Calcium, iron, magnesium, potassium, and sodium were detected in the background monitoring well (G101D) and in all of the downgradient bedrock monitoring wells. All occurrences of these analytes in the downgradient bedrock wells were within one order of magnitude of the background concentrations, except for magnesium in monitoring well MW-07D and potassium in monitoring well MW-035, which were within approximately two orders of magnitude of the background concentrations. Manganese, a common soil constituent in this region, was detected at a trace level (61 ppb) in monitoring well G102L, but was not detected in the background well.

A total of 7 other inorganic analytes (i.e., cadmium, nickel, arsenic, barium, aluminum, lead, and cyanide) were detected in downgradient wells, but not in the background well. Cadmium was found in monitoring well MW-04D at 7 ppb, nickel in G102D at 46 ppb, and lead in a total of four downgradient wells (MW-04D, MW-03D, MW-07D, AND G104D) at concentrations ranging from 2.3 ppb to 7.2 ppb. Barium was present at 67 ppb in monitoring well G102L and at 100 ppb in monitoring well G102DR. Aluminum was detected in monitoring well MW-01D at 1,000 ppb, but not in any of the other wells, and cyanide was found in monitoring well G106DR at 12 ppb. Trace amounts of arsenic, (5.1 ppb to 6.7 ppb) were detected in three of the downgradient wells (i.e., G102D, G104D, and G102L).

5.0 MAGNITUDE AND EXTENT OF GROUND WATER CONTAMINATION

This section describes the magnitude and extent of contamination in the surficial aquifer below the Lenz Oil site, based on valid field and analytical data collected during the Phase I, Task 2 Remedial Investigation. The results of previous investigative activities have also been considered, if the data are of sufficient quality to meet the objectives of this remedial investigation.

Organic Contamination

As discussed in Section 4.0, NAPL floating on the ground water was identified in monitoring wells G106L, MW-05S, and G105L (prior to the abandonment of the G105 cluster). The thickness of the NAPL was measured using a Keck KIR-89 Interface Probe on June 24, 1991, and was determined to be 0.66 feet in G106S and 1.09 feet in MW-05S. No measurable NAPL was observed in monitoring wells G104L, MW-01S, MW-02S, MW-04S, and G102L; however, an oily sheen was observed in monitoring wells MW-04S and MW02S. The extent of the NAPL is shown on Figure 5-1.

The floating NAPL was not sampled for characterization during Phase I; however, sufficient NAPL separated from the water sample collected from G106L to enable analysis for TCL SVOCs and pesticides/PCBs. The following compounds were detected in the NAPL: naphthalene, 2-Methylnapthalene, acenaphthene, dibenzofuran, fluorene, n-nitrosodiphenylamine, phenanthrene, pyrene, bis(2-ethylhexyl)phthalate, and Aroclor 1242.

The extent of the dissolved organic ground water plume is illustrated on Figure 5-1. The lateral extent of the plume, as illustrated, is defined by wells in which no organic contamination was detected (MW-06S and MW-07S), wells in which compounds were detected at estimated

concentrations below quantitation limits (MW-03S), and wells in which compounds were detected at trace concentrations (MW-02S). The upgradient limit of the ground water plume is approximated by well cluster G101, in which trace quantities of five volatile organic compounds were detected in the deep monitoring well G101D.

In the vertical direction, organic contamination does not extend beyond a depth of approximately 50 feet. Organic compounds were only detected in two deep wells. Trace quantities of five VOCs were detected at G101D, and the VOC, chloroethane, was detected at a concentration of 53 ug/l in G106DL. These two wells represent the approximate maximum depth of contamination at this site.

The relatively limited extent of dissolved organic contamination at the Lenz Oil site is primarily a result of the amount of partitioning which occurs between the NAPL and the ground water. For example, the octanol-water partition coefficients (K_{ow}) for some of the SVOCs are approximately 10^3 - 10^4. As a result, it would be expected that ground water concentrations adjacent to a NAPL containing these compounds would be 3 to 4 orders of magnitude less than the concentrations in the NAPL. The SVOCs in the ground water sample for G106L, below the NAPL, are approximately 4 orders of magnitude less than the concentrations of the same SVOCs detected in the NAPL. In conclusion, the floating NAPL beneath the Lenz Oil site has limited the dissolution of organic compounds and prevented the organics from migrating significant distances from the site.

Inorganic Contamination

Many inorganic analytes are commonly found in ground water in carbonate bedrock aquifers. These inorganics are from the composition of the limestone/dolomite bedrock and also from impurities in the bedrock itself. The following are common constituents of limestone/dolomite

bedrock aquifers: calcium, magnesium, manganese, sodium, and potassium (U.S.G.S., 1989 p. 77, 85, 198-200). Although not significant in evaluating contamination at the site, these data will be important in evaluating potential ground water treatment alternatives.

To evaluate the potential for inorganic contamination of the ground water the site, monitoring well data were compared to the concentrations reported for G101M, G101L, and G101D. The wells screened in the unconsolidated aquifer were compared to the results of G101M, and the wells screened in the bedrock aquifer were compared to G101L and G101D sample results.

Although several of the following inorganic analytes naturally occur in carbonate aquifers, the results of ground water analyses indicate a potential for the site as source of aluminum, arsenic, barium, cadmium, copper, lead, zinc, and cyanide. The aluminum was detected in the background well G101L at an estimated concentration of 970 ug/L, and in only two of the other wells samples; MW-04S (450 mg/L) and MW-01D (1,000J mg/L). Based on the concentrations of aluminum in these wells, as compared to background, aluminum detected on site is likely representative of background conditions.

The horizontal and vertical distribution of inorganics in the ground water closely resembles the contamination extent estimated in Figure 5-1. The delineation of potential inorganic impact is similarly defined by wells with low concentrations or no detection of analytes potentially attributable to the site.

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TABLE 2-1

MONITORING WELL CONSTRUCTION SUMMARY
LENZ OIL SERVICES, INC.

WELL #	GRID N	GRID E	ELEVATION TOP OF CASING	ELEVATION GRADE	DEPTH TO TOP OF SCREEN	DEPTH TO BOTTOM OF SCREEN	SCREEN LENGTH
G101L	885.00	352.00	611.25	608.40	28.90	30.92	2.02
G101M	887.00	362.00	612.05	608.40	18.53	23.53	5.00
G101D	884.00	345.00	610.98	608.50	35.50	37.52	2.02
G102L	417.00	477.00	601.63	599.50	11.26	13.28	2.02
G102D	416.00	469.00	602.41	598.70	16.01	18.03	2.02
G104L	544.00	145.00	602.60	599.70	4.99	7.03	2.04
G104D	539.00	145.00	602.38	599.80	10.90	12.92	2.02
G106S	507.00	237.00	603.08	601.00	6.50	11.50	5.00
G106DR	502.71	245.81	603.28	601.00	34.35	39.35	5.00
MW01S	713.33	614.97	602.88	600.04	3.50	13.50	10.00
MW01D	723.48	615.77	602.11	599.91	35.15	40.15	5.00
MW02S	550.57	608.41	603.23	600.28	3.00	13.00	10.00
MW02D	559.26	608.87	602.63	600.30	33.00	38.00	5.00
MW03S	18.32	581.80	597.99	594.91	3.00	13.00	10.00
MW03D	9.67	586.13	597.87	595.31	34.15	39.15	5.00
MW04S	655.37	500.77	603.35	600.55	3.35	13.35	10.00
MW04D	657.86	507.30	602.80	600.51	35.35	40.35	5.00
MW05S	507.91	423.67	603.92	600.07	6.00	16.00	10.00
MW05D	514.50	424.08	603.91	601.26	36.15	41.15	5.00
MW06S	61.57	210.87	594.04	593.60	1.25	11.25	10.00
MW06D	67.21	203.47	595.95	593.37	33.60	38.60	5.00
MW07S	365.86	17.41	608.26	605.59	22.25	27.25	5.00
MW07D	375.30	17.74	607.98	605.41	44.15	49.15	5.00

TABLE 2-2

DEVELOPMENT WATER REMOVAL SUMMARY
LENZ OIL SERVICES, INC.

WELL #	TOTAL DRILLING FLUIDS LOST TO FORMATION (gal)	TOTAL DEVELOPMENT WATER PUMPED FROM WELL (gal)
MW01S	0	360
MW01D	1525	1850
MW02S	10	205
MW02D	1630	1650
MW03S	358	360
MW03D	3500	3530
MW04S	400	415
MW04D	3000	3075
MW05S	0	90
MW05D	1865	1920
MW06S	150	180
MW06D	800	825
MW07S	50	50
MW07D	549	650
G106DR	1022	1030

Note: The monitoring wells were hand bailed at least three well volumes after purging.

TABLE 2-3
GROUND WATER LEVELS
LENZ OIL SERVICES, INC.

		DATE: 5/9/91		DATE: 4/24/91		DATE: 3/20/91		DATE: 2/26/91		DATE: 1/21/91	
WELL #	ELEVATION TOP OF CASIN	DEPTH T WATER	PIEZOMETRIC SURFACE ELEV.	DEPTH T WATER	PIEZOMETRIC SURFACE ELEV.	DEPTH T WATER	PIEZOMETRIC SURFACE ELEV.	DEPTH T WATER	PIEZOMETRIC SURFACE ELEV.	DEPTH T WATER	PIEZOMETRIC SURFACE ELEV.
G101L	611.25	15.46	595.79	14.56	596.69	15.41	595.84	17.10	594.15	16.72	594.53
G101M	612.05	16.21	595.84	15.31	596.74	16.51	595.54	16.30	595.75	17.47	594.58
G101D	610.98	15.37	595.61	14.44	596.54	15.41	595.57	16.34	594.64	17.67	593.31
G102L	601.63	8.69	592.94	7.69	593.94	8.02	593.61	9.65	591.98	10.24	591.39
G102D	602.41	9.66	592.75	8.64	593.77	8.98	593.43	10.60	591.81	11.18	591.23
G104L	602.60	4.24	598.36	3.12	599.48	3.22	599.38	4.73	597.87	--	--
G104D	602.38	7.12	595.26	6.23	596.15	7.03	595.35	8.04	594.34	8.40	593.98
G106S	603.08	8.92	594.16	10.00	593.08	6.87	596.21	9.54	593.54	11.66	591.42
G106DR	603.28	10.86	592.42	9.74	593.54	--	--	--	--	--	--
MW01S	602.88	7.17	595.71	6.21	596.67	6.95	595.93	--	--	--	--
MW01D	602.11	8.84	593.27	6.28	595.83	7.21	594.90	--	--	--	--
MW02S	603.23	7.95	595.28	--	--	--	--	--	--	--	--
MW02D	602.63	9.73	592.90	--	--	--	--	--	--	--	--
MW03S	597.99	6.54	591.45	5.18	592.81	--	--	--	--	--	--
MW03D	597.87	5.83	592.04	4.71	593.16	--	--	--	--	--	--
MW04S	603.35	7.97	595.38	7.09	596.26	7.04	596.31	--	--	--	--
MW04D	602.80	10.16	592.64	8.78	594.02	9.63	593.17	--	--	--	--
MW05S	603.92	8.85	595.07	7.91	596.01	8.22	595.70	--	--	--	--
MW05D	603.91	11.37	592.54	10.01	593.90	10.81	593.10	--	--	--	--
MW06S	594.04	1.63	592.41	0.71	593.33	--	--	--	--	--	--
MW06D	595.95	4.26	591.69	3.10	592.85	--	--	--	--	--	--
MW07S	608.26	16.31	591.95	15.18	593.08	--	--	--	--	--	--
MW07D	607.98	15.80	592.18	14.47	593.51	--	--	--	--	--	--
RIVER:SG-1	609.78	21.78	588.00	22.10	587.68	--	--	--	--	20.87	588.91
DITCH:SG-2	597.08	0.79	596.29	0.71	596.37	--	--	--	--	--	--
DITCH:SG-3	596.99	1.02	595.97	0.94	596.05	--	--	--	--	--	--

Note: "--" = No measurement was taken.

TABLE 2-4

ROUND ONE GROUND WATER SAMPLES ANALYSES
LENZ OIL SERVICES, INC.

ERM SAMPLE NUMBER	LABORATORY ANALYSES CONDUCTED *					
	TCL VOC	TCL SVOC	TCL PEST/PCB	TOTAL TAL INORG	DISSOLVED TAL INORG	CYANIDE
LO-1MW01S-GW	X	X	X	X	X	X
LO-1MW01D-GW	X	X	X	X	X	X
LO-1MW02S-GW	X	X	X	X	X	X
LO-1MW02D-GW	X	X	X	X	X	X
LO-1MW03S-GW	X	X	X	X	X	X
LO-1MW03D-GW	X	X	X	X	X	X
LO-1MW04S-GW	X	X	X	X	X	X
LO-1MW04D-GW	X	X	X	X	X	X
LO-1MW05S-GW	X	X	X	X	X	X
LO-1MW05D-GW	X	X	X	X	X	X
LO-1MW06S-GW	X	X	X	X	X	X
LO-1MW06D-GW	X	X	X	X	X	X
LO-1MW07S-GW	X	X	X	X	X	X
LO-1MW07D-GW	X	X	X	X	X	X
LO-1G101L-GW	X	X	X	X	X	X
LO-1G101M-GW	X	X	X	X	X	X
LO-1G101D-GW	X	X	X	X	X	X
LO-1G102L-GW	X	X	X	X	X	X
LO-1G102D-GW	X	X	X	X	X	X
LO-1G104L-GW	X	X	X	X	X	X
LO-1G104D-GW	X	X	X	X	X	X
LO-1G106DR-GW	X	X	X	X	X	X
LO-1G106S-WO	X	X	X	X	X	X
LO-1MW03S-FD	X	X	X	X	X	X
LO-1MW04S-FD	X	X	X	X	X	X
LO-1MW05S-FD	X	X	X	X	X	X
LO-1MW02S-MSMSD	X	X	X			
LO-1G106DR-MSMSD	X	X	X			
LO-1GW1-FB	X	X	X	X	X	X
LO-1GW2-FB	X	X	X	X	X	X
LO-1GW3-FB	X	X	X	X	X	X
LO-GW6-TB	X					
LO-1GW-TB1	X					
LO-1GW-TB	X					
LO-1GW-TB3	X					

NOTES

* TCL VOC = Target Compound List volatile organic compounds
TCL SVOC = Target Compound List semivolatile organic compounds
TCL PEST/PCB = Target Compound List pesticide/PCBs
TOTAL TAL INORG = Total Target Analyte List inorganic analytes
DISSOLVED TAL INORG = Dissolved Target Analyte List inorganic analytes

TABLE 2-5

GROUND WATER SAMPLE CONTAINERS AND PRESERVATION
LENZ OIL SERVICES, INC.

ANALYTICAL FRACTION	CONTAINER	PRESERVATION	FILLING PROCEDURES
TCL Volatile Organic Compounds	2 - 40 ml glass vials with Teflon-lined septum	Cool - 4 degrees Celsius	Zero headspace - no air bubbles
TCL Semivolatile Organic Compounds	3 - 1 liter amber glass bottles with Teflon-lined caps	Cool - 4 degrees Celsius	Fill to neck of bottle
PCBs/Pesticides	2 - 1 liter amber glass bottles with Teflon-lined caps	Cool - 4 degrees Celsius	Fill to neck of bottle
TAL Dissolved Metals	2 - 500 ml polyethylene bottles	Nitric acid to pH<2 Cool - 4 degrees Celsius	Field filter and fill to neck of bottle
TAL Total Metals	2 - 500 ml polyethylene bottles	Nitric Acid to pH<2 Cool - 4 degrees Celsius	Fill to neck of bottle
Cyanide	2 - 1 liter clear glass bottles with Teflon-lined caps	Sodium hydroxide to pH>12 Cool - 4 degrees Celsius	Fill to neck of bottle

TABLE 3-1

GEOTECHNICAL ANALYTICAL RESULTS
LENZ OIL SERVICES

SAMPLE NUMBER	COLLECTION INTERVAL (ft BGS)	MOISTURE CONTENT (%)	POROSITY (%)	DRY DENSITY (lb/ft**2)	TOC (ppm)	SPECIFIC GRAVITY (g/cm**2)
MW01S	6-10	16.4	31.4	116.1	15000	2.706
MW02S	8-12	10.4	ND	ND	1608	ND
MW04S	6-10	51.1	57.0	68.7	14000	2.2565
MW04SDUP	6-10	42.5	53.7	72.5	15000	2.513
MW05S	11-15	8.4	19.1	139	15000	2.758

TABLE 4-1
SHALLOW WELLS - DETECTED ORGANIC COMPOUNDS
LENZ OIL SERVICES

ERM - NC Sample Number	LO-1G101M-GW	LO-1G102L-GW	LO-1G104L-GW	G106S-WO-WATER	G106S-WODL-OIL	G106S-WODLRE-OIL	G106S-WO-OIL	LO-1MW01S-GW
Laboratory Sample Number	11897-4	11897-2	111908 9	111928-i	111908-11	111908-11	111908-11	11897-7
Date sample collected	5/6/91	5/6/91	5/7/91	5/9/91	5/7/91	5/7/91	5/7/91	5/6/91
Dilution Factor	1	1	1	10	5	5	1	1
Units	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
Vinyl Chloride	10 U	10 U	10 U	10 U	n/a	n/a	n/a	10 U
Chloroethane	10 U	4 J	10 U	27 J	n/a	n/a	n/a	10 U
Methylene Chloride	5 U	5 U	5 U	41 U	n/a	n/a	n/a	5 U
Acetone	10 U	10 U	10 U	150 J	n/a	n/a	n/a	10 U
1,1-Dichloroethene	5 U	5	5 U	5 U	n/a	n/a	n/a	5 U
1,1-Dichloroethane	5 U	58	5 U	5 U	n/a	n/a	n/a	5 U
Total 1,2-Dichloroethene	5 U	21	5 U	5 U	n/a	n/a	n/a	5 U
Chloroform	5 U	5 U	5 U	5 U	n/a	n/a	n/a	5 U
1,1,1-Trichloroethane	5 U	120	5 U	5 U	n/a	n/a	n/a	5 U
Carbon Tetrachloride	5 U	5 U	5 U	5 U	n/a	n/a	n/a	5 U
Benzene	5 U	5 U	5 U	140 J	n/a	n/a	n/a	5 U
Trichloroethene	5 U	6	5 U	5 U	n/a	n/a	n/a	5 U
Tetrachloroethene	5 U	3 J	5 U	5 U	n/a	n/a	n/a	5 U
Toluene	5 U	5 U	5 U	360 J	n/a	n/a	n/a	6 U
Ethylbenzene	5 U	5 U	5 U	130 J	n/a	n/a	n/a	5 U
Total Xylenes	5 U	5 U	5 U	2400 J	n/a	n/a	n/a	5 U
Phenol	10 U	10 U	10 U	13	100000 UD	100000 UD	20000 U	10 U
1,2-Dichlorobenzene	10 U	10 U	10 U	10 J	100000 UD	100000 UD	20000 R	10 U
2-Methylphenol	10 U	10 U	10 U	10 U	100000 UD	100000 UD	20000 U	10 U
4-Methylphenol	10 U	10 U	10 U	8 J	100000 UD	100000 UD	20000 U	10 U
2,4-Dimethylphenol	10 U	10 U	10 U	17	100000 UD	100000 UD	20000 U	10 U
Benzoic Acid	50 U	50 U	50 U	10 U	500000 UD	500000 UD	100000 U	50 U
Naphthalene	10 U	10 U	10 U	82	430000 J	410000 J	20000 R	10 U
2-Methylnaphthalene	10 U	10 U	10 U	190	150000 J	140000 J	730000 J	10 U
Acenaphthene	10 U	10 U	10 U	15	290000 J	320000 J	430000 R	10 U
Dibenzofuran	10 U	10 U	10 U	10 U	190000 J	420000 J	53000 J	10 U
Fluorene	10 U	10 U	10 U	27	540000 J	570000 J	820000 J	10 U
N-Nitrosodiphenylamine	10 U	10 U	10 U	24	240000 J	200000 J	140000 J	10 U
Phenanthrene	10 U	10 U	10 U	47	640000 J	520000 J	51000 J	10 U
Anthracene	10 U	10 U	10 U	10 U	100000 UD	100000 UD	20000 U	10 U
Fluoranthene	10 U	10 U	10 U	10 U	100000 UD	100000 UD	20000 U	10 U
Pyrene	10 U	10 U	10 U	4 J	28000 J	30000 J	47000 J	10 U
Butylbenzylphthalate	10 U	10 U	10 U	10 U	100000 UD	100000 UD	20000 U	10 U
bis(2-Ethylhexyl)phthalate	10 U	10 U	10 U	15	120000 J	130000 J	120000 J	10 U
Aroclor-1242	0.5 U	0.5 U	0.5 U	n/a	0.5 U	n/a	1130	0.5 U
Aroclor-1248	0.5 U	0.5 U	0.5 U	n/a	1200 U	n/a	0.5 R	0.5 U
Aroclor-1260	1 U	1 U	1 U	n/a	2400 U	n/a	1 R	1 U

See notes on page 4

TABLE 4-1
SHALLOW WELLS - DETECTED ORGANIC COMPOUNDS
LENZ OIL SERVICES

ERM - NC Sample Number	LO-1MW02S-GW	LO-1MW02S-GWRE	LO-1MW02S-MS/MSD	LO-1MW03S-GW	LO-1MW03S-GWRE	LO-1MW03S-FD	LO-1MW03S-FDRE
Laboratory Sample Number	11918-3	111918-3RE	11918-7	11897-8	11897-8RE	11897-10	11897-10RE
Date sample collected	5/8/91	5/8/91	5/8/91	5/6/91	5/6/91	5/6/91	5/6/91
Dilution Factor	1	1	1	1	1	1	1
Units	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
Vinyl Chloride	10 UL	n/a	10 U	10 U	10 U	10 U	10 UL
Chloroethane	10 UL	n/a	10 U	10 U	10 U	10 U	10 UL
Methylene Chloride	12 U	n/a	5 U	5 U	2 U	5 U	27 U
Acetone	10 UL	n/a	10 U	10 U	10 U	10 U	10 UL
1,1-Dichloroethene	5 UL	n/a	5 U	5 U	5 U	5 U	5 UL
1,1-Dichloroethane	5 UL	n/a	2 J	5 U	5 U	5 U	5 UL
Total 1,2-Dichloroethene	3 J	n/a	3 J	5 U	5 U	5 U	5 UL
Chloroform	5 UL	n/a	5 U	5 U	5 U	5 U	5 UL
1,1,1-Trichloroethane	5 UL	n/a	5 U	5 U	5 U	5 U	5 UL
Carbon Tetrachloride	5 UL	n/a	5 U	5 U	5 U	5 U	5 UL
Benzene	5 UL	n/a	5 U	5 U	5 U	5 U	5 UL
Trichloroethene	5 UL	n/a	5 U	5 U	5 U	5 U	5 UL
Tetrachloroethene	5 UL	n/a	5 U	5 U	5 U	2 J	5 UL
Toluene	5 UL	n/a	5 UL	5 U	5 U	5 U	5 UL
Ethylbenzene	5 UL	n/a	5 UL	5 U	5 U	5 U	5 UL
Total Xylenes	5 UL	n/a	5 UL	5 U	5 U	12 U	5 UL
Phenol	10 U	10 U	10 U	10 U	n/a	10 U	n/a
1,2-Dichlorobenzene	10 U	10 U	10 U	10 U	n/a	10 U	n/a
2-Methylphenol	10 U	10 U	10 U	10 U	n/a	10 U	n/a
4-Methylphenol	10 U	10 U	10 U	10 U	n/a	10 U	n/a
2,4-Dimethylphenol	10 U	10 U	10 U	10 U	n/a	10 U	n/a
Benzoic Acid	50 U	50 U	50 U	50 U	n/a	50 U	n/a
Naphthalene	10 U	10 U	10 U	10 U	n/a	10 U	n/a
2-Methylnaphthalene	10 U	10 U	10 U	10 U	n/a	10 U	n/a
Acenaphthene	10 U	10 U	10 U	10 U	n/a	10 U	n/a
Dibenzofuran	10 U	10 U	10 U	10 U	n/a	10 U	n/a
Fluorene	10 U	10 U	10 U	10 U	n/a	10 U	n/a
N-Nitrosodiphenylamine	10 U	10 U	10 U	10 U	n/a	10 U	n/a
Phenanthrene	10 U	10 U	10 U	10 U	n/a	10 U	n/a
Anthracene	10 U	10 U	10 U	10 U	n/a	10 U	n/a
Fluoranthene	10 U	10 U	10 U	10 U	n/a	10 U	n/a
Pyrene	10 UL	10 U	10 U	10 U	n/a	10 U	n/a
Butylbenzylphthalate	10 U	10 U	10 U	10 U	n/a	10 U	n/a
bis(2-Ethylhexyl)phthalate	2 J	10 U	10 U	10 U	n/a	10 U	n/a
Aroclor-1242	0.5 U	n/a	0.5 U	0.5 U	n/a	0.5 U	n/a
Aroclor-1248	0.5 U	n/a	0.5 U	0.5 U	n/a	0.5 U	n/a
Aroclor-1260	1 U	n/a	1 U	1 U	n/a	1 U	n/a

See notes on page 4

TABLE 4-1
SHALLOW WELLS - DETECTED ORGANIC COMPOUNDS
LENZ OIL SERVICES

ERM - NC Sample Number	LO-1MW04S-GW	LO-1MW04S-GWRE	LO 1MW04S-FD	LO-1MW05S-GW	LO-1MW05S-GWRE	LO-1MW05S-FD	LO-1MW05S-FDRE
Laboratory Sample Number	11918-6	11918-6RE	11918-2	111908-7	111908-7RE	111908-8	111908-8RE
Date sample collected	5/8/91	5/8/91	5/8/91	5/7/91	5/7/91	5/7/91	5/7/91
Dilution Factor	1	1	1	10	10	10	10
Units	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
Vinyl Chloride	10 U	10 U	10 U	100 U	n/a	100 UL	100 U
Chloroethane	10 U	10 U	10 U	100 U	n/a	100 UL	100 U
Methylene Chloride	5 U	5 U	6 U	50 U	n/a	50 U	50 U
Acetone	10 U	10 U	10 U	10 U	n/a	10 UL	10 U
1,1-Dichloroethene	5 U	5 U	5 U	50 U	n/a	50 UL	50 U
1,1-Dichloroethane	5 U	5 U	2 J	28 J	n/a	31 J	28 J
Total 1,2-Dichloroethene	5 U	5 U	5 U	50 U	n/a	50 UL	50 U
Chloroform	5 U	5 U	5 U	14 J	n/a	50 UL	50 U
1,1,1-Trichloroethane	5 U	5 U	5 U	50 U	n/a	50 UL	50 UL
Carbon Tetrachloride	5 U	5 U	5 U	50 U	n/a	50 UL	50 UL
Benzene	5 U	5 U	5 U	50 U	n/a	50 UL	50 UL
Trichloroethene	5 U	2 J	5 U	50 U	n/a	50 UL	50 UL
Tetrachloroethene	5 U	5 U	5 U	50 U	n/a	50 UL	50 UL
Toluene	5 UL	5 U	5 UL	50 UL	n/a	50 UL	50 UL
Ethylbenzene	5 UL	5 U	5 UL	270 J	n/a	350 J	370 J
Total Xylenes	5 UL	5 U	5 UL	670 J	n/a	920 J	890 J
Phenol	10 U	n/a	10 U	100 R	100 R	100 R	100 R
1,2-Dichlorobenzene	10 U	n/a	10 U	100 U	100 U	100 U	100 U
2-Methylphenol	10 U	n/a	10 U	100 U	100 R	100 R	100 R
4-Methylphenol	10 U	n/a	10 U	10 U	10 U	10 U	10 U
2,4-Dimethylphenol	2 J	n/a	2 J	100 R	100 R	100 R	100 U
Benzoic Acid	50 U	n/a	27 J	500 UL	500 R	500 R	500 R
Naphthalene	10 U	n/a	10 U	1300 J	1100 J	1800 J	1100
2-Methylnaphthalene	10 U	n/a	10 U	3200 J	1900 J	3400 J	2200 J
Acenaphthene	10 U	n/a	10 U	100 U	100 U	100 U	100 U
Dibenzofuran	10 U	n/a	10 U	410 J	340 J	660 J	670 J
Fluorene	10 U	n/a	10 U	710 J	580 J	870 J	930 J
N-Nitrosodiphenylamine	10 U	n/a	10 U	500 U	500 R	500 U	500 U
Phenanthrene	10 U	n/a	10 U	1800 J	2300 J	2300 J	3600 J
Anthracene	10 U	n/a	10 U	79 J	120 J	150 J	210 J
Fluoranthene	10 U	n/a	10 U	100 UL	100 R	75 J	130 J
Pyrene	10 U	n/a	10 U	110 J	59 J	160 J	99 J
Butylbenzylphthalate	10 U	n/a	10 U	100 UL	100 U	100 UL	100 U
bis(2-Ethylhexyl)phthalate	10 U	n/a	10 U	290 J	380 J	520 J	530
Aroclor-1242	0.5 U	n/a	0.5 U	645	n/a	0.5 U	n/a
Aroclor-1248	0.5 U	n/a	0.5 U	350	n/a	420	n/a
Aroclor-1260	1 U	n/a	1 U	120	n/a	160	n/a

See notes on page 4

TABLE 4-1
SHALLOW WELLS - DETECTED ORGANIC COMPOUNDS
LENZ OIL SERVICES

ERM - NC Sample Number	LO-1MW05S-FDDL		LO-1MW06S-GW	
Laboratory Sample Number	111908-8DL		11918-5	
Date sample collected	5/7/91		5/8/91	
Dilution Factor	50		1	
Units	(ug/L)		(ug/L)	
Vinyl Chloride	n/a		10	U
Chloroethane	n/a		10	U
Methylene Chloride	n/a		5	U
Acetone	n/a		10	U
1,1-Dichloroethene	n/a		5	U
1,1-Dichloroethane	n/a		5	U
Total 1,2-Dichloroethene	n/a		5	U
Chloroform	n/a		5	U
1,1,1-Trichloroethane	n/a		5	U
Carbon Tetrachloride	n/a		5	U
Benzene	n/a		5	U
Trichloroethene	n/a		5	U
Tetrachloroethene	n/a		5	U
Toluene	n/a		5	UL
Ethylbenzene	n/a		5	UL
Total Xylenes	n/a		5	UL
Phenol	500	R	10	U
1,2-Dichlorobenzene	500	U	10	U
2-Methylphenol	500	R	10	U
4-Methylphenol	10	U	10	U
2,4-Dimethylphenol	500	R	10	U
Benzoic Acid	2500	R	50	U
Naphthalene	2400		10	U
2-Methylnaphthalene	6000		10	U
Acenaphthene	100	U	10	U
Dibenzofuran	560	J	10	U
Fluorene	1300	J	10	U
N-Nitrosodiphenylamine	2500	U	10	U
Phenanthrene	3200	J	10	U
Anthracene	500	UL	10	U
Fluoranthene	500	UL	10	U
Pyrene	500	UL	10	U
Butylbenzylphthalate	500	UL	10	U
bis(2-Ethylhexyl)phthalate	640		10	U
Aroclor-1242	n/a		n/a	
Aroclor-1248	n/a		n/a	
Aroclor-1260	n/a		n/a	

NOTES:
- U Compound was not detected at the detection limit reported.
- J Quantitation is approximate due to limitations identified during the quality control review (data validation).
- R *Unreliable result - Analyte may or may not be present in this sample.*
- B Compound detected in laboratory blank.
- UL This analyte was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.

TABLE 4-2
INTERMEDIATE WELLS - DETECTED ORGANIC COMPOUNDS
LENZ OIL SERVICES

ERM - NC Sample Number	LO-1G101L-GW		LO-1G102D-GW		LO-1G104D-GW		LO-1MW07S-GW	
Laboratory Sample Number	11897-5		11897-1		111908-2		111908-5	
Date sample collected	5/6/91		5/6/91		5/7/91		5/7/91	
Dilution Factor	1		1		1		1	
Units	(ug/L)		(ug/L)		(ug/L)		(ug/L)	
Vinyl Chloride	10	U	13		10	U	10	U
Chloroethane	10	U	5	J	10	U	10	U
Methylene Chloride	5	U	5	U	5	U	5	U
Acetone	10	U	10	U	10	U	10	U
1,1-Dichloroethene	5	U	3	J	5	U	5	U
1,1-Dichloroethane	5	U	70		4	J	5	U
Total 1,2-Dichloroethene	5	U	15		5	U	5	U
Chloroform	5	U	5	U	5	U	5	U
1,1,1-Trichloroethane	5	U	83		5	U	5	U
Carbon Tetrachloride	5	U	5	U	5	U	5	U
Benzene	5	U	5	U	5	U	5	U
Trichloroethene	5	U	3	J	5	U	5	U
Tetrachloroethene	5	U	5	U	5	U	5	U
Toluene	5	U	5	U	5	U	5	U
Ethylbenzene	5	U	5	U	5	U	5	U
Total Xylenes	5	U	5	U	5	U	5	U
Phenol	10	U	10	U	10	U	10	U
1,2-Dichlorobenzene	10	UL	10	U	10	U	10	U
2-Methylphenol	10	UL	10	U	10	U	10	U
4-Methylphenol	10	UL	10	U	10	U	10	U
2,4-Dimethylphenol	10	UL	10	U	10	U	10	U
Benzoic Acid	50	UL	50	U	50	U	50	U
Naphthalene	10	UL	10	U	10	U	10	U
2-Methylnaphthalene	10	UL	10	U	10	U	10	U
Acenaphthene	10	UL	10	U	10	U	10	U
Dibenzofuran	10	UL	10	U	10	U	10	U
Fluorene	10	UL	10	U	10	U	10	U
N-Nitrosodiphenylamine	10	UL	10	U	10	U	10	U
Phenanthrene	10	UL	10	U	10	U	10	U
Anthracene	10	UL	10	U	10	U	10	U
Fluoranthene	10	UL	10	U	10	U	10	U
Pyrene	10	UL	10	U	10	U	10	U
Butylbenzylphthalate	10	UL	10	U	10	U	5	U
bis(2-Ethylhexyl)phthalate	10	UL	10	U	10	U	10	U
Aroclor-1242	0.5	U	0.5	U	0.5	U	0.5	U
Aroclor-1248	0.5	U	0.5	U	0.5	U	0.5	U
Aroclor-1260	1	U	1	U	1	U	1	U

See notes on page 4

NOTES:
- U Compound was not detected at the detection limit reported.
- J Quantitation is approximate due to limitations identified during the quality control review (data validation).
- R *Unreliable result - Analyte may or may not be present in this sample.*
- B Compound detected in laboratory blank.
- UL This analyte was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.

TABLE 4-3
DEEP - DETECTED ORGANIC COMPOUNDS
LENZ OIL SERVICES

ERM - NC Sample Number	LO-1G101D-GW	LO-1G106DR-GW	LO-G106DR-MS/MSD	LO-1MW01D-GW	LO-1MW02D-GW	LO-1MW03D-GW	LO-1MW03D-GWRE	LO-1MW04D-GW
Laboratory Sample Number	11897-3	111908-11	111908-12	11897-6	111908-6	11897-9	11897-9RE	111908-1
Date sample collected	5/6/91	5/7/91	5/7/91	5/6/91	5/7/91	5/6/91	5/6/91	5/7/91
Dilution Factor	1	1	1	1	1	1	1	1
Units	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
Vinyl Chloride	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chloroethane	10 U	53	46	10 U	10 U	10 U	10 U	10 U
Methylene Chloride	5 U	7 U	5 U	23 U	6 U	5 U	19 U	5 U
Acetone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethene	2 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Total 1,2-Dichloroethene	5 U	5 U	2 J	5 U	5 U	5 U	5 U	5 U
Chloroform	3 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,1-Trichloroethane	2 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon Tetrachloride	3 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene	5 U	5 U	5 UL	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	2 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	5 U	5 UL	5 UL	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5 U	5 UL	5 UL	5 U	5 U	5 U	5 U	5 U
Total Xylenes	5 U	5 UL	5 UL	5 U	5 U	13 U	5 U	5 U
Phenol	10 U	10 U	10 U	10 U	10 U	10 U	n/a	10 U
1,2-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	n/a	10 U
2-Methylphenol	10 U	10 U	10 U	10 U	10 U	10 U	n/a	10 U
4-Methylphenol	10 U	10 U	10 U	10 U	10 U	10 U	n/a	10 U
2,4-Dimethylphenol	10 U	10 U	10 U	10 U	10 U	10 U	n/a	10 U
Benzoic Acid	50 U	50 U	50 U	50 U	50 U	50 U	n/a	50 U
Naphthalene	10 U	10 U	10 U	10 U	10 U	10 U	n/a	10 U
2-Methylnaphthalene	10 U	10 U	10 U	10 U	10 U	10 U	n/a	10 U
Acenaphthene	10 U	10 U	10 U	10 U	10 U	10 U	n/a	10 U
Dibenzofuran	10 U	10 U	10 U	10 U	10 U	10 U	n/a	10 U
Fluorene	10 U	10 U	10 U	10 U	10 U	10 U	n/a	10 U
N-Nitrosodiphenylamine	10 U	10 U	10 U	10 U	10 U	10 U	n/a	10 U
Phenanthrene	10 U	10 U	10 U	10 U	10 U	10 U	n/a	10 U
Anthracene	10 U	10 U	10 U	10 U	10 U	10 U	n/a	10 U
Fluoranthene	10 U	10 U	10 U	10 U	10 U	10 U	n/a	10 U
Pyrene	10 U	10 U	10 U	10 U	10 U	10 U	n/a	10 U
Butylbenzylphthalate	10 U	10 U	10 U	10 U	10 U	10 U	n/a	10 U
bis(2-Ethylhexyl)phthalate	10 U	10 U	10 U	10 U	10 U	10 U	n/a	10 U
Aroclor-1242	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	n/a	0.5 U
Aroclor-1248	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	n/a	0.5 U
Aroclor-1260	1 U	1 U	1 U	1 U	1 U	1 U	n/a	1 U

TABLE 4-3
DEEP WELLS - DETECTED ORGANIC COMPOUNDS
LENZ OIL SERVICES

ERM - NC Sample Number	LO-1MW05D-GW	LO-1MW06D-GW	LO-1MW06D-GWRE	LO-1MW07D-GW	LO-1GW1-FB	LO-1GW1-FBRE	LO-1GW2-FB	LO-1GW3-FB
Laboratory Sample Number	111908-10	11918-1	111918-1RE	111908-4	11897-11	11897-11RE	111908-3	11918-4
Date sample collected	5/7/91	5/8/91	5/8/91	5/7/91	5/6/91	5/6/91	5/7/91	5/8/91
Dilution Factor	1	1	1	1	1	1	1	1
Units	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
Vinyl Chloride	10 U	10 U	n/a	10 U	10 U	10 U	10 U	10 U
Chloroethane	10 U	10 U	n/a	10 U	10 U	16 J	10 U	10 U
Methylene Chloride	6 U	7 U	n/a	5 U	5 U	5 U	4 J	8 J
Acetone	10 U	10 U	n/a	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethene	5 U	5 U	n/a	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	5 U	5 U	n/a	5 U	5 U	5 U	5 U	5 U
Total 1,2-Dichloroethene	5 U	5 U	n/a	5 U	5 U	5 U	5 U	5 U
Chloroform	5 U	5 U	n/a	5 U	5 U	5 U	5 U	5 U
1,1,1-Trichloroethane	5 U	5 U	n/a	5 U	5 U	5 U	5 U	5 U
Carbon Tetrachloride	5 U	5 U	n/a	5 U	5 U	5 U	5 U	5 U
Benzene	5 U	5 U	n/a	5 U	5 U	5 U	5 U	5 U
Trichloroethene	5 U	5 U	n/a	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	5 U	5 U	n/a	5 U	5 U	5 U	5 U	5 U
Toluene	5 U	5 UL	n/a	5 U	3 J	5 U	5 U	5 UL
Ethylbenzene	5 U	5 UL	n/a	5 U	5 U	5 U	5 U	5 UL
Total Xylenes	5 U	5 UL	n/a	5 U	11 J	5 U	5 U	5 UL
Phenol	10 U	10 R	10 R	10 U	10 U	n/a	10 U	10 U
1,2-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U	n/a	10 U	10 U
2-Methylphenol	10 U	10 R	10 R	10 U	10 U	n/a	10 U	10 U
4-Methylphenol	10 U	10 U	10 U	10 U	10 U	n/a	10 U	10 U
2,4-Dimethylphenol	10 U	10 R	10 R	10 U	10 U	n/a	10 U	10 U
Benzoic Acid	50 U	50 U	50 R	50 U	50 U	n/a	50 U	50 U
Naphthalene	10 U	10 U	10 U	10 U	10 U	n/a	10 U	10 U
2-Methylnaphthalene	2 J	10 U	10 U	10 U	10 U	n/a	10 U	10 U
Acenaphthene	10 U	10 U	10 U	10 U	10 U	n/a	10 U	10 U
Dibenzofuran	10 U	10 R	10 R	10 U	10 U	n/a	10 U	10 U
Fluorene	10 U	10 U	10 U	10 U	10 U	n/a	10 U	10 U
N-Nitrosodiphenylamine	10 U	10 U	10 U	10 U	10 U	n/a	10 U	10 U
Phenanthrene	10 U	10 U	10 U	10 U	10 U	n/a	10 U	10 U
Anthracene	10 U	10 U	10 U	10 U	10 U	n/a	10 U	10 U
Fluoranthene	10 U	10 U	10 U	10 U	10 U	n/a	10 U	10 U
Pyrene	10 U	10 U	10 U	10 U	10 U	n/a	10 U	10 U
Butylbenzylphthalate	10 U	10 U	10 U	10 U	10 U	n/a	10 U	5 J
bis(2-Ethylhexyl)phthalate	10 U	10 U	10 U	10 U	10 U	n/a	10 U	10 U
Aroclor-1242	0.5 U	0.5 U	n/a	0.5 U	0.5 U	n/a	0.5 U	0.5 U
Aroclor-1248	0.5 U	0.5 U	n/a	0.5 U	0.5 U	n/a	0.5 U	0.5 U
Aroclor-1260	1 U	1 U	n/a	1 U	1 U	n/a	1 U	1 U

TABLE 4-3
DEEP WELLS - DETECTED ORGANIC COMPOUNDS
LENZ OIL SERVICES

NOTES:
- U Compound was not detected at the detection limit reported.
- J Quantitation is approximate due to limitations identified during the quality control review (data validation).
- R Unreliable result - Analyte may or may not be present in this sample.
- B Compound detected in laboratory blank.
- UL This analyte was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.

TABLE 4-4
SHALLOW WELLS - DETECTED INORGANIC ANALYTES
DISSOLVED METALS
LENZ OIL SERVICES

ERM-NC Sample Number	LO-1G101M-GW		LO-1G102L-GW		LO-1G104L-GW		LO-1MW01S-GW		LO-1MW02S-GW		LO-1MW03S-GW		LO-1MW3S-FD		LO-1MW04S-GW	
Laboratory Sample Number	11897-4		11897-2		11908-9		11897-7		11918-3		11897-8		11897-10		11918-6	
Date sample collected	5/6/91		5/6/91		5/7/91		5/6/91		5/8/91		5/6/91		5/6/91		5/8/91	
Units	(ug/L)		(ug/L)		(ug/L)		(ug/L)		(ug/L)		(ug/L)		(ug/L)		(ug/L)	
Aluminum	200	U	200	U	200	R	200	U	200	R	200	U	200	U	450	J
Antimony	60	UL	60	UL	60	UL	60	UL	60	R	60	UL	60	UL	60	R
Arsenic	0.9	U	5.1		4.5	U	8.3		0.9	U	0.9	U	0.9	U	31	
Barium	50	U	67		55	J	79		50	R	50	U	50	U	84	J
Beryllium	5	UL	5	UL	5	UL	5	UL	5	UL	5	UL	5	R	5	UL
Cadmium	5	R	5	R	5	R	5	R	5	R	5	R	5	R	5	R
Calcium	87000	J	110000	J	110000	J	130000	J	180000	J	93000	J	91000	J	190000	J
Chromium	10	UL	10	UL	10	U	10	UL	10	U	10	UL	10	UL	10	U
Cobalt	50	UL	50	UL	50	UL	50	UL	50	UL	50	UL	50	UL	50	UL
Copper	25	U	25	U	25	UL	25	U	25	UL	25	U	25	U	25	UL
Iron	50	U	1200		50	U	2600		99	J	50	U	50	U	110	J
Lead	2	U	2	U	2	U	2	U	2	UL	5.5	J	2	U	5.8	J
Magnesium	44000		56000		78000	J	61000		94000		46000		46000		210000	
Manganese	15	UL	61		510	J	80		440		15	UL	15	UL	150	
Mercury	0.2	U	0.2	U	0.2	UL	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Nickel	40	UL	40	UL	40	UL	40	UL	40	UL	40	UL	40	UL	40	UL
Potassium	1600	J	5600	J	34000		5600	J	6500		2300	J	2300	J	70000	J
Selenium	0.9	U	0.9	U	4.5	U	0.9	U	0.9	UL	0.9	U	0.9	U	0.9	UL
Silver	10	U	10	U	10	UL	10	U	10	R	10	U	10	U	10	R
Sodium	3800		140000		110000		210000		220000		27000		27000		890000	
Thallium	5	UL	5	UL	5	UL	5	UL	5	UL	5	UL	5	U	5	UL
Vanadium	50	U	50	U	50	U	50	U	50	U	50	U	50	U	50	U
Zinc	20	UL	20	UL	23	J	20	U	20	U	20	UL	20	UL	20	U
Cyanide	10	UL	10	UL	10	UL	10	UL	10	UL	10	UL	10	UL	96	J

NOTES:
- U Compound was not detected at the quantitation limit shown.
- J Quantitation is approximate due to limitations identified in the quality assurance review.
- UL This analyte was not detected, but the quantitation limit is probaly higher due to a low bias identified during the quality assurance review.
- R Unreliable result - Analyte may or may not be present in this sample.

TABLE 4-4
SHALLOW WELLS - DETECTED INORGANIC ANALYTES
DISSOLVED METALS
LENZ OIL SERVICES

ERM-NC Sample Number	LO-1MW04S-FD		LO-1MW05S-GW		LO-1MW05S-FD		LO-1MW06S-GW		LO-1MW07S-GW	
Laboratory Sample Number	11918-2		11908-7		11908-8		11918-5		11908-5	
Date sample collected	5/8/91		5/7/91		5/7/91		5/8/91		5/7/91	
Units	(ug/L)		(ug/L)		(ug/L)		(ug/L)		(ug/L)	
Aluminum	38	R	200	R	200	R	200	R	200	R
Antimony	12	R	60	UL	60	UL	60	R	60	UL
Arsenic	34		22		23		0.9	U	0.9	U
Barium	100	J	62	J	62	J	50	R	81	J
Beryllium	0.96	UL	5	UL	5	UL	5	UL	5	UL
Cadmium	9	J	5	R	5	R	5	R	5	R
Calcium	200000	J	120000	J	120000	J	73000	J	220000	J
Chromium	1.9	U	10	U	10	U	10	U	10	U
Cobalt	9.6	UL	50	UL	50	UL	50	UL	50	UL
Copper	4.8	UL	25	UL	25	UL	25	UL	25	UL
Iron	610	J	1500		1600		67	J	9900	
Lead	4.2	J	3.7		2	U	2	UL	2.5	
Magnesium	210000		58000	J	58000	J	28000		120000	J
Manganese	170	J	220		220		15	R	15	UL
Mercury	0.067	U	0.2	UL	0.2	UL	0.2	U	0.2	UL
Nickel	7.7	UL	40	UL	40	UL	40	UL	40	UL
Potassium	63000		4200	J	4100	J	6300	J	7100	J
Selenium	0.87	UL	0.9	U	4.5	U	0.9	UL	0.9	U
Silver	1.9	R	10	UL	10	UL	10	R	10	UL
Sodium	890000		190000	J	200000	J	26000		450000	
Thallium	9.6	UL	5	UL	5	UL	5	UL	5	UL
Vanadium	9.6	U	50	U	50	U	50	U	50	U
Zinc	42	J	20	U	20	U	20	U	28	J
Cyanide	73	J	10	UL	10	UL	10	UL	10	UL

NOTES:
- U Compound was not detected at the quantitation limit shown.
- J Quantitation is approximate due to limitations identified in the quality assurance review.
- UL This analyte was not detected, but the quantitation limit is probaly higher due to a low bias identified during the quality assurance review.
- R Unreliable result - Analyte may or may not be present in this sample.

TABLE 4-5
INTERMEDIATE WELLS - DETECTED INORGANIC ANALYTES
DISSOLVED METALS
LENZ OIL SERVICES

ERM-NC Sample Number	LO-1G101L-GW		LO-1G102D-GW		LO-1G104D-GW		LO-1MW07S-GW	
Laboratory Sample Number	11897-5		11897-1		11908-2		11908-5	
Date sample collected	5/6/91		5/6/91		5/7/91		5/7/91	
Units	(ug/L)		(ug/L)		(ug/L)		(ug/L)	
Aluminum	970	J	200	U	38	R	200	R
Antimony	60	UL	60	UL	12	UL	60	UL
Arsenic	0.9	U	5.6		6.7		0.9	U
Barium	50	U	50	U	9.6	UL	81	J
Beryllium	5	UL	5	UL	0.96	UL	5	UL
Cadmium	5	R	5	R	0.96	R	5	R
Calcium	110000	J	110000	J	130000	J	220000	J
Chromium	10	UL	10	UL	1.9	U	10	U
Cobalt	50	UL	50	UL	9.6	UL	50	UL
Copper	25	U	25	U	4.8	UL	25	UL
Iron	270	J	1600		1000		9900	
Lead	2	UL	2	U	7.2		2.5	
Magnesium	54000		55000		70000	J	120000	J
Manganese	15	UL	37	J	2.9	UL	15	UL
Mercury	0.2	U	0.2	U	0.067	UL	0.2	UL
Nickel	40	UL	46	J	7.7	UL	40	UL
Potassium	3[illegible]00	J	5900	J	6500	J	7100	J
Selenium	0.9	U	0.9	U	0.87	U	0.9	U
Silver	10	U	10	U	1.9	UL	10	UL
Sodium	1300000	J	140000		130000		450000	
Thallium	5	U	5	UL	9.6	UL	5	UL
Vanadium	50	U	50	U	9.6	U	50	U
Zinc	20	UL	20.0	UL	3.8	U	28	J
Cyanide	10	UL	10	UL	10	UL	10	UL

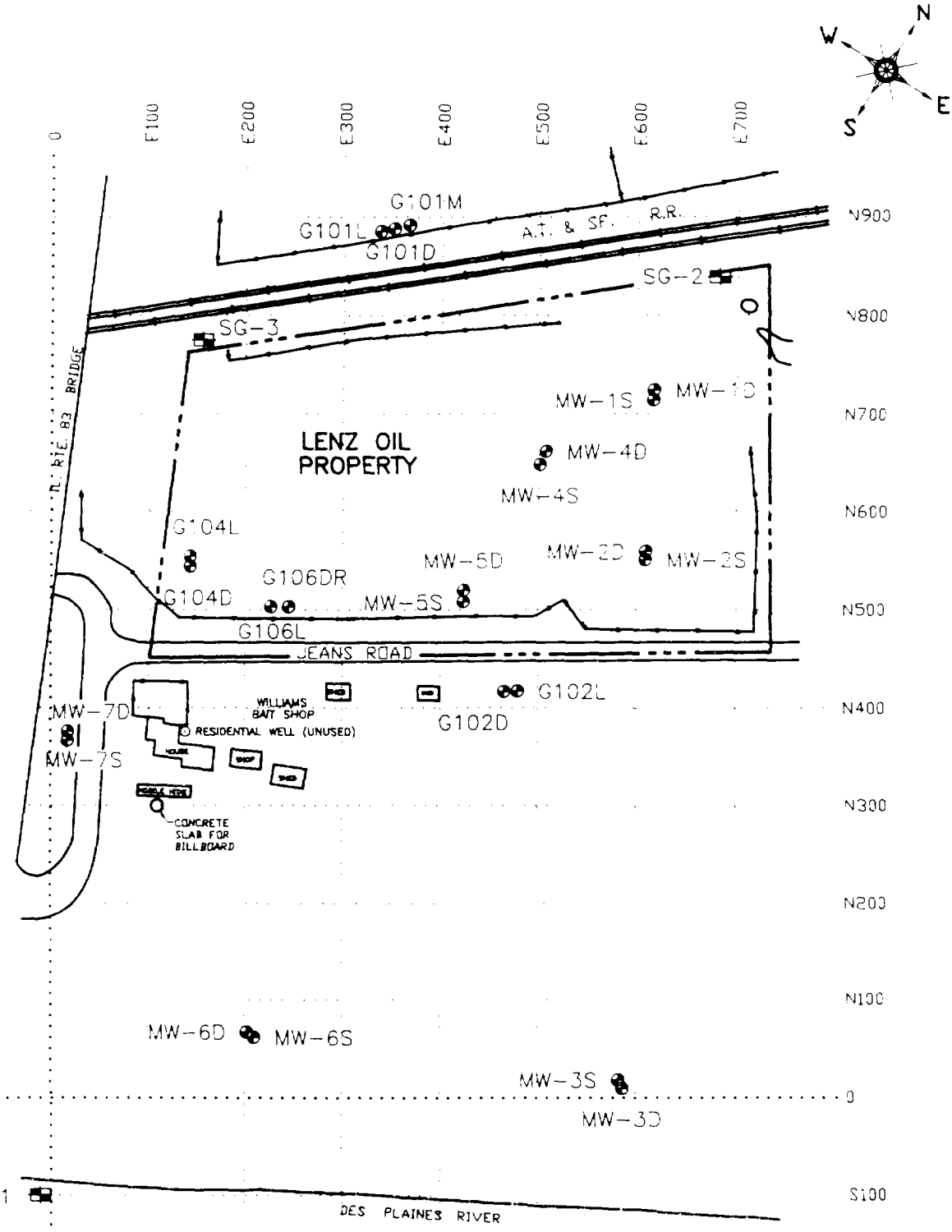
NOTES:
- U Compound was not detected at the quantitation limit shown.
- J Quantitation is approximate due to limitations identified in the quality assurance review.
- UL This analyte was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.
- R Unreliable result - Analyte may or may not be present in this sample.

TABLE 4-6
DEEP WELLS - DETECTED INORGANIC ANALYTES
DISSOLVED METALS
LENZ OIL SERVICES

ERM-NC Sample No.	LO-1G101D-GW		LO-1G106DR-GW		LO-1MW01D-GW		LO-1MW02D-GW		LO-1MW03D-GW		LO-1MW04D-GW		LO-1MW05D-GW		LO-1MW06D-GW		LO-1MW07D-GW	
Laboratory Sample No.	11897-3		11908-11		11897-6		11908-6		11897-9		11908-1		11908-10		11908-1		11908-4	
Date sample collected	5/6/91		5/7/91		5/6/91		5/7/91		5/6/91		5/7/91		5/7/91		5/8/91		5/7/91	
Units	(ug/L)		(ug/L)		(ug/L)		(ug/L)		(ug/L)		(ug/L)		(ug/L)		(ug/L)		(ug/L)	
Aluminum	200	U	38	R	1000	J	200	R	200	U	200	R	200	R	200	R	200	R
Antimony	60	UL	12	UL	60	UL	60	UL	60	UL	60	UL	60	UL	60	R	60	UL
Arsenic	0.9	U	0.87	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U
Barium	50	U	110	J	50	U	50	UL	50	U	50	UL	50	UL	50	R	50	UL
Beryllium	5	UL	0.96	UL	5	UL	5	UL	5	UL	5	UL	5	UL	5	UL	5	UL
Cadmium	5	R	0.96	R	5	R	5	R	5	R	7	J	5	R	5	R	5	R
Calcium	120000	J	130000	J	160000	J	160000	J	180000	J	170000	J	150000	J	180000	J	170000	J
Chromium	10	UL	1.9	U	10	UL	10	U	10	UL	10	U	10	U	10	U	10	U
Cobalt	50	UL	9.6	UL	50	UL	50	UL	50	UL	50	UL	50	UL	50	UL	50	UL
Copper	25	U	4.8	UL	25	U	25	UL	25	U	25	UL	25	UL	25	UL	25	UL
Iron	820		700	J	1400		1900		1800		1900		1200		2400	J	1100	
Lead	2	U	0.38	UL	2	U	2	U	2.3	J	4.1		2	U	2	UL	5.4	
Magnesium	61000		58000	J	87000		84000	J	98000		87000	J	78000	J	88000		93000	J
Manganese	15	UL	2.9	UL	15	UL	15	UL	15	UL	15	UL	15	UL	15	R	15	UL
Mercury	0.2	U	0.067	UL	0.2	U	0.2	UL	0.2	U	0.2	UL	0.2	UL	0.2	U	0.2	UL
Nickel	40	UL	7.7	UL	40	UL	40	UL	40	UL	40	UL	40	UL	40	UL	40	UL
Potassium	2600	J	15000	J	3600	J	5500	J	4690	J	5800	J	7000	J	6400		3800	J
Selenium	0.9	U	0.87	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	0.9	UL	0.9	U
Silver	10	U	1.9	UL	10	U	10	UL	10	U	10	UL	10	UL	10	R	10	UL
Sodium	7900		180000		22000		64000		39000		110000		150000		62000		36000	
Thallium	5	UL	9.6	UL	5	UL	5	UL	5	UL	5	UL	5	UL	5	UL	5	UL
Vanadium	50	U	9.6	U	50	U	50	U	50	U	50	U	50	U	50	U	50	U
Zinc	20	UL	3.8	U	20	UL	20	U	20	UL	20	U	20	U	20	U	20	U
Cyanide	10	UL	12	J	10	UL	10	UL	10	UL	10	UL	10	UL	10	UL	10	UL

NOTES:
- U Compound was not detected at the quantitation limit shown.
- J Quantitation is approximate due to limitations identified in the quality assurance review.
- UL This analyte was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.
- R Unreliable result - Analyte may or may not be present in this sample.

FIGURES



APPROX. SCALE (ft.)

0 160

SYMBOL LEGEND:

- PROPERTY LINE
- FENCE LINE
- RAILROAD
- MONITORING WELL
- STREAM GAGE
- BUILDING

FIGURE 2-1

MONITORING WELL LOCATION MAP
LENZ OIL
LEMONT, ILLINOIS

ERM

CLIENT NAME:	LENZ OIL
APPROVED:	
DATE:	8/29/91
CHECKED:	
DRAWN:	BLAS
REPORT:	TM3
PROJECT:	0252

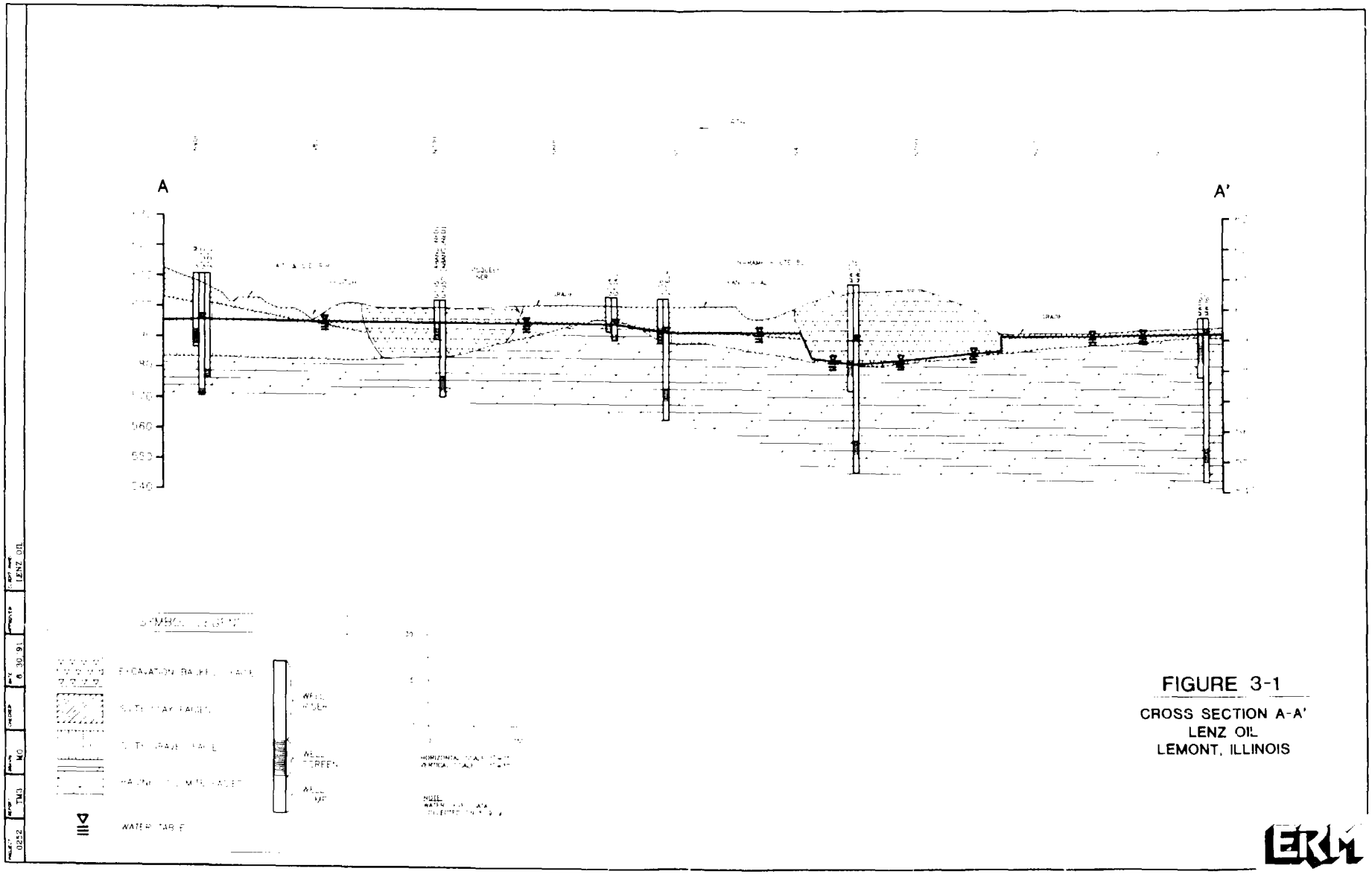


FIGURE 3-1

CROSS SECTION A-A'
LENZ OIL
LEMONT, ILLINOIS

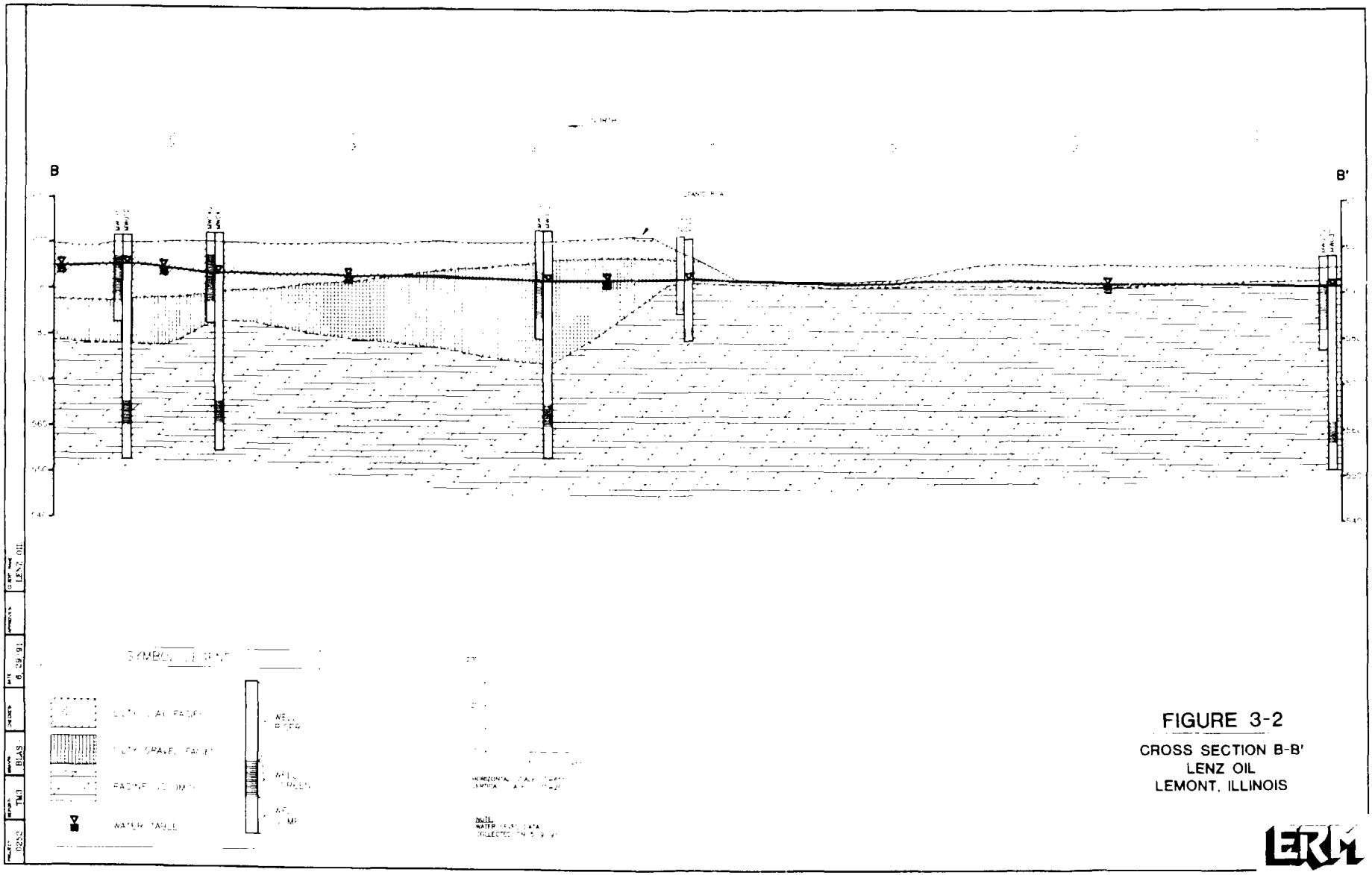


FIGURE 3-2

CROSS SECTION B-B'
LENZ OIL
LEMONT, ILLINOIS

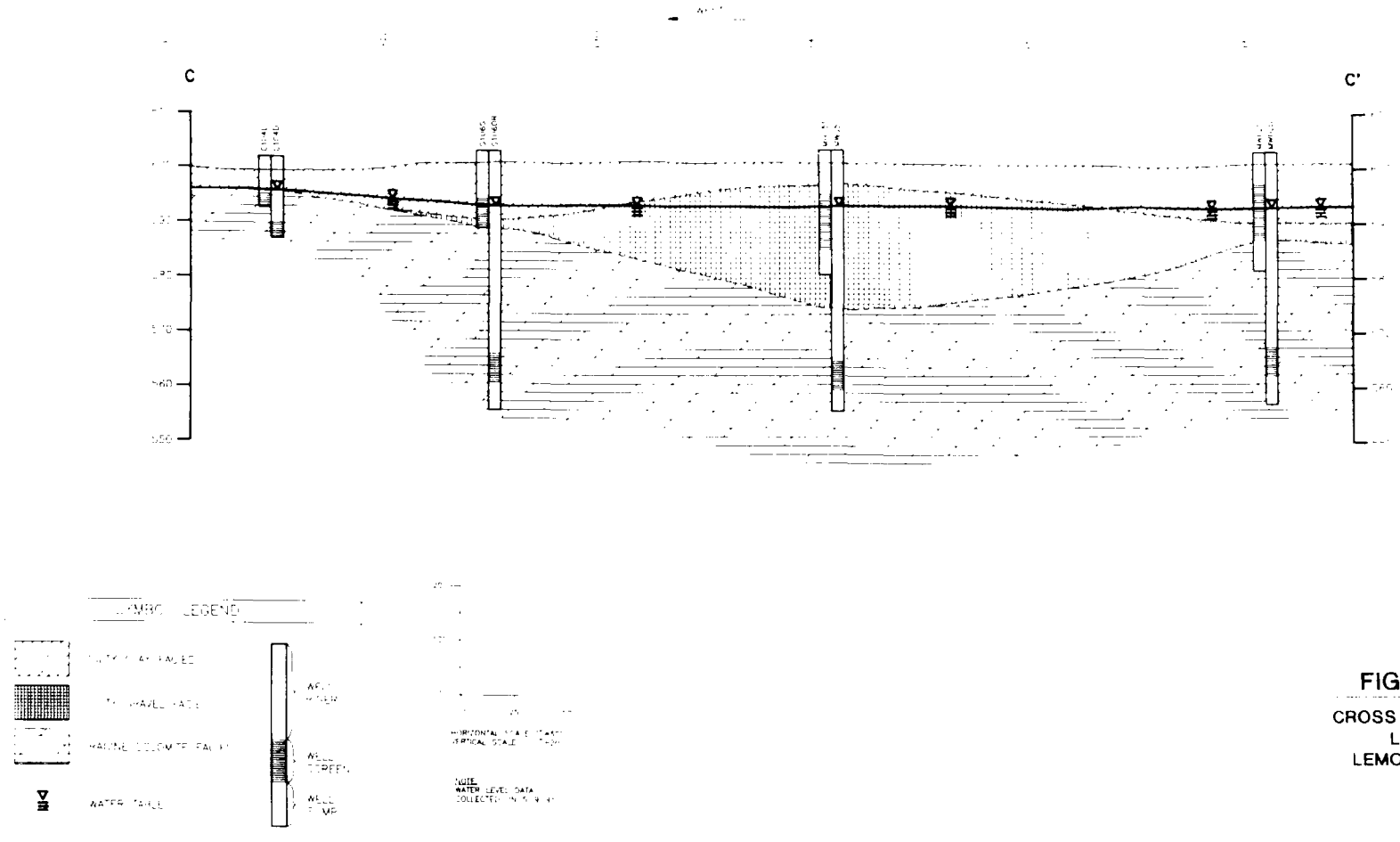


FIGURE 3-3

CROSS SECTION C-C'
LENZ OIL
LEMONT, ILLINOIS

ERM

PROJECT	REPORT	DRAWN	CHECKED	DATE	APPROVED	CLIENT NAME
0252	TM3	MO-		6/30/91		LENZ OIL

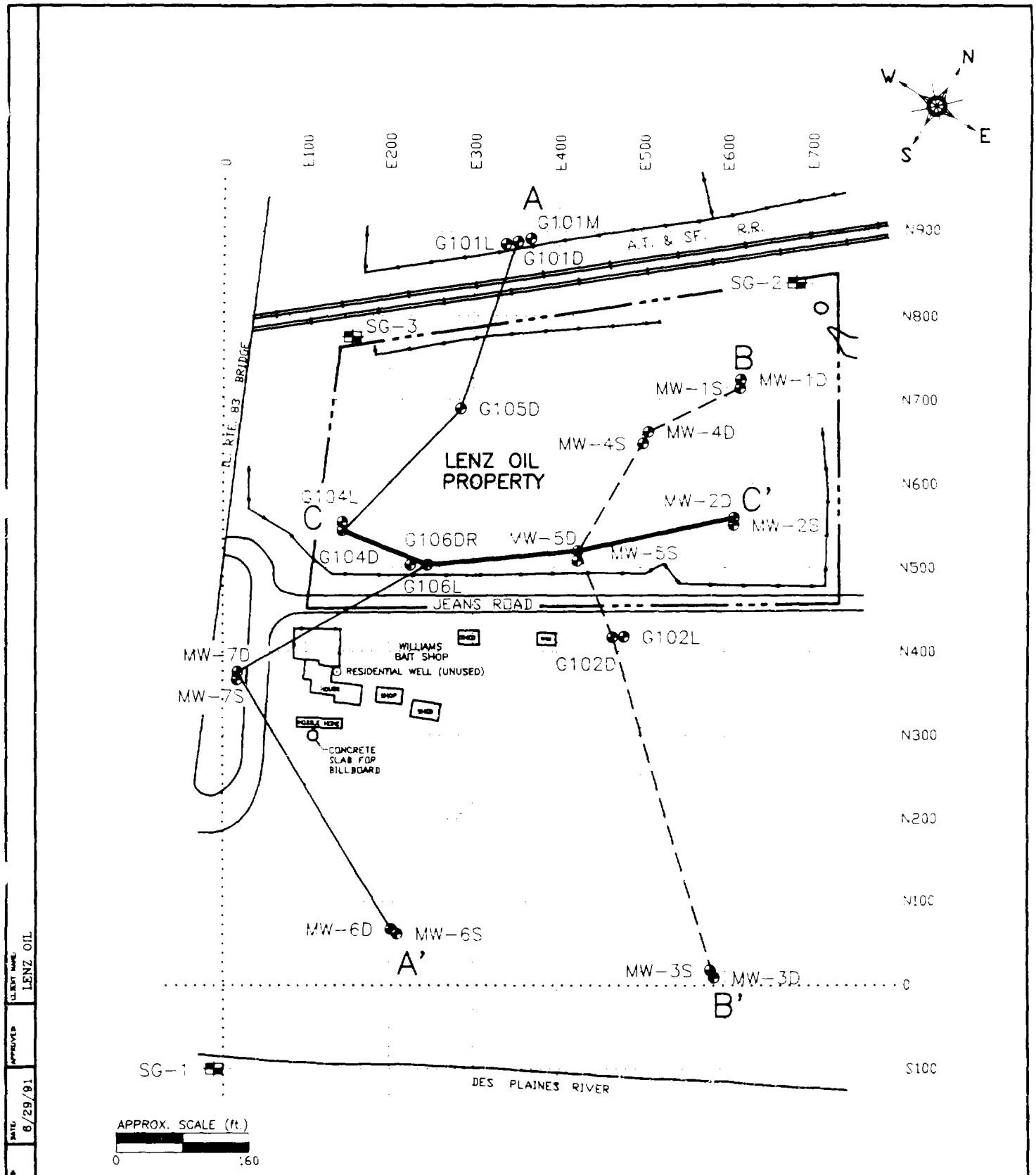
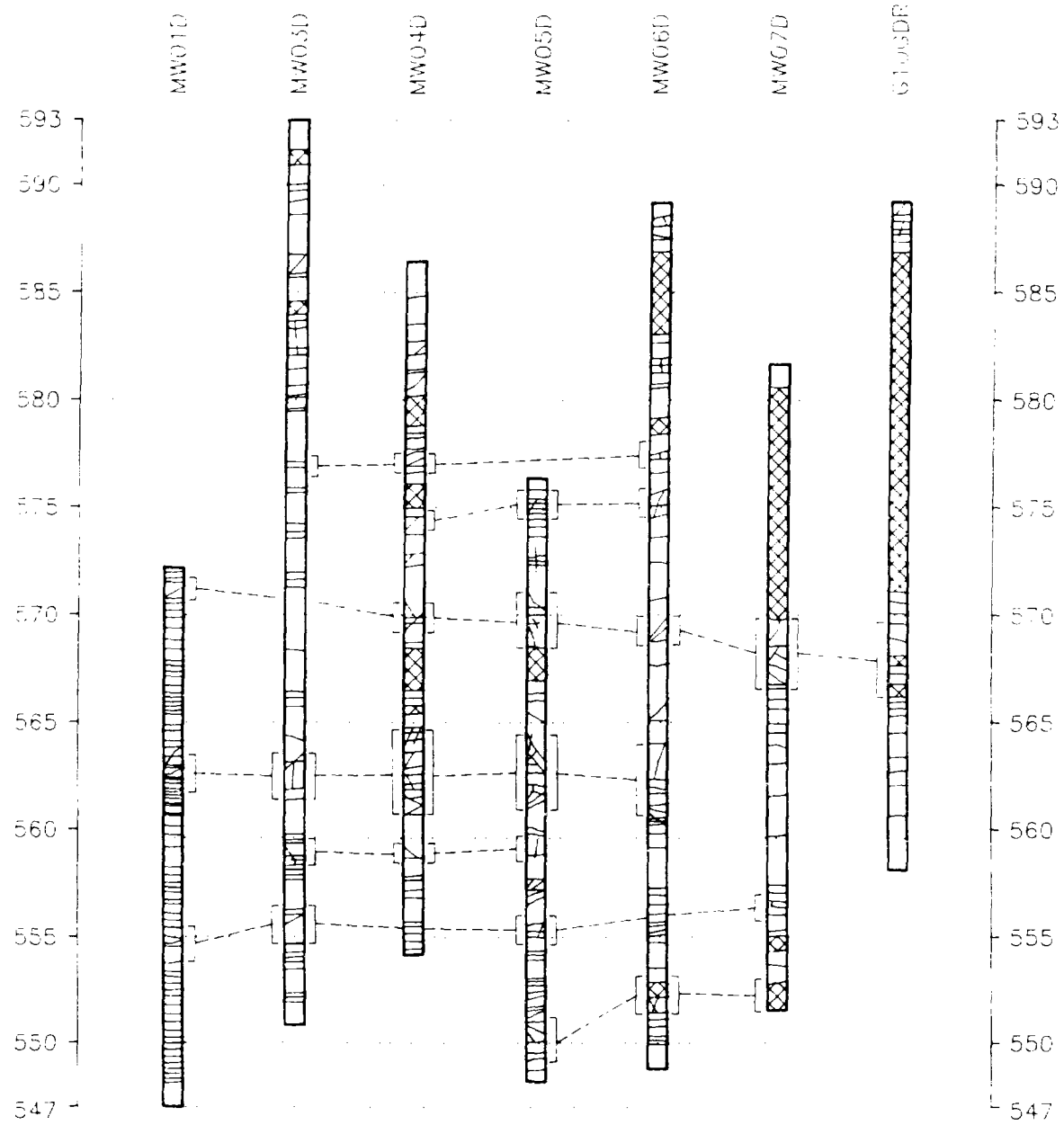


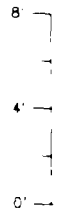
FIGURE 3-4

CROSS SECTION LOCATION MAP
LENZ OIL
LEMONT, ILLINOIS

ERM

CLIENT NAME	LENZ OIL
APPROVED	
DATE	8/29/91
CHECKED	
DRAWN	CMM-
REPORT	TM3
PROJECT	0252





VERTICAL SCALE 1" = 8'

SYMBOL LEGEND:

RUBBLY ZONE

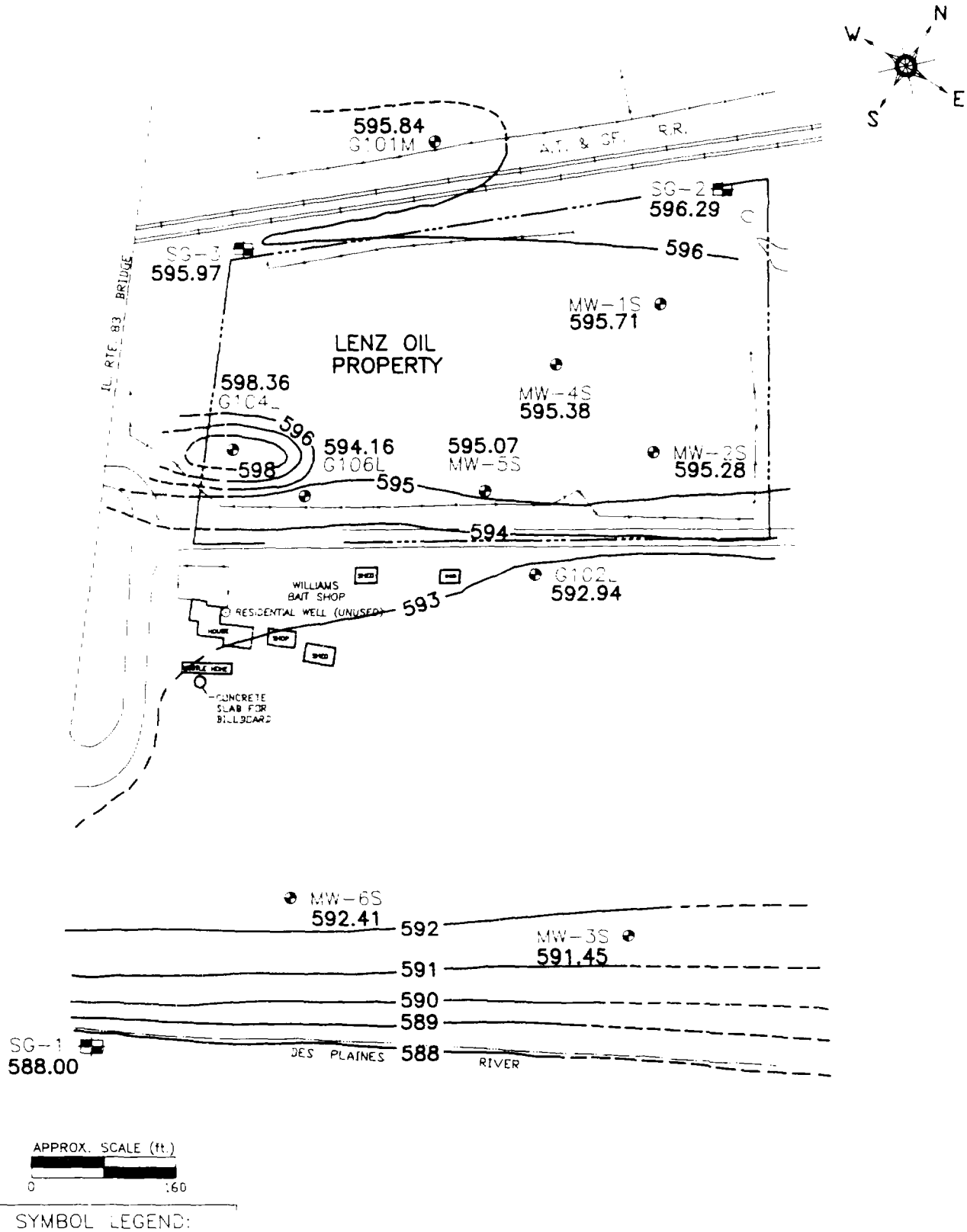
CORRELATED FRACTURE ZONE

FIGURE 3-5

SITE-SPECIFIC BEDROCK FRACTURE RESULTS
LENZ OIL
LEMONT, ILLINOIS

ERM

CLIENT NAME	LENZ OIL
APPROVED	
DATE	7/1/91
CHECKED	
DRAWN	MO
REPORT	TM3
PROJECT	0252



APPROX. SCALE (ft.)

0 160

SYMBOL LEGEND:

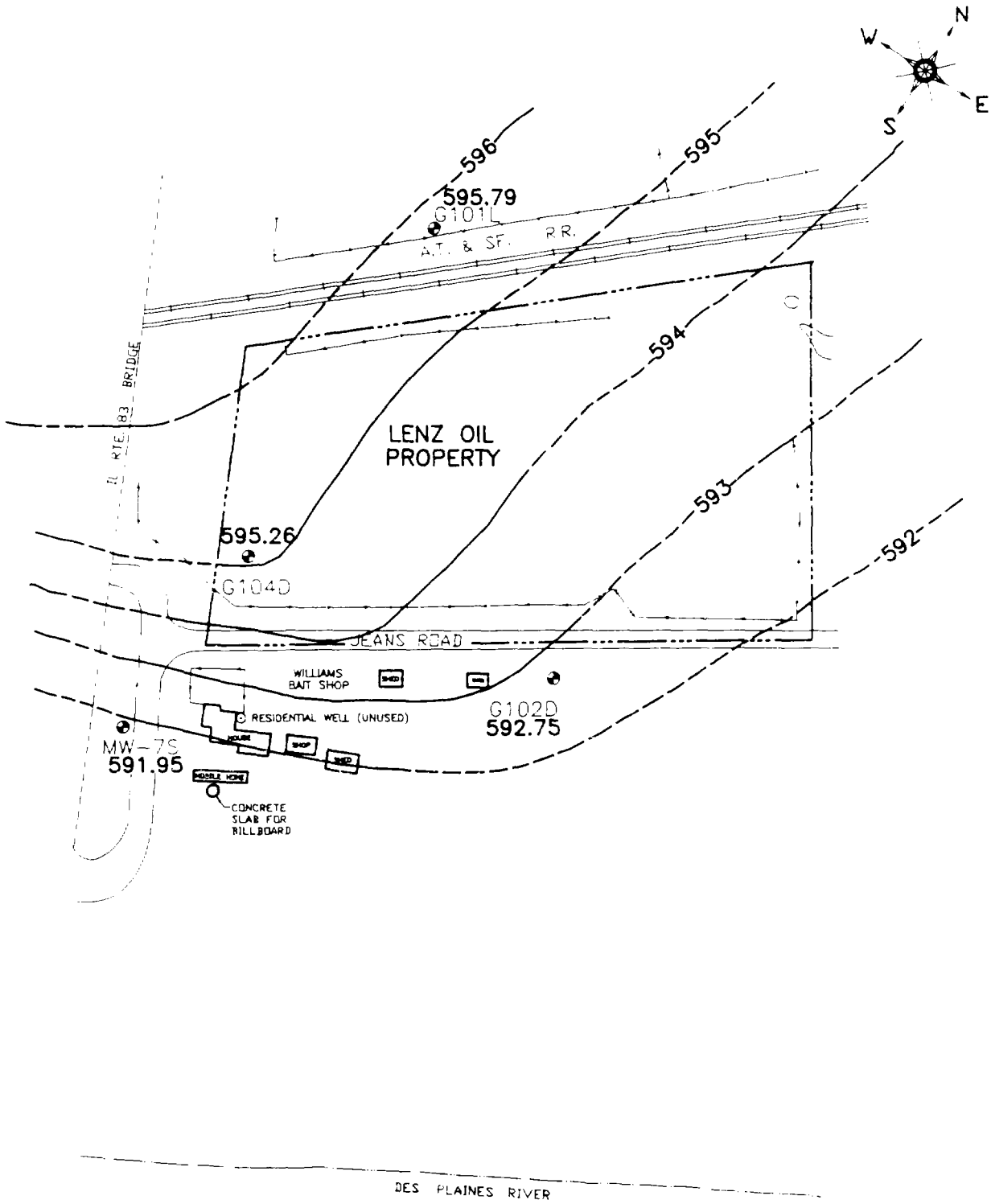
- PROPERTY LINE
- FENCE LINE
- RAILROAD
- INFERRED
- MONITORING WELL
- STREAM GAGE
- BUILDING

FIGURE 3-6

PIEZOMETRIC SURFACE
SHALLOW WELLS
MAY 9, 1991
LENZ OIL
LEMONT, ILLINOIS

ERM

CLIENT NAME	LENZ OIL
APPROVED	
DATE	8/29/91
CHECKED	
DRAWN	CMM
REPORT	TM3
PROJECT	0252



APPROX. SCALE (ft.)

0 160

SYMBOL LEGEND:

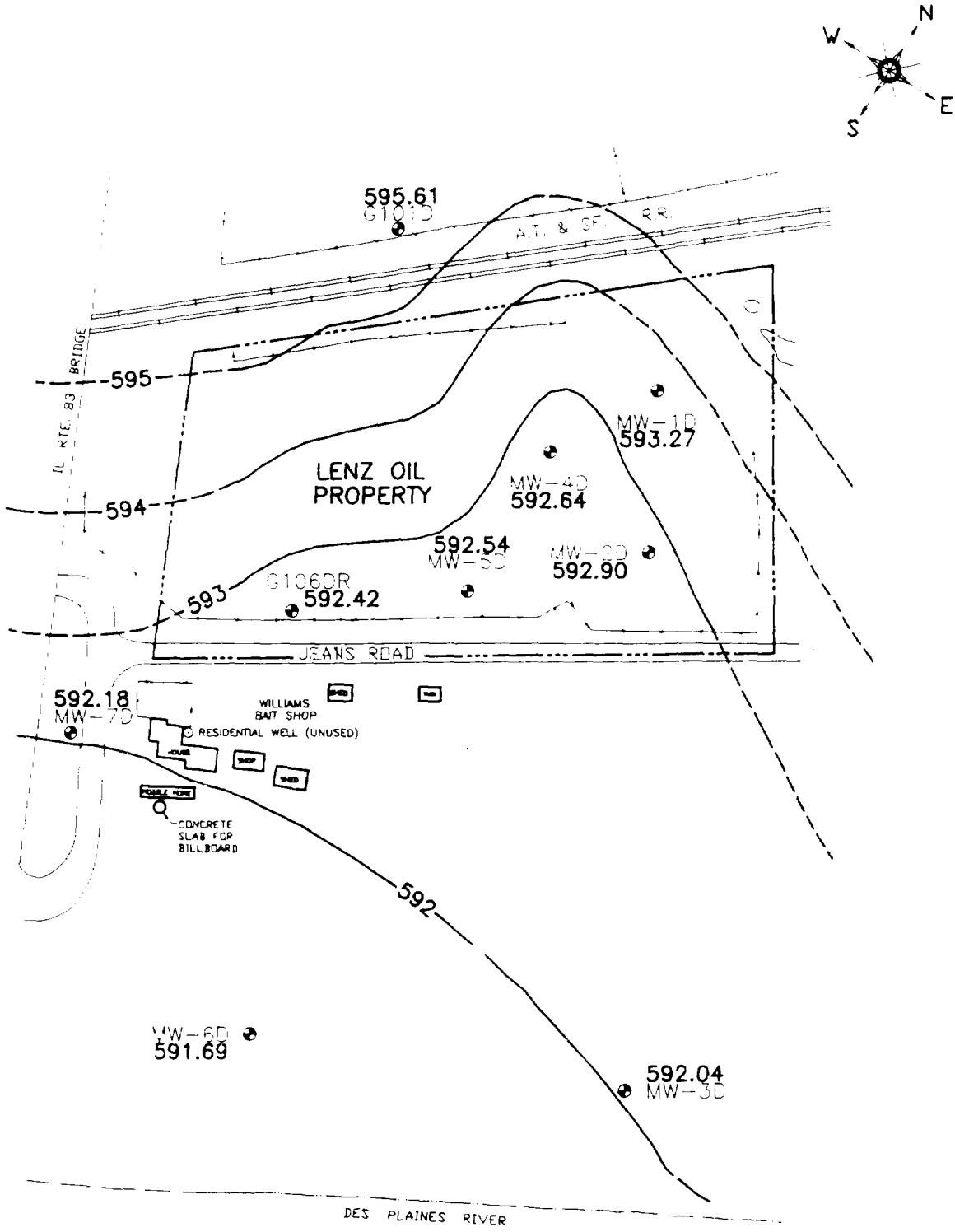
- PROPERTY LINE
- FENCE LINE
- RAILROAD
- MONITORING WELL
- BUILDING
- INFERRED

FIGURE 3-7

PIEZOMETRIC SURFACE
INTERMEDIATE WELLS
MAY 9, 1991
LENZ OIL
LEMONT, ILLINOIS

ERM

CLIENT NAME:	LENZ OIL
APPROVED:	
DATE:	8/27/91
CHECKED:	
DRAWN:	CMM
REPORT:	TM3
PROJECT:	0252



APPROX. SCALE (ft.)

0 160

SYMBOL LEGEND:

- PROPERTY LINE
- FENCE LINE
- RAILROAD
- INFERRED
- MONITORING WELL
- BUILDING

FIGURE 3-8

PIEZOMETRIC SURFACE
DEEP WELLS
MAY 9, 1991
LENZ OIL
LEMONT, ILLINOIS

ERM

CLIENT NAME:	LENZ OIL
APPROVED:	
DATE:	8/29/91
CHECKED:	
DRAWN:	CMM
REPORT:	TM3
PROJECT:	0252

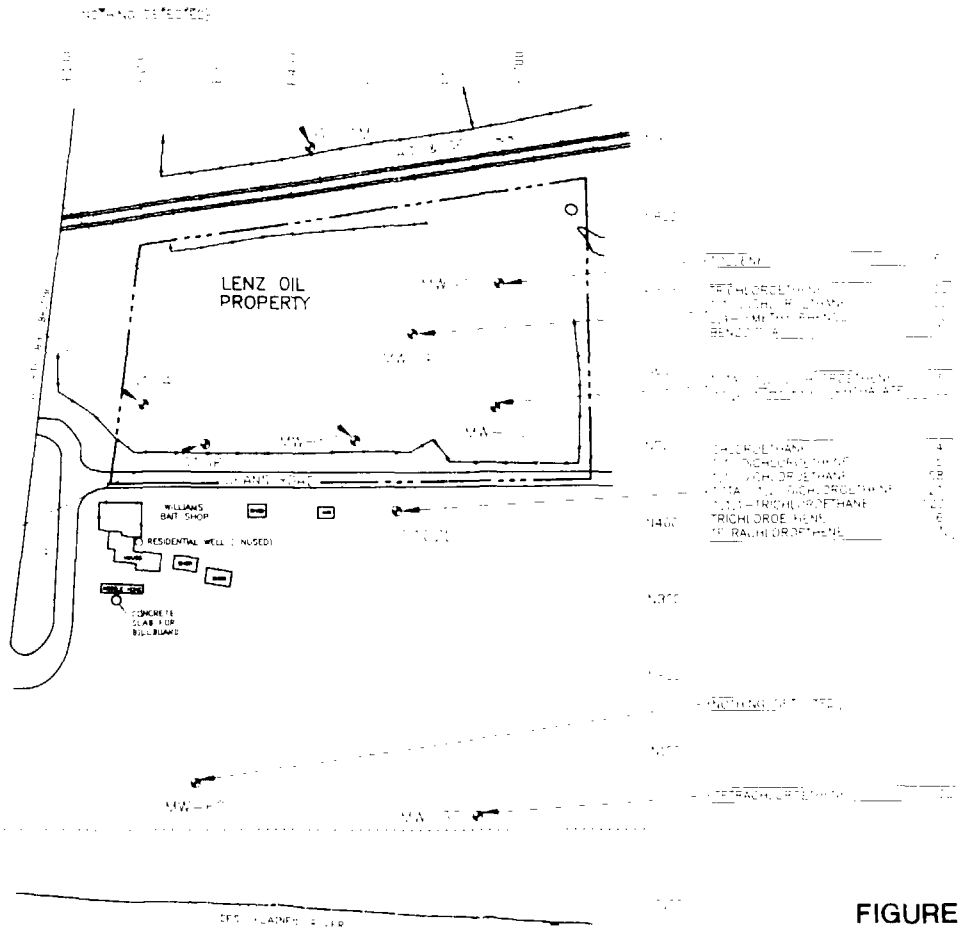
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
NAPHTHALENE	2430
2-METHYLNAPHTHALENE	[illegible]
DIBENZOFURAN	[illegible]
FLUORENE	[illegible]
PHENANTHRENE	[illegible]
ANTHRACENE	[illegible]
FLUORANTHENE	[illegible]
PYRENE	[illegible]
BIS(2-ETHYLHEXYL)PHTHALATE	[illegible]
ARCOCLOR 1254	[illegible]
ARCOCLOR 1248	[illegible]
ARCOCLOR 1260	[illegible]

OIL – (NOT ANALYZED FOR VOLATILES)

NAPHTHALENE	[illegible]
2-METHYLNAPHTHALENE	[illegible]
ACENAPHTHENE	[illegible]
DIBENZOFURAN	[illegible]
FLUORENE	[illegible]
2,4,6-TRINITROTOLUENE	[illegible]
PHENANTHRENE	[illegible]
PYRENE	[illegible]
BIS(2-ETHYLHEXYL)PHTHALATE	[illegible]
ARCOCLOR 1242	[illegible]

WATER – NOT ANALYZED FOR PCBs/PESTICIDES

CHLOROETHANE	270
ACETONE	1600
BENZENE	1400
TOLUENE	160
ETHYLBENZENE	130
TOTAL XYLENES	2400
1,2-DICHLOROBENZENE	[illegible]
PHENOL	[illegible]
4-METHYLPHENOL	[illegible]
2,4-DIMETHYLPHENOL	[illegible]
NAPHTHALENE	[illegible]
2-METHYLNAPHTHALENE	190
ACENAPHTHENE	[illegible]
FLUORENE	[illegible]
2-NITROSODIPHENYLAMINE	[illegible]
PHENANTHRENE	[illegible]
PYRENE	[illegible]
BIS(2-ETHYLHEXYL)PHTHALATE	[illegible]



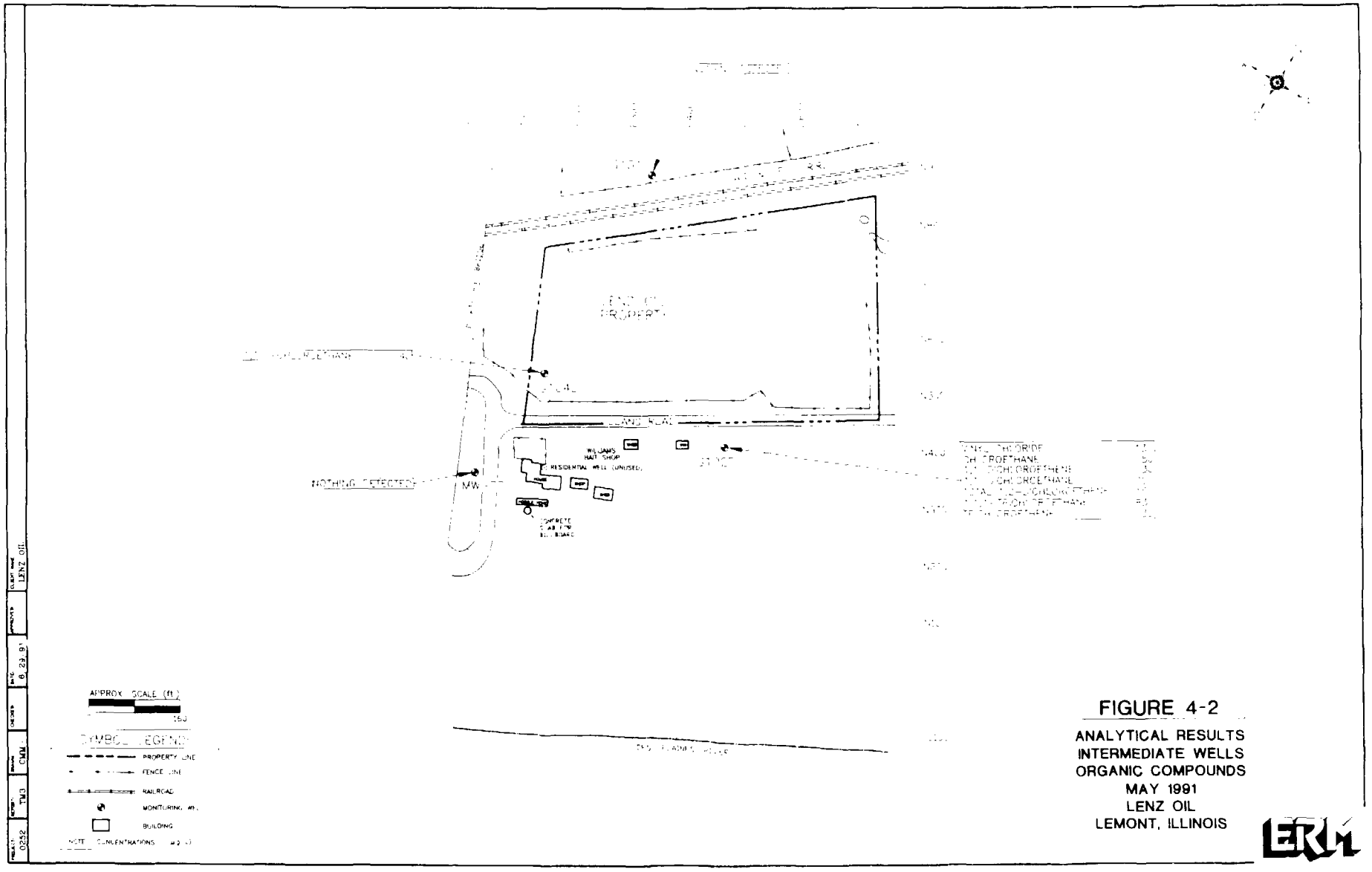


FIGURE 4-2

ANALYTICAL RESULTS
INTERMEDIATE WELLS
ORGANIC COMPOUNDS
MAY 1991
LENZ OIL
LEMONT, ILLINOIS

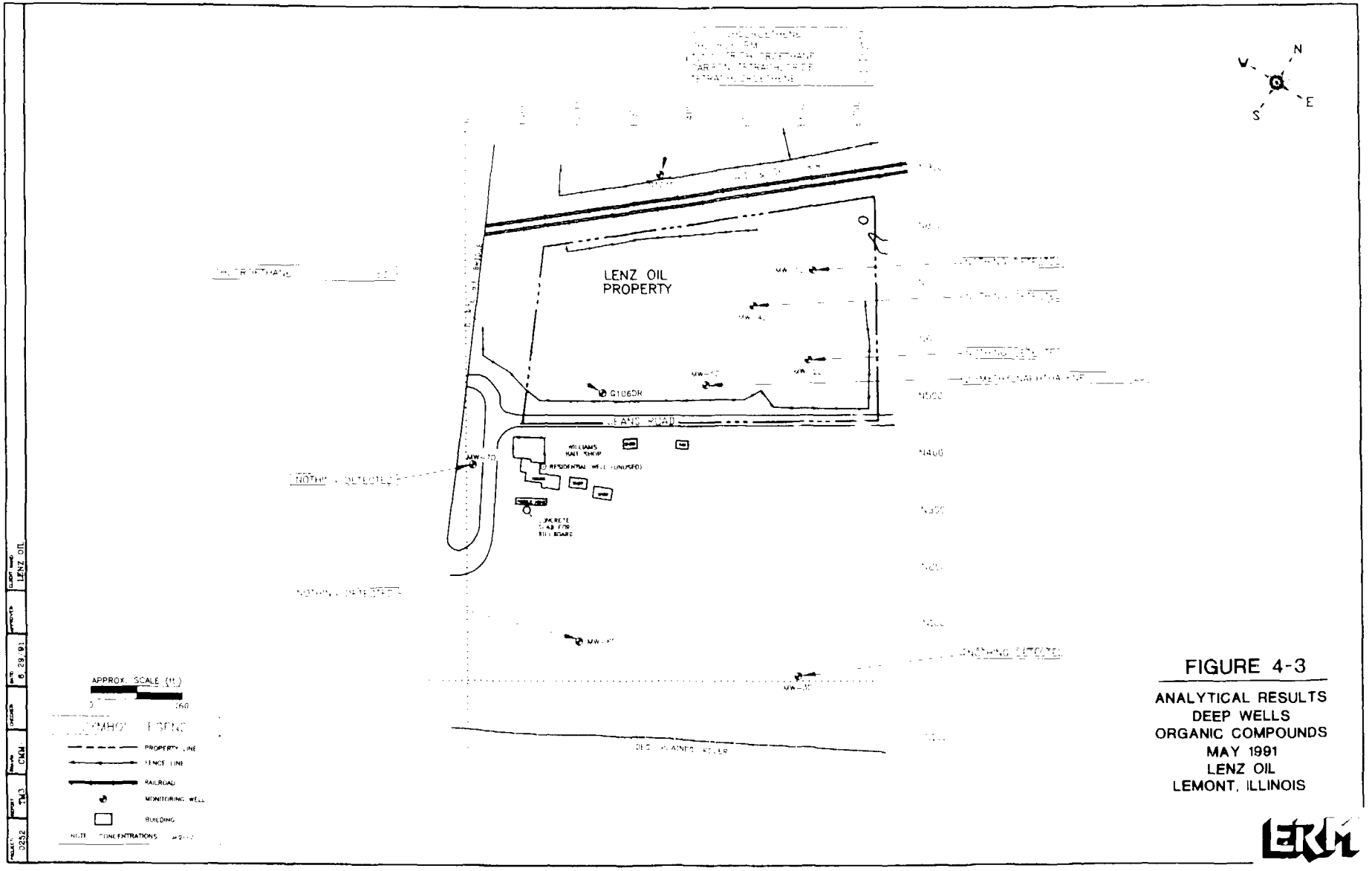


FIGURE 4-3

ANALYTICAL RESULTS
DEEP WELLS
ORGANIC COMPOUNDS
MAY 1991
LENZ OIL
LEMONT, ILLINOIS

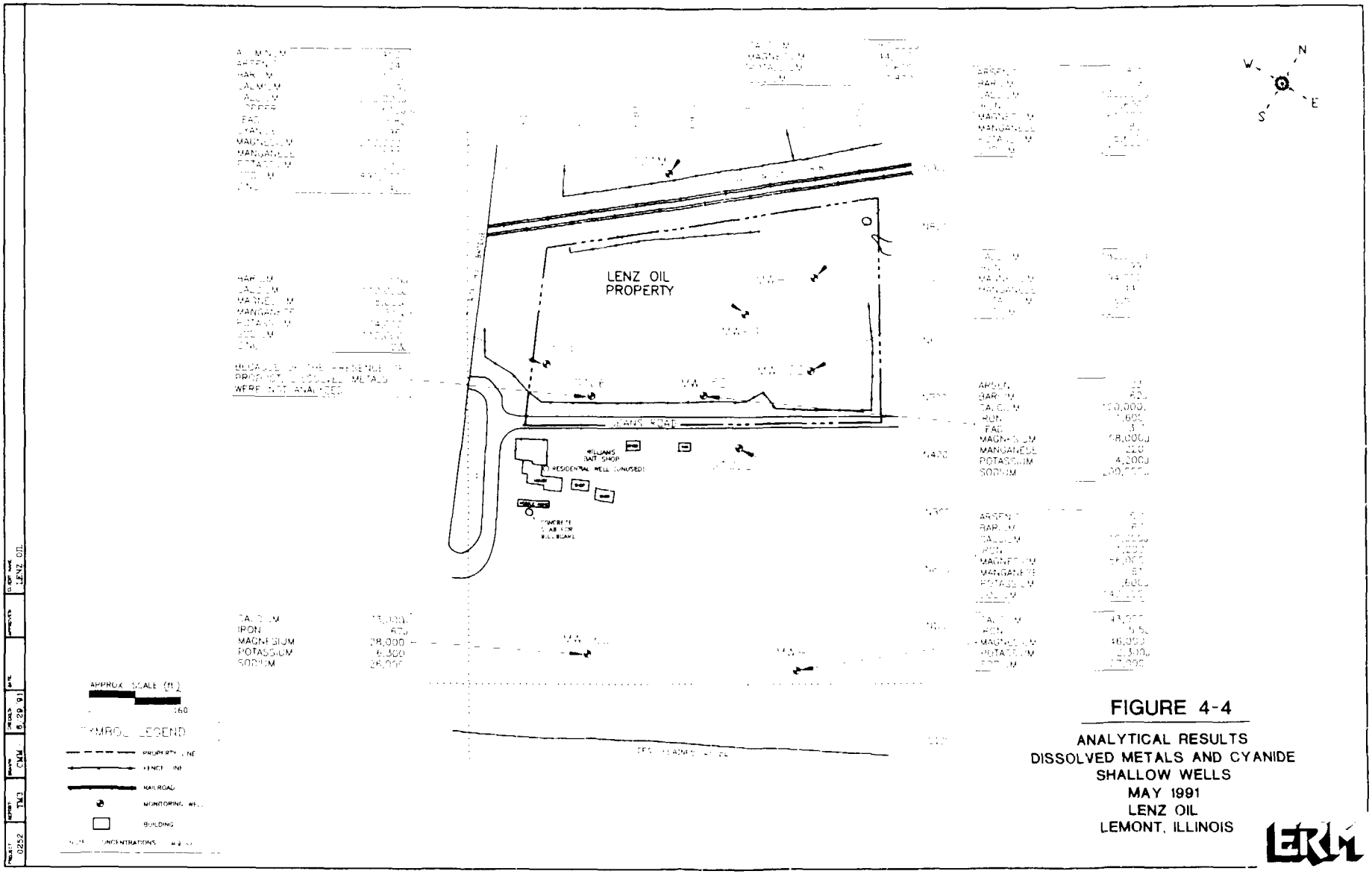


FIGURE 4-4

ANALYTICAL RESULTS
DISSOLVED METALS AND CYANIDE
SHALLOW WELLS
MAY 1991
LENZ OIL
LEMONT, ILLINOIS

ERM

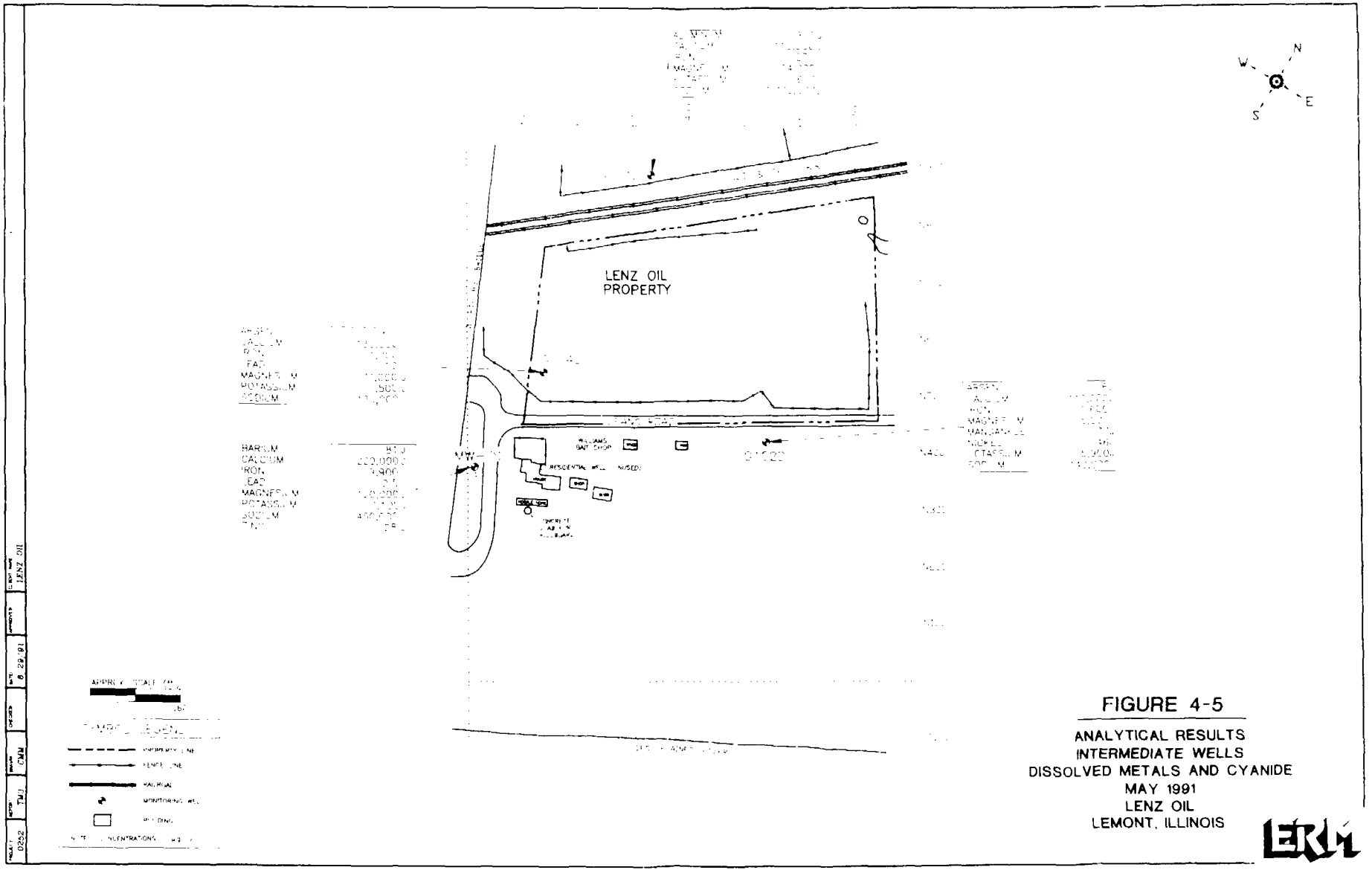


FIGURE 4-5

ANALYTICAL RESULTS
INTERMEDIATE WELLS
DISSOLVED METALS AND CYANIDE
MAY 1991
LENZ OIL
LEMONT, ILLINOIS

ERM

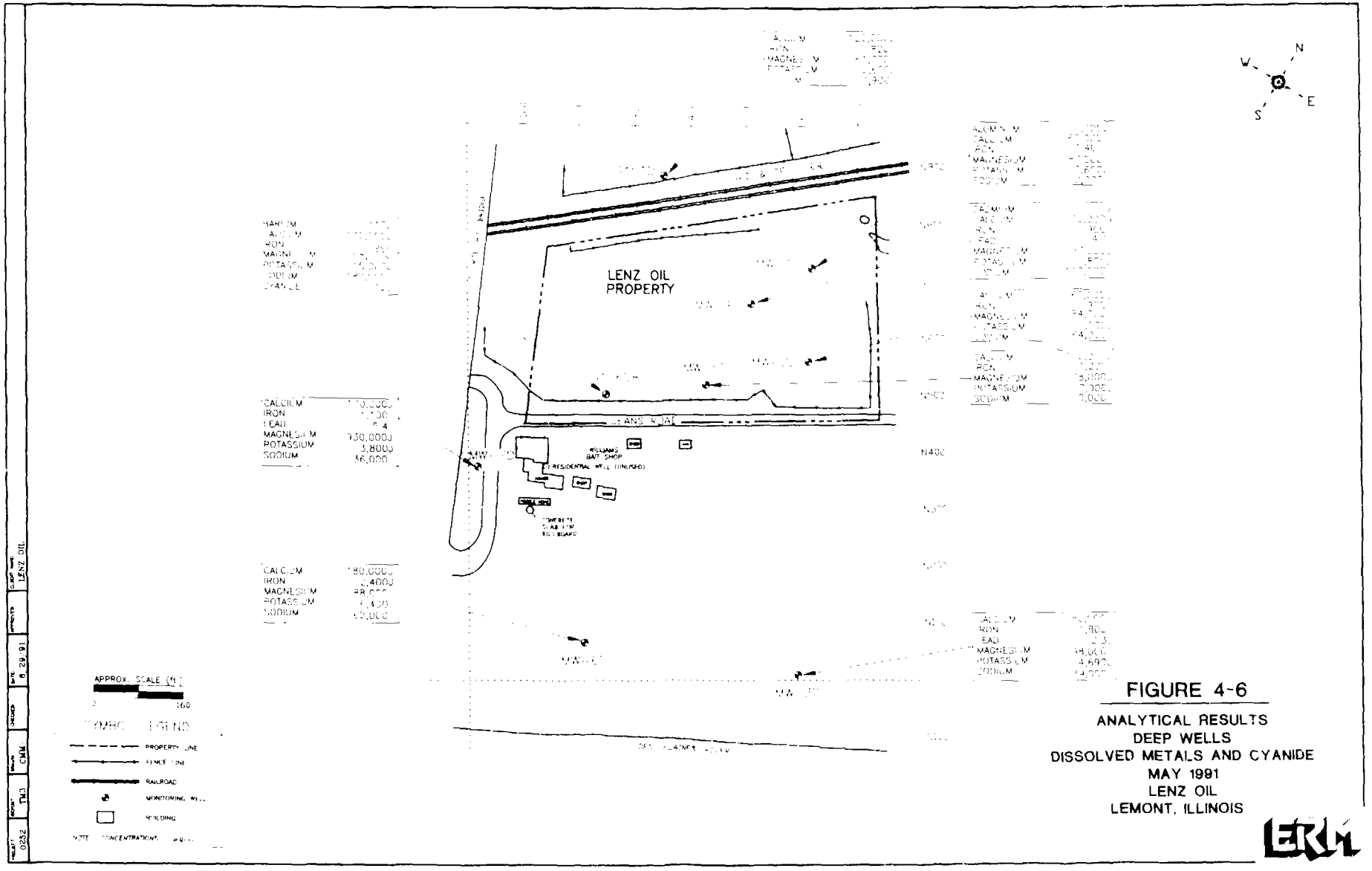


FIGURE 4-6

ANALYTICAL RESULTS
DEEP WELLS
DISSOLVED METALS AND CYANIDE
MAY 1991
LENZ OIL
LEMONT, ILLINOIS

ERM

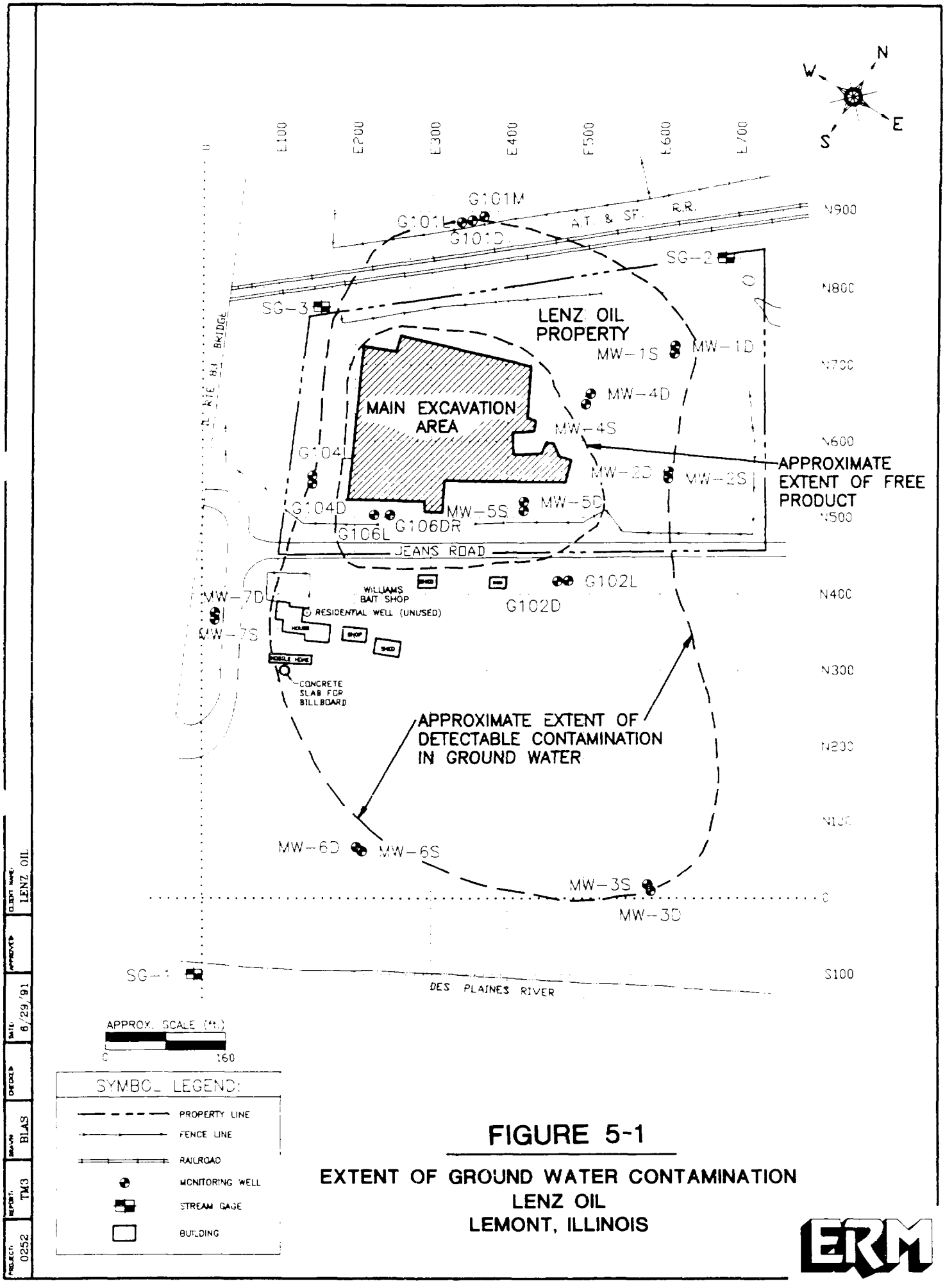


FIGURE 5-1

EXTENT OF GROUND WATER CONTAMINATION
LENZ OIL
LEMONT, ILLINOIS

ERM

APPENDIX A

MONITORING WELL BORING LOGS

ERM - North Central, Inc.
Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT	PROJECT NUMBER	SHEET NO.	HOLE NO.
Lenz Oil RI/FS	0252	1 OF 3	MW-01D

SITE	COORDINATES	ANGLE FROM HORIZ	BEARING
LENZ OIL RI/FS	N 723; E 616	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	TOTAL DEPTH
3-6-91		FOX DRILLING	CME-75	11.5"	47.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
28.9/41	4	0		602.1	▽ / ▼ /	22.4/

SAMPLE DEVICE	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
2"x2' Split Spoon/NX Core Barrel		Dirk Kaiser

Samples/R. Core: Sample No. Time	Rec. (ft)	Length(ft)	Blow Count RQD(%)	Contaminant Screening: Amb. Air* VOC(ppm)	Sample ** VOC(ppm)	Visual Observ.	LAYER ELEV. DEPTH	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							602.1					
SS-1 08:30	1.4	2.0	17 17 9 8	0.0	0.5		600.1 2.0				0-2':**GRAVEL**: Dusky yellow green (10GY 3/2), .3' gravel, with very fine grained silt, very moist 1.1' same as above, very oily	Drilling: Smooth
SS-2 08:41	1.4	2.0	8 10 10 24	0.0	0.5		598.1 4.0				2-4':**SAND AND GRAVEL**: Medium light gray (5N5), medium grained, SAND, with a trace of gravel, oil, moist 0.4' olive black (5Y 2/1) SILTY CLAY, with trace of wood pieces, gravely, with some sand, purple sand lens 2mm thick	
SS-3 08:48	0.3	2.0	2 3 8 15	0.0	0.0			5			0.5' light gray (7N7) well sorted, medium grained, SAND, trace small gravel, grading to very coarse oily sand with trace gravel, moist	Driller indicates possible water table
SS-4 08:53	1.6	2.0	3 1 5 6	0.0	0.0						4-12':**SILT**: Olive black (5Y 2/1), very fine grained silt trace of organic roots, moist 0.6' Same as above, very moist 1.0' mottled, light gray (6N6), moderate olive brown (5Y 4/4), CLAYEY SILT, with well rounded, sub-angular, pebbles, moist	
SS-5 09:00	0.1	2.0	8 2 8 9	0.0	0.0						Same as above, very soft, moist	
SS-6 09:15	0.6	2.0	6 9 1 15	0.0	0.0		590.1 12.0	10			Same as above, very soft, very moist	
SS-7 09:25	0.4	2.0	12 22 29 27	0.0	0.0						12-18':**SAND AND GRAVEL**: Medium light gray (6N6), very angular, dolomite fragments, saturated	
SS-8 09:42	0.7	2.0	6 12 22 18	0.0	0.0			15			Same as above, with some medium light gray (6N6) silt	Drilling: Tough
SS-9 10:02	1.1	2.0	52 24 36 26	0.0	0.0		584.1 18.0				Same as above, without the silt, saturated	
SS-10 10:13	1.5	2.0	40 30 76 32	0.0	0.0						18-22.4':**SILT**: Medium gray (5N5), very fine grained, gravelly, saturated 0.7' angular, dolomite chips, saturated	

CONTAMINANT SCREENING NOTES
*HNu w/10.2 eV ** Split Spoon Screenin

SITE: LENZ OIL RI/FS
HOLE NO.: MW-01D

ERM - North Central, Inc.
Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT	PROJECT NUMBER	SHEET NO.	HOLE NO.
Lenz Oil RI/FS	0252	2 OF 3	MW-01D

Samples/R. Core: Sample # / Time	Rec. (ft)	Length (ft)	Blow Cnt / RQD(%)	Contaminant Screening: Amb Air* VOC(ppm)	Sample** VOC(ppm)	Visual Observ.	LAYER ELEV. / DEPTH	DEPTH	GRAPHICS / SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
SS-11 11:12	1.2	2.0	24 32 220	0.0	0.0					Same as above, with 0.1" silty lens, saturated	
										Same as above	
SS-12 11:34	0.7	2.0	125	0.0	0.0		579.7 / 22.4			22.4-47.0': **RACINE FORMATION** Yellowish gray (5Y 8/1), finely crystalline, **DOLOMITE**, with some interclasts, peloids, occasional zones of wavy laminae of clay, heavy minerals, calcite, some quartz infillings, moderately vuggy	Bedrock
RUN 1 15:20	2.4	2.4					575.7 / 26.4	25			
							575.1 / 27.0			Auger and Ream to 27'	
RUN 2 16:20	5.0	5.0						30		Same as above	
RUN 3 16:55	9.9	10.0					570.1 / 32.0	35		Same as above, with some fossils	
								40		40.55'-40.60': Sand lens (?)	
RUN 4 17:15	5.0	5.0					560.1 / 42.0			Same as above, with peloids of a very white clay textured material (?)	

ERM - North Central, Inc.
Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT	PROJECT NUMBER	SHEET NO.	HOLE NO.
Lenz Oil RI/FS	0252	3 OF 3	MW-01D

Samples/R. Core: Sample # / Time	Rec. (ft)	Length (ft)	Blow Cnt / RQD(%)	Contaminant Screening: Amb Air* VOC(ppm)	Sample** VOC(ppm)	Visual Observ.	LAYER ELEV. / DEPTH	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							555.1 / 47.0				End of boring, 47'	
								50				
								55				
								60				
								65				

ERM - North Central, Inc.
Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT	PROJECT NUMBER	SHEET NO.	HOLE NO.
Lenz Oil RI/FS	0252	1 OF 2	MW-02D

SITE	COORDINATES	ANGLE FROM HORIZ	BEARING
LENZ OIL RI/FS	N 0; E 0	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	TOTAL DEPTH
4-24-91	4-25-91	FOX DRILLING	CME-75	11.5"	43.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
0.0/0	0	0		0.0	6.0/-6.0 /	15.5/

SAMPLE DEVICE	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
2"x2' Split Spoon/NX Core Barrel		Dirk Kaiser

Samples/R. Core: Sample No./Time	Rec. (ft)	Length (ft)	Blow Count / RQD(%)	Contaminant Screening: Amb. Air* VOC(ppm)	Sample ** VOC(ppm)	Visual Observ.	LAYER ELEV. DEPTH	DEPTH	GRAPHICS / SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							0.0				
	1.0	2.0	20 12 7 12	0.0	0.0					0-5.8': **SILTY SAND & GRAVEL**: light olive brown (5Y5/6), poor sorting, dry	
	0.7	2.0	4 12 13 13	0.0	0.0						
	1.2	2.0	5 9 16 14	0.0	0.0			5			
	1.4	2.0	6 6 6 9	0.0	0.0		-5.9 5.9			5.8-6.0': Color change to med. grey (5N5), very moist in tip of spoon	
							-7.3 7.3			6-7.3': **SAND**: light brown, well sorted, fine grained, saturated	
	1.0	2.0	16 17 27 25	0.0	0.0					7.3-8': **SILT** medium grey (5N5), very soft, saturated. As Above - some gravel, stiff, moist	
	0.8	2.0	- - - -	0.0	0.0		-9.9 9.9	10		10.0-15.5': **GRAVEL** with silt, sandy, poorly sorted, angular, saturated.	
	1.0	2.0	85 175	0.0	0.0						
	0.8	1.5	111 116 116	0.0	0.0			15			
							-15.5 15.5			22.4-47.0': **RACINE FORMATION** Yellowish gray (5Y 8/1), finely crystalline, **DOLOMITE**, with some interclasts, peloids, occasional zones of wavy laminae of clay, heavy minerals, calcite, some quartz infillings, moderately vuggy	Lost all water return
		2.5									
		4.5									

CONTAMINANT SCREENING NOTES
*HNu w/10.2 eV ** Split Spoon Screenin

SITE: LENZ OIL RI/FS

HOLE NO.: MW-02D

ERM - North Central, Inc.
Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT	PROJECT NUMBER	SHEET NO.	HOLE NO.
Lenz Oil RI/FS	0252	2 OF 2	MW-02D

Samples/R. Core: Sample # / Time	Rec. (ft)	Length (ft)	Blow Cnt / RQD(%)	Contaminant Screening: Amb Air* VOC(ppm)	Sample** VOC(ppm)	Visual Observ.	LAYER ELEV. DEPTH	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
		3.8						25				
		6.3						30				
		10.0						35				
								40				
							-43.0					
							43.0				End of boring, 43'	

ERM - North Central, Inc.
Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT	PROJECT NUMBER	SHEET NO.	HOLE NO.
Lenz Oil RI/FS	0252	1 OF 2	MW-03D

SITE	COORDINATES	ANGLE FROM HORIZ	BEARING
LENZ OIL RI/FS	N 10; E 586	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	TOTAL DEPTH
3-21-91	3-22-91	FOX DRILLING	CME-75	11.5"	44.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
40.0/90	5	0	597.87	595.3	6.0/589.3 /	2.3/

SAMPLE DEVICE	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
2"x2' Split Spoon/NX Core Barrel		Dirk Kaiser

Samples/R. Core: Sample No. / Time	Rec. (ft)	Length(ft)	Blow Count / RQD(%)	Contaminant Screening: Amb. Air* VOC(ppm)	Sample ** VOC(ppm)	Visual Observ.	LAYER ELEV. DEPTH	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							595.3					
SS01	0.5	2.0		0.0	0.0						0-2.3': TOPSOIL - Black and Dark Brown mottled, some clay, some fine sand, grass, roots, soft, moist.	
							593.0 / 2.3					Bedrock at 2.3'
							591.3				2.3-44.0': RACINE FORMATION: Yellowish gray (5Y 8/1), Finely crystalline, dolomite, with some intraclasts and peloids, occasional zones of wavy laminae, fractured with clay, heavy mineral and calcite infillings, some open fractures, slightly fossiliferous	
Run#1	10.0	10.0		0.0			4.0	5			4.0-14.0': Run#1 4.0-4.5': Highly Fractured	Water table at -6'
								10			10.8-11.5': Highly Fractured	
							581.3					
Run#2	10.0	10.0		0.0			14.0	15			14.0-24.0': Run#2	

CONTAMINANT SCREENING NOTES
*HNu w/10.2 eV **Split Spoon Screening

SITE: LENZ OIL RI/FS

HOLE NO.: MW-03D

ERM - North Central, Inc.
Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT	PPOJECT NUMBER	SHEET NO.	HOLE NO.
Lenz Oil RI/FS	0252	2 OF 2	MW-03D

Samples/R. Core: Sample # / Time	Rec. (ft)	Length (ft)	Blow Cnt / RQD(%)	Contaminant Screening: Amb Air* VOC(ppm)	Sample** VOC(ppm)	Visual Observ.	LAYER ELEV. / DEPTH	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							571.3					
Run#3	10.0	10.0		0.0			24.0				24.0-34.0': Run#3	
								25				
								30			29.9': 1" very fine grained sandstone lense, CaCO3 cemented	
							561.3					
Run#4	10.0	10.0		0.0			34.0				34.0-44.0': Run#4	
								35				
											37.5': 2-3" vug	
								40				
							551.3					
							44.0				End of boring, 44.0'	

ERM - North Central, Inc.
Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT	PROJECT NUMBER	SHEET NO.	HOLE NO.
Lenz Oil RI/FS	0252	1 OF 3	MW-04D

SITE	COORDINATES	ANGLE FROM HORIZ	BEARING
LENZ OIL RI/FS	N 658; E 507	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	TOTAL DEPTH
3-13-91	3-14-91	W. Holloman	CME-75	9.0"	46.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
28.0/95	4	15	602.80	600.5	▽ 5.0/595.5 5.0 ▼ /	17.5/

SAMPLE DEVICE	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
2"x2' Split Spoon/NX Core Barrel		Dirk Kaiser

Samples/R. Core: Sample No. Time	Rec. (ft)	Length(ft)	Blow Count RQD(%)	Contaminant Screening: Amb. Air* VOC(ppm)	Sample ** VOC(ppm)	Visual Observ.	LAYER ELEV. DEPTH 600.5	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
SS-A 09:30	2.0	2.0	11 18 35 36	0.0	1.0						0.0-1.5': GRAVELLY SANDY CLAY Black, oil stained, limestone fragments	
SS-B 09:45	1.8	2.0	20 13 36 92	0.0	0.0						1.5-2.0': SAND & GRAVEL Orange-brown, coarse grained sand, limestone up to 1" 2.0-2.7': CLAY Black, organic, with limestone fragments 2.7-3.5': GRAVEL Orange-yellow to light grey, weathered	
SS-C 09:50	1.0	2.0	49 62 20 13	0.0	0.0			5			3.5-4.0': GRAVEL & CLAY Light grey stained black, weathering 4.0-4.5': CLAY Black, organic Water Table @ 5.0' 4.5-6.0': As Above - with limestone fragments up to 3" in diameter.	
SS-D 10:05	0.0	2.0	2 1 2 3	0.0	0.8						6.0-8.0': No recovery	
SS-E 10:15	1.2	2.0	2 5 7 9	0.0	0.8						8.0-8.5': SILTY CLAY Black, organic, with light grey limestone fragments 8.5-9.5': CLAY Olive-brown, dense 9.5-10.0': As Above - stained black (oily?), wet. no odor	
SS-F 10:30	0.5	2.0	11 17 19 13	0.0	0.6			10			10.0-11.0': As Above - with limestone fragments 11.0-12.0': GRAVEL Light grey, limestone, covered with a dark oily liquid	
SS-G 11:15	1.0	2.0	39 67 30 42	0.0	0.0						12.0-14.0': As Above	
SS-H 11:50	2.0	2.0	32 51 67 170	0.0	0.0			15			14.0-16.0': As Above - fractured, ground up	
SS-I	1.0	1.5	96 65 100	0.0	0.0		583.0 17.5				16.0-17.5': As Above	
RUN 1 08:50 09:15	3.8	4.3		0.0							17.5-46.0': RACINE FORMATION: Yellowish gray (5Y 8/1), Finely crystalline, dolomite, with some intraclasts and peloids, occasional zones of wavy laminae, fractured with clay, heavy mineral and calcite infillings, some open	

CONTAMINANT SCREENING NOTES
*HNu w/10.2 eV **Split Spoon Screening

SITE: LENZ OIL RI/FS
HOLE NO. MW-04D

ERM - North Central, Inc.
Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT	PROJECT NUMBER	SHEET NO.	HOLE NO.
Lenz Oil RI/FS	0252	2 OF 3	MW-04D

Samples/R. Core: Sample # / Time	Rec. (ft)	Length (ft)	Blow Cnt / RQD(%)	Contaminant Screening: Amb Air* VOC(ppm)	Sample** VOC(ppm)	Visual Observ.	LAYER ELEV. / DEPTH	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
											fractures, horizontal and high angle fractures. 20.6-21.8': Highly fractured	
							578.7					
RUN 2 09:25 09:50	4.7	4.7		0.0			21.8					
								25			24.5-25.5': highly fractured	
							574.0					
RUN 3 10:00 10:25	3.5	6.5		0.0			26.5					
								30				
											32.5': Sand Seam - 0.7mm, calcite cemented, very fine grained	
							567.5					
RUN 4 11:00 11:30	5.5	5.5		0.0			33.0				32.6-34.4': highly fractured	
								35			34.6-35.0': highly fractured	
							562.0					
RUN 5 11:40 12:00	2.8	2.8		0.0			38.5					
								40				
							559.2					
RUN 6 12:05 12:15	4.7	4.7		0.0			41.3					

ERM - North Central, Inc.
Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT	PROJECT NUMBER	SHEET NO.	HOLE NO.
Lenz Oil RI/FS	0252	3 OF 3	MW-04D

Samples/R. Core: Sample # / Time	Rec. (ft)	Length (ft)	Blow Cnt / RQD(%)	Contaminant Screening: Amb Air* VOC(ppm)	Sample** VOC(ppm)	Visual Observ.	LAYER ELEV. DEPTH	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							554.5 / 46.0					
											End of Boring - 46.0' Total loss of water during drilling to formation: MW-04D: 2610 gallons MW-04S: 0 gallons	
								50				
								55				
								60				
								65				

ERM - North Central, Inc.
Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT	PROJECT NUMBER	SHEET NO.	HOLE NO.
Lenz Oil RI/FS	0252	1 OF 3	MW-05D

SITE	COORDINATES	ANGLE FROM HORIZ	BEARING
LENZ OIL RI/FS	N 515; E 424	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	TOTAL DEPTH
2-26-91	3-4-91	FOX DRILLING	CME-75	7.5"	54.5

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
28.9/41	4			603.9	/ /	26.5/

SAMPLE DEVICE	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
2"x2' Split Spoon/NX Core Barrel		Dirk Kaiser

Samples/R. Core: Sample No. / Time	Rec. (ft)	Length (ft)	Blow Count / RQD(%)	Contaminant Screening: Amb. Air* VOC(ppm)	Sample ** VOC(ppm)	Visual Observ.	LAYER ELEV. DEPTH 603.9	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
SS-1 08:40	1.5	2.0	9 12 13 10	0.0	0.0						Light olive gray (5Y 5/2), silty, ASH, small pebbles to cobbles, non-homogenous 0.6'-0.9': Same as above with oil 0.9'-1.5': Dusky yellow (5Y 6/4), SAND, cobbly to silty, moist	
SS-2 08:50	1.2	2.0	9 5 12 21	0.0	0.0						-Same as above, with pebbles and cobbles, angular, well rounded, moist to wet	
SS-3 09:00	1.1	2.0	41 15 53 64	0.0	0.0			5			Mottled dusky yellow (5Y 6/4) and yellowish gray (5Y 7/2), sub-angular, cobbles, **SANDS, GRAVELS, and DOLOMITE**, moist	
SS-4 09:14	1.6	2.0	9 14 17 22	0.0	0.0						-Same as above, moist	
SS-5 09:22	1.6	2.0	16 21 23 28	0.0	4-20						1.1': Same as above 0.5': Black, angular, **DOLOMITE**, stained, saturated, sulfer smell	
SS-6 09:40	0.9	2.0	9 7 6 4	0.0	1.1			10			-Same as above, oil, saturated	
SS-7 09:50	1.3	2.0	3 2 4 10	0.0	1.0						Light olive gray (5Y 6/1), silty, sandy, gravel, dolomite chips, oily stain, saturated	
SS-8 10:00	1.0	2.0	8 8 6 7	0.0	0.5			15			-Same as above, not as oily as above, saturated	
SS-9 10:10	1.1	2.0	10 21 52 31	0.0	1.0						-Same as above, saturated	
SS-10 10:15	0.8	2.0	13 4 2 8	0.0	0.0						-Same as above, saturated	

CONTAMINANT SCREENING NOTES
*HNu w/10.2 eV **Split Spoon Sreening

SITE: LENZ OIL RI/FS

HOLE NO. MW-05D

ERM - North Central, Inc.
Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT	PROJECT NUMBER	SHEET NO.	HOLE NO.
Lenz Oil RI/FS	0252	2 OF 3	MW-05D

Samples/R. Core: Sample # / Time	Rec. (ft)	Length (ft)	Blow Cnt / RQD(%)	Contaminant Screening: Amb Air* VOC(ppm)	Sample** VOC(ppm)	Visual Observ.	LAYER ELEV. DEPTH	DEPTH	GRAPHICS / SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
SS-11 10:21	0.9	2.0	4 4 19 11	0.0	0.5					-Same as above, 1"-2" dolomite cobbles	
SS-12 10:33	1.0	2.0	13 17 11 12	0.0	0.0					-Same as above, but light gray (7N7)	
SS-13 10:42	0.9	2.0	10 12 100	0.0	0.0			25		-Same as above	
	0.0	0.5		0.0	0.0		577.4				
RUN 1 15:20	9.0	9.0		0.0			26.5	30 35		**RACINE FORMATION**: Yellowish gray (5Y 8/1), Finely crystalline, dolomite, with some intraclasts and peloids, occasional zones of wavy laminae, fractured with clay, heavy mineral and calcite infillings, some open fractures, slightly fossiliferous -Clay infillings in fracture @ 36.0'-36.8' 0.01" wide.	
							568.4				
RUN 2 16:20	8.0	8.0		0.0			35.5	40		-Same as above	
							560.4				
RUN 3 16:55	5.5	5.5		0.0			43.5				

ERM - North Central, Inc.
Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT	PROJECT NUMBER	SHEET NO.	HOLE NO.
Lenz Oil RI/FS	0252	3 OF 3	MW-05D

Samples/R. Core: Sample # / Time	Rec. (ft)	Length (ft)	Blow Cnt / RQD(%)	Contaminant Screening: Amb Air* VOC(ppm)	Sample** VOC(ppm)	Visual Observ.	LAYER ELEV. DEPTH	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							554.9 / 49.0					
RUN 4 17:15	5.5	5.5		0.0				50				
							549.4 / 54.5					
								55			End of boring, 54.5'	
								60				
								65				

ERM - North Central, Inc.
Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT	PROJECT NUMBER	SHEET NO.	HOLE NO.
Lenz Oil RI/FS	0252	1 OF 2	MW-06D

SITE	COORDINATES	ANGLE FROM HORIZ	BEARING
LENZ OIL RI/FS	N 67; E 203	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	TOTAL DEPTH
3-18-91	3-19-91	FOX DRILLING	CME-75	11.5"	44.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
44.0/80	5	0	595.95	593.4	2.0/591.4 /	/

SAMPLE DEVICE	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
2"x2' Split Spoon/NX Core Barrel		Dirk Kaiser

Samples/R. Core: Sample No. / Time	Rec. (ft)	Length (ft)	Blow Count / RQD(%)	Contaminant Screening: Amb. Air* VOC(ppm)	Sample ** VOC(ppm)	Visual Observ.	LAYER ELEV. / DEPTH	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							593.4					
SS01 10:40	1.2	2.0	2 2 3 12	0.0	0.0						0-0.7': TOPSOIL - Black organic clay, sandy, grass, roots, soft, moist. 0.7-2.0': As Above - Orange to yellow orange with weathered limestone fragments	Water Table
							591.2 2.2					
							589.4				2.6-44.0': RACINE FORMATION: Yellowish gray (5Y 8/1), Finely crystalline, dolomite, with some intraclasts and peloids, occasional zones of wavy laminae, fractured with clay, heavy mineral and calcite infillings, some open fractures, slightly fossiliferous	Bedrock at 2.6' Casing driven to 3.3' Hole reamed to 4.0' prior to coring
Run#1	9.0	9.3		0.0			4.0	5			4.0-13.3': Run#1 4.0-4.5': Highly Fractured 6.5-10.2': Highly fractured	
								10			11.5-12.3': Mg nodules in fractures	
							580.1					
Run#2	6.0	6.7		0.0			13.3	15			13.3-20.0': Run#2 14.5-15.0': Heavily fractured	
							573.4					

CONTAMINANT SCREENING NOTES
*HNu w/10.2 eV ** Split Spoon Screenin

SITE	HOLE NO.
LENZ OIL RI/FS	MW-06D

ERM - North Central, Inc.
Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT	PROJECT NUMBER	SHEET NO.	HOLE NO.
Lenz Oil RI/FS	0252	2 OF 2	MW-06D

Samples/R. Core: Sample # / Time	Rec. (ft)	Length (ft)	Blow Cnt / RQD(%)	Contaminant Screening: Amb Air* VOC(ppm)	Sample** VOC(ppm)	Visual Observ.	LAYER ELEV. DEPTH	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
Run#3	9.0	9.0		0.0			20.0				20.0-29.0': Run#3	
								25				
							564.4					
Run#4	10.0	10.0		0.0			29.0				29.0-39.0': Run#4	
								30				
											32.5-32.7': Highly fractured	
								35				
							554.4					
Run#5	5.0	5.0					39.0				39.0-44.0': Run#5	
								40				
											41.0-42.5': Highly fractured	
							549.4				43.5-43.6': Highly fractured	
							44.0				End of boring at 44.0'	

ERM - North Central, Inc.
Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT	PROJECT NUMBER	SHEET NO.	HOLE NO.
Lenz Oil RI/FS	0252	1 OF 3	MW-07D

SITE	COORDINATES	ANGLE FROM HORIZ	BEARING
LENZ OIL RI/FS	N 375; E 18	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	TOTAL DEPTH
3-28-91	4-1-91	FOX DRILLING	CME-75	7.5"	53.8

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
28.8/	3			608.0	▽ 23.0/585.0 ▼ /	24.0/

SAMPLE DEVICE	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
2"x2' Split Spoon/NX Core Barrel		Dirk Kaiser

Samples/R. Core: Sample No. / Time	Rec. (ft)	Length (ft)	Blow Count / RQD(%)	Contaminant Screening: Amb. Air* VOC(ppm)	Sample ** VOC(ppm)	Visual Observ.	LAYER ELEV. DEPTH	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							608.0					
SS-1 08:35	1.1	2.0	4 32 29 15	0.0	0.0		607.1 0.9				0-1.0': TOPSOIL - Moderate brown (5 YR 3/4), trace sand, moist	
							606.1 1.9				1.0-2.0': GRAVEL - Dark yellowish orange (10 YR 6/6)	
SS-2 08:40	0.6	2.0	11 9 9 13	0.0	0.0						2.0-4.0': GRAVELLY CLAY - Moderate yellowish brown, some iron stains, some sand, dry	
SS-3 08:55	1.1	2.0	11 4 4 6	0.0	0.0			5			4.0-6.8': As Above - soft, moist	
SS-4 09:05	1.4	2.0	2 3 8 6	0.0	0.0		600.6 7.4				6.8-7.4': As Above - Grading to dusky yellow green	
SS-5 09:10	1.2	2.0	8 15 28 24	0.0	0.0		599.4 8.6				7.4-8.6': SAND/FILL? - Black, very fine grained, hard, trace cinders (?)	
											8.6-10.0': SILTY SAND - Grayish yellow (5 Y 8/4), some gravel, moderately sorted, trace silt, moist	
SS-6 09:25	1.2	2.0	31 90 67 50	0.0	0.0			10			10.0-12.0': As Above - with cobbles of dolomite	
SS-7 10:20	1.8	2.0	39 67 136 106	0.0	0.0						12.0-14.0': As Above - mottled gray in spots	
SS-8 10:40	2.0	2.0	31 55 64 65	0.0	0.0			15			14.0-24.0': As Above - Color change at 15.0' to medium light grey (N6), moist	
SS-9 11:25	1.5	2.0	37 65 81 131	0.0	0.0							
SS-10 11:50	1.5	2.0	38 54 59 67	0.0	0.0							

CONTAMINANT SCREENING NOTES
*HNu w/10.2 eV **Split Spoon Screening

SITE: LENZ OIL RI/FS

HOLE NO.: MW-07D

ERM - North Central, Inc.
Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT	PROJECT NUMBER	SHEET NO.	HOLE NO.
Lenz Oil RI/FS	0252	2 OF 3	MW-07D

Samples/R. Core: Sample # / Time	Rec. (ft)	Length (ft)	Blow Cnt / RQD(%)	Contaminant Screening: Amb Air* VOC(ppm)	Sample** VOC(ppm)	Visual Observ.	LAYER ELEV. / DEPTH	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
SS-11 12:10	1.5	2.0	14 50 34 24	0.0	0.0							
SS-12 13:15	1.8	2.0	13 24 36 100	0.0	0.0						23.0 Saturated at 23.0', water rising to 14.0'	
							584.0 24.0					
Run#1	3.0	3.0		0.0	0.0			25			24-53.8': **RACINE FORMATION**: Yellowish gray (5Y 8/1), Finely crystalline, dolomite, with some intraclasts and peloids, occasional zones of wavy laminae, fractured with clay, heavy mineral and calcite infillings, some open fractures, slightly fossiliferous 25.0-35.2': Highly fractured	
							580.0					
Run#2	3.8	3.8		0.0	0.0		28.0	30				
							576.2					
Run#3	3.2	3.2		0.0	0.0		31.8					
							573.0	35				
Run#4	4.0	4.0		0.0	0.0		35.0				37.7-37.9': Highly fractured	
							569.0					
Run#5	9.0	9.0		0.0	0.0		39.0	40				

ERM - North Central, Inc.
Environmental Resources Management

GEOLOGIC DRILL LOG

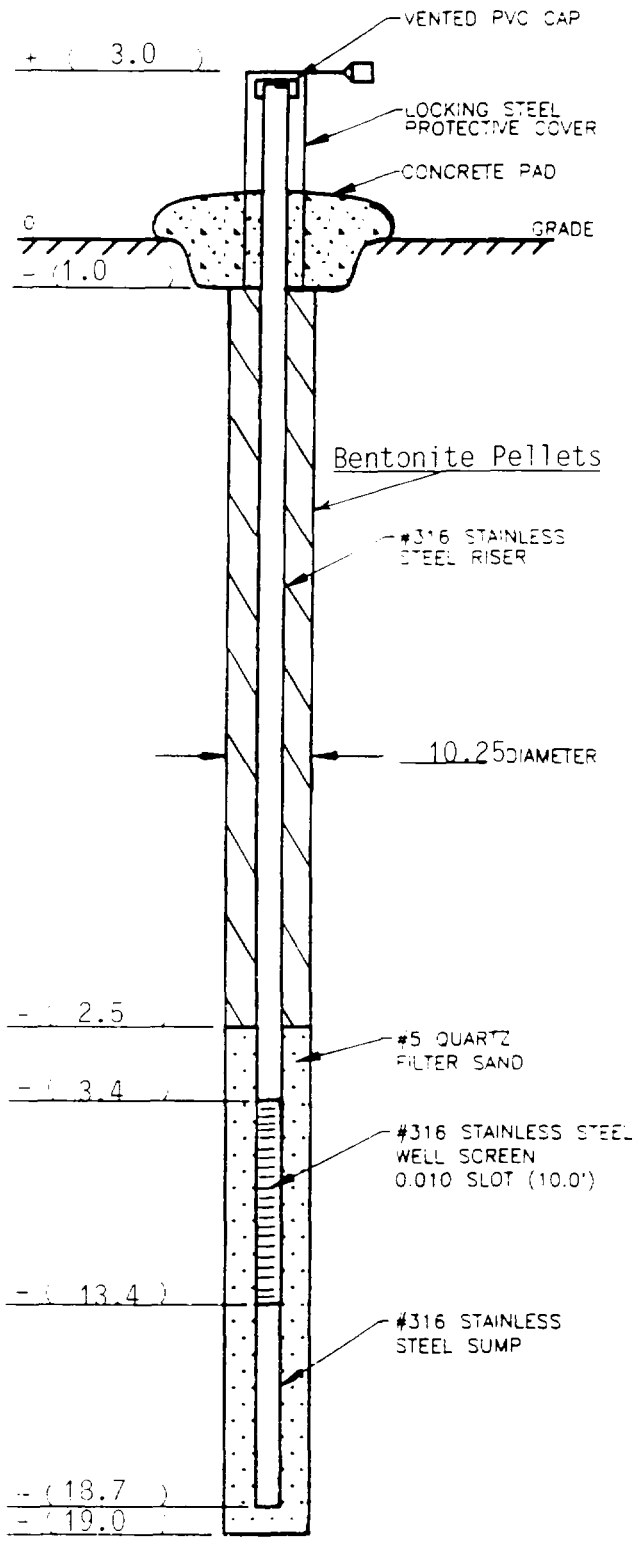
PROJECT	PROJECT NUMBER	SHEET NO.	HOLE NO.
Lenz Oil RI/FS	0252	3 OF 3	MW-07D

Samples/R. Core: Sample # / Time	Rec. (ft)	Length (ft)	Blow Cnt / RQD(%)	Contaminant Screening: Amb Air* VOC(ppm)	Sample** VOC(ppm)	Visual Observ.	LAYER ELEV. DEPTH	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							560.0					
Run#6	5.8	5.8		0.0	0.0		48.0					
								50			50.1-50.7': Highly fractured	
											52.8-53.8': Highly fractured	
							554.3 / 53.7					
											End of Boring at 53.8'	
								55				
								60				
								65				

APPENDIX B

MONITORING WELL CONSTRUCTION LOGS

WELL CONSTRUCTION LOG



ERM JOB # 0252

PROJECT Lenz Oil WELL MW01S
TOWN/CITY Lemont
COUNTY DuPage STATE IL
ELEVATION
GRADE 602.88 MSL
TOP OF CASING 600.04 MSL (M.P.)
SURVEY BY Patrick Engineering, Inc.
INSTALLATION DATE(S) 3/11/91
DRILLING METHOD HSA
DRILLING CONTRACTOR Fox Drilling, Inc.
DRILLING FLUID DuPage County Municipal Water Supply
DEVELOPMENT TECHNIQUE(S) AND DATE(S) Centrifugal Pump/Bailing

FLUID LOSS DURING DRILLING 0 GAL
WATER REMOVED DURING DEVELOPMENT 360 GAL
STATIC DEPTH TO WATER
FEET BELOW M.P. 7.17 DATE 5 / 9 / 91
PUMPING DURATION ____ HOURS
YIELD ____ gpm DATE ___/___/___
REMARKS

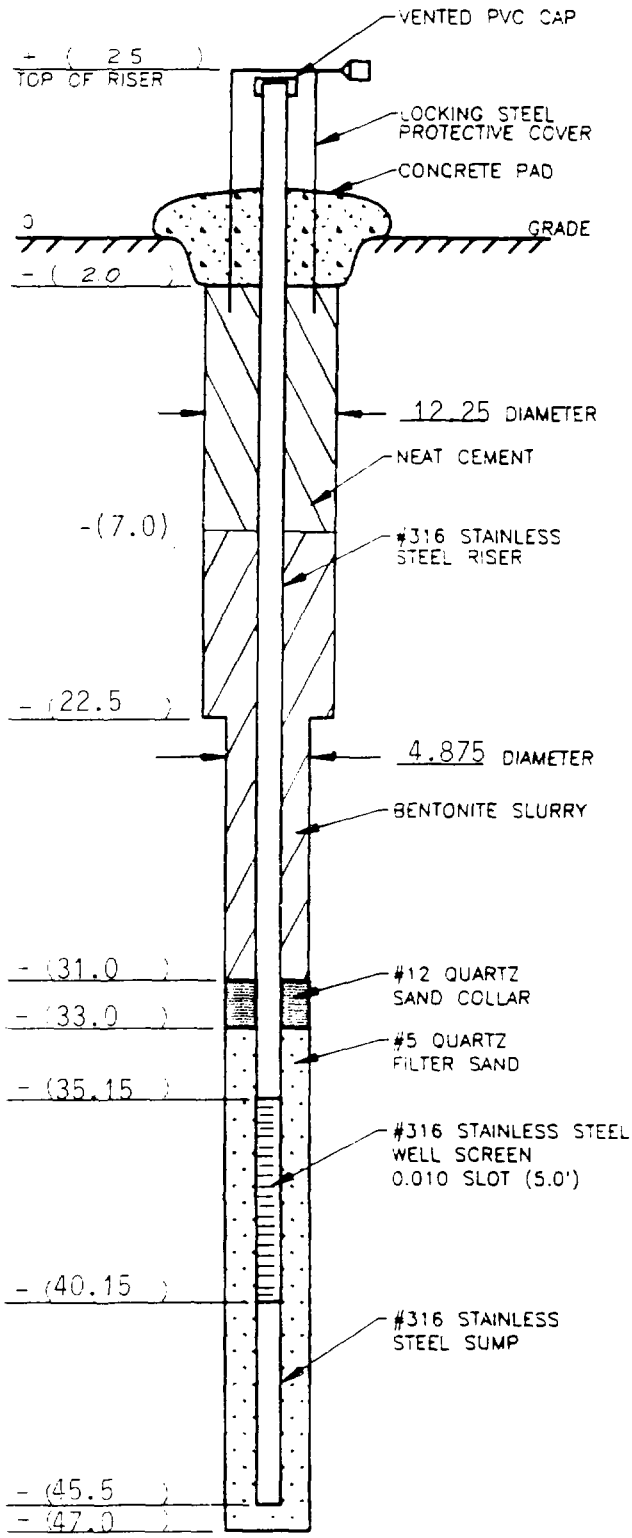
PREPARED BY Dirk Kaiser, ERM

NOT DRAWN TO SCALE

ERM

PROJECT	0252
REPORT	TM3
DRAWN	CMM
CHECKED	
DATE	8/20/91
APPROVED	
CLIENT NAME	KMZ - LENZ OIL

WELL CONSTRUCTION LOG



NOT DRAWN TO SCALE

ERM JOB # 0252

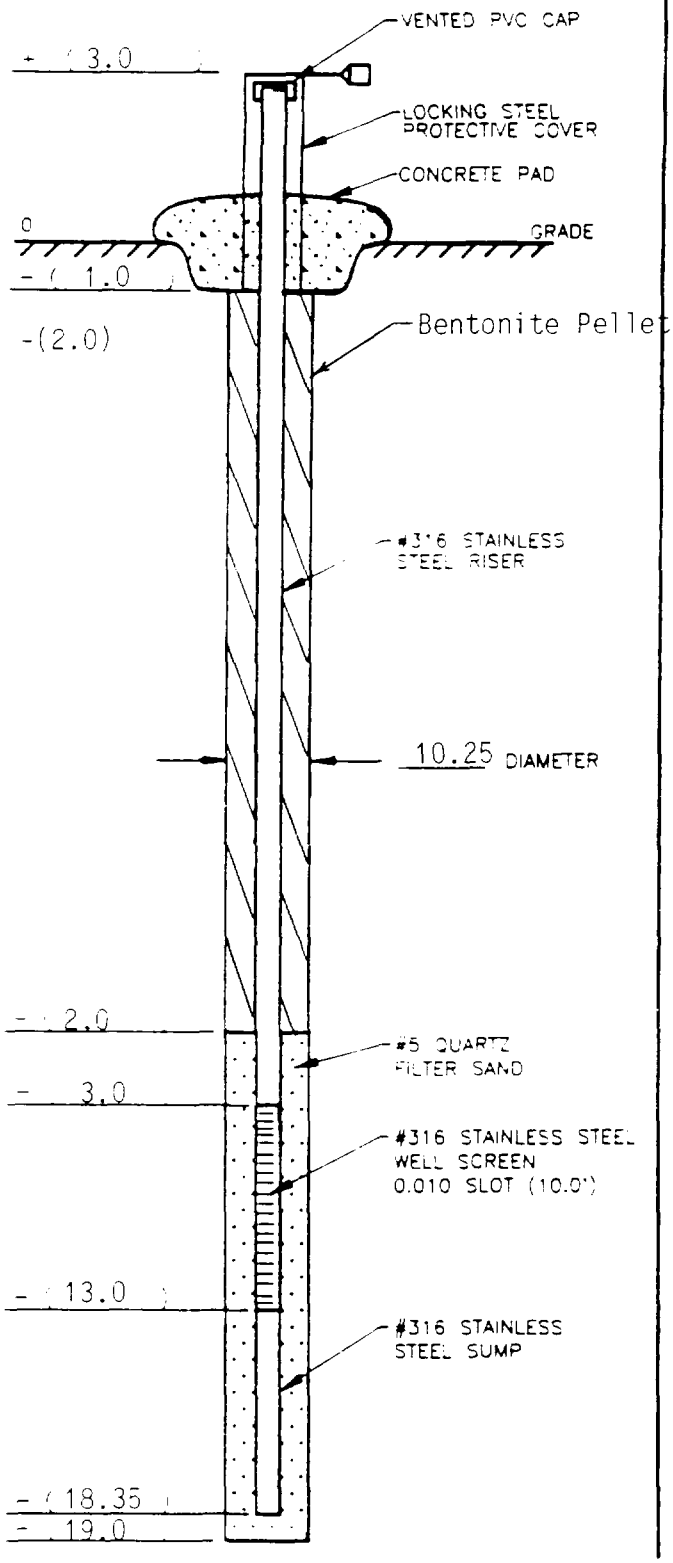
PROJECT Lenz Oil WELL MW01D
TOWN/CITY Lemont
COUNTY DuPage STATE IL
ELEVATION
GRADE 599.91 MSL
TOP OF CASING 602.11 MSL (M.P.)
SURVEY BY Patrick Engineering, Inc.
INSTALLATION DATE(S) 3/7/91
DRILLING METHOD HSA/Rotory
DRILLING CONTRACTOR Fox Drilling, Inc.
DRILLING FLUID DuPage County Municipal Water Supply
DEVEOLPMENT TECHNIQUE(S) AND DATE(S)
Centrifugal Pump
Bailing
FLUID LOSS DURING DRILLING 1525 GAL
WATER REMOVED DURING DEVELOPMENT 1850 GAL
STATIC DEPTH TO WATER
FEET BELOW M.P. 8.84 DATE 5 / 9 / 91
PUMPING DURATION HOURS
YIELD gpm DATE / /
REMARKS

PREPARED BY Dirk Kaiser, ERM

PROJECT: 0252 | REPORT: TM3 | DRAWN: CMM | CHECKED: | DATE: 6/20/91 | APPROVED: | CLIENT NAME: KMZ - LENZ OIL

ERM

WELL CONSTRUCTION LOG



ERM JOB # 0252

PROJECT Lenz Oil WELL MW025
TOWN/CITY Lemont
COUNTY DuPage STATE IL
ELEVATION
GRADE 600.28 MSL
TOP OF CASING 603.23 MSL (M.P.)
SURVEY BY Patrick Engineering, Inc.
INSTALLATION DATE(S) 4/25/91
DRILLING METHOD HSA
DRILLING CONTRACTOR Fox Drilling, Inc.
DRILLING FLUID DuPage County Municipal Water Supply
DEVELOPMENT TECHNIQUE(S) AND DATE(S) Centrifugal Pump/Bailing

FLUID LOSS DURING DRILLING 10 GAL
WATER REMOVED DURING DEVELOPMENT 205 GAL
STATIC DEPTH TO WATER
FEET BELOW M.P. 7.95 DATE 5 / 9 /91
PUMPING DURATION _____ HOURS
YIELD _____ gpm DATE ___ / ___
REMARKS

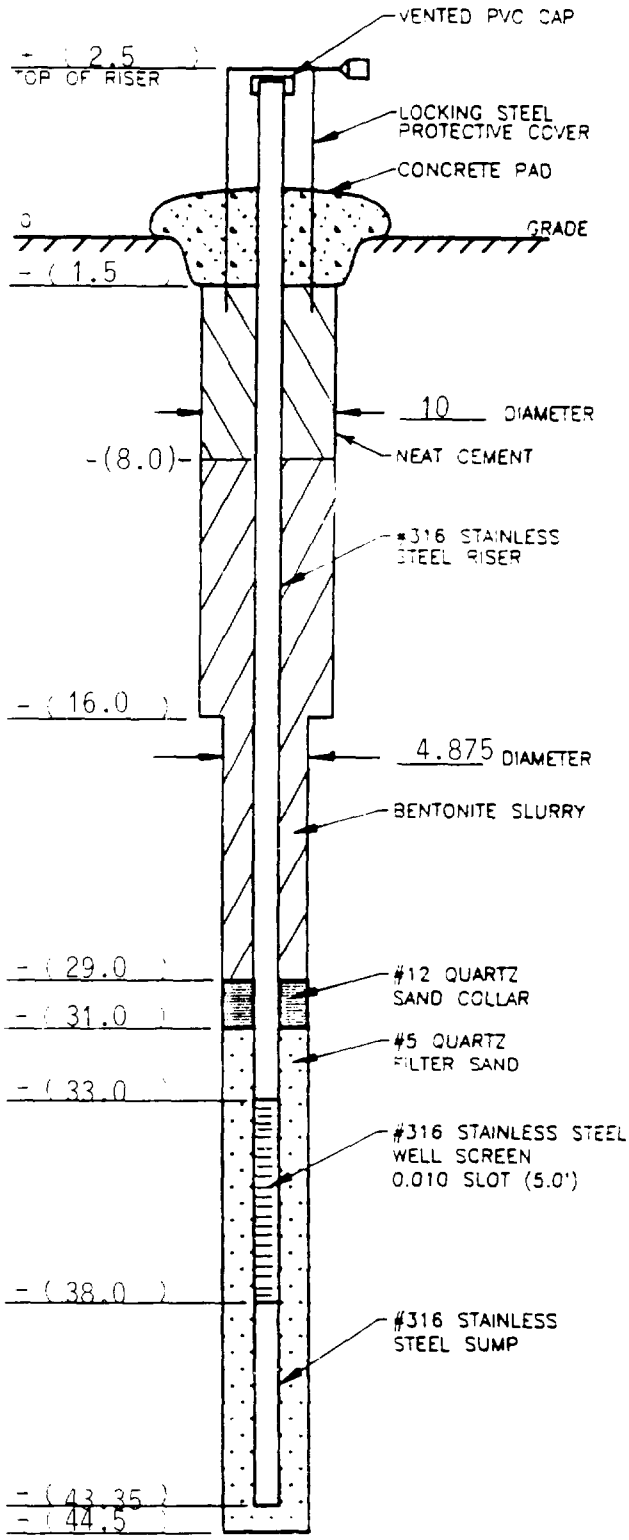
PREPARED BY Dirk Kaiser, ERM

NOT DRAWN TO SCALE

ERM

PROJECT: 0252 | REPORT: TM3 | DRAWN: CMM | CHECKED: | DATE: 6/20/91 | APPROVED: | CLIENT NAME: KMZ - LENZ OIL

WELL CONSTRUCTION LOG



NOT DRAWN TO SCALE

ERM JOB # 0252

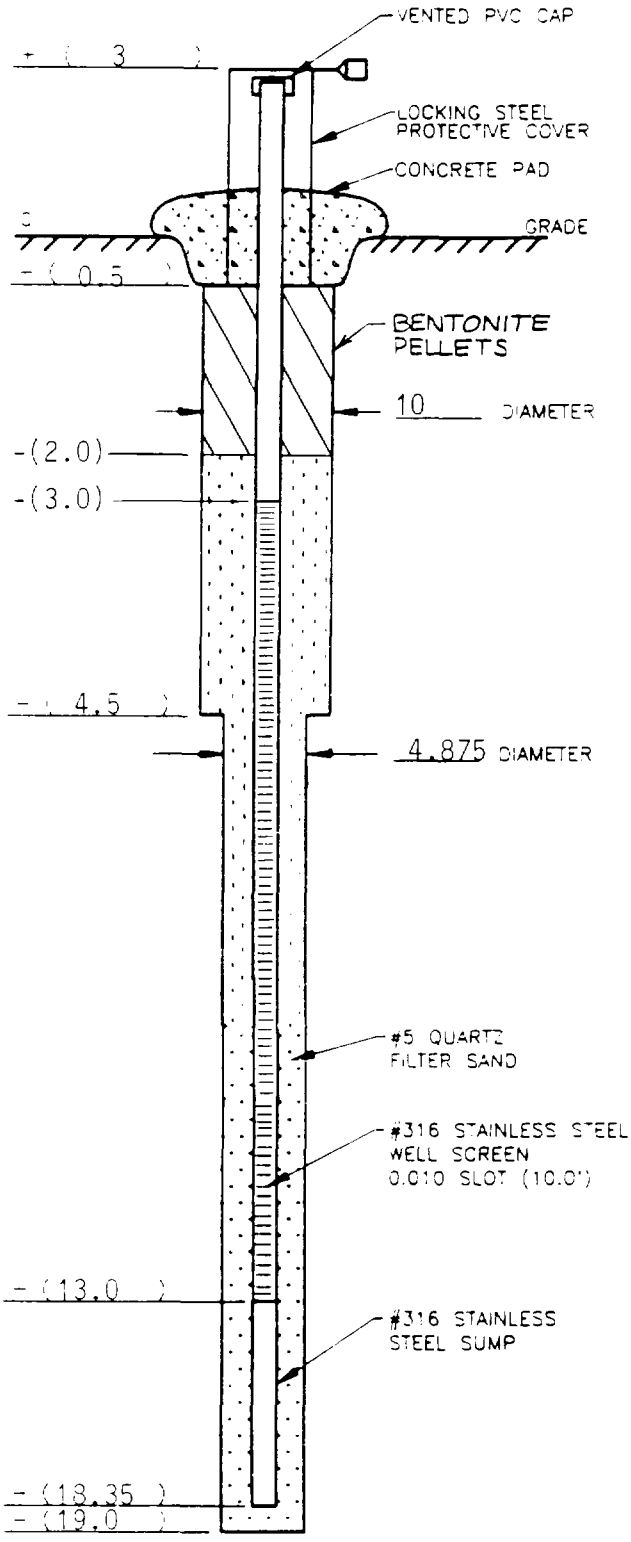
PROJECT Lenz Oil WELL MW02D
TOWN/CITY Lemont
COUNTY DuPage STATE IL
ELEVATION
GRADE 600.30 MSL
TOP OF CASING 602.63 MSL (M.P.)
SURVEY BY Patrick Engineering, Inc.
INSTALLATION DATE(S) 4/24/91
DRILLING METHOD HSA/Rotory
DRILLING CONTRACTOR Fox Drilling, Inc.
DRILLING FLUID DuPage County Municipal Water Supply
DEVELOPMENT TECHNIQUE(S) AND DATE(S)
Centrifugal Pump
Bailing
FLUID LOSS DURING DRILLING 1630 GAL
WATER REMOVED DURING DEVELOPMENT 1650 GAL
STATIC DEPTH TO WATER
FEET BELOW M.P. 9.73 DATE 5 / 9 / 91
PUMPING DURATION HOURS
YIELD gpm DATE / /
REMARKS

PREPARED BY Dirk Kaiser, ERM

PROJECT: 0252 | REPORT: TM3 | DRAWN: CMM | CHECKED: | DATE: 6/20/91 | APPROVED: | CLIENT NAME: KMZ - LENZ OIL

ERM

WELL CONSTRUCTION LOG



ERM JOB # 0252

PROJECT Lenz Oil WELL MW03S
TOWN/CITY Lemont
COUNTY DuPage STATE IL
ELEVATION
GRADE 597.91 MSL
TOP OF CASING 597.91 MSL (M.P.)
SURVEY BY Patrick Engineering, Inc.
INSTALLATION DATE(S) 4/4/91
DRILLING METHOD HSA/Rotory
DRILLING CONTRACTOR Fox Drilling, Inc.
DRILLING FLUID DuPage County Municipal Water Supply
DEVELOPMENT TECHNIQUE(S) AND DATE(S)
Centrifugal Pump
Bailing
FLUID LOSS DURING DRILLING 358 GAL
WATER REMOVED DURING DEVELOPMENT 360 GAL
STATIC DEPTH TO WATER
FEET BELOW M.P. 6.54 DATE 5 / 9 / 91
PUMPING DURATION HOURS
YIELD gpm DATE
REMARKS

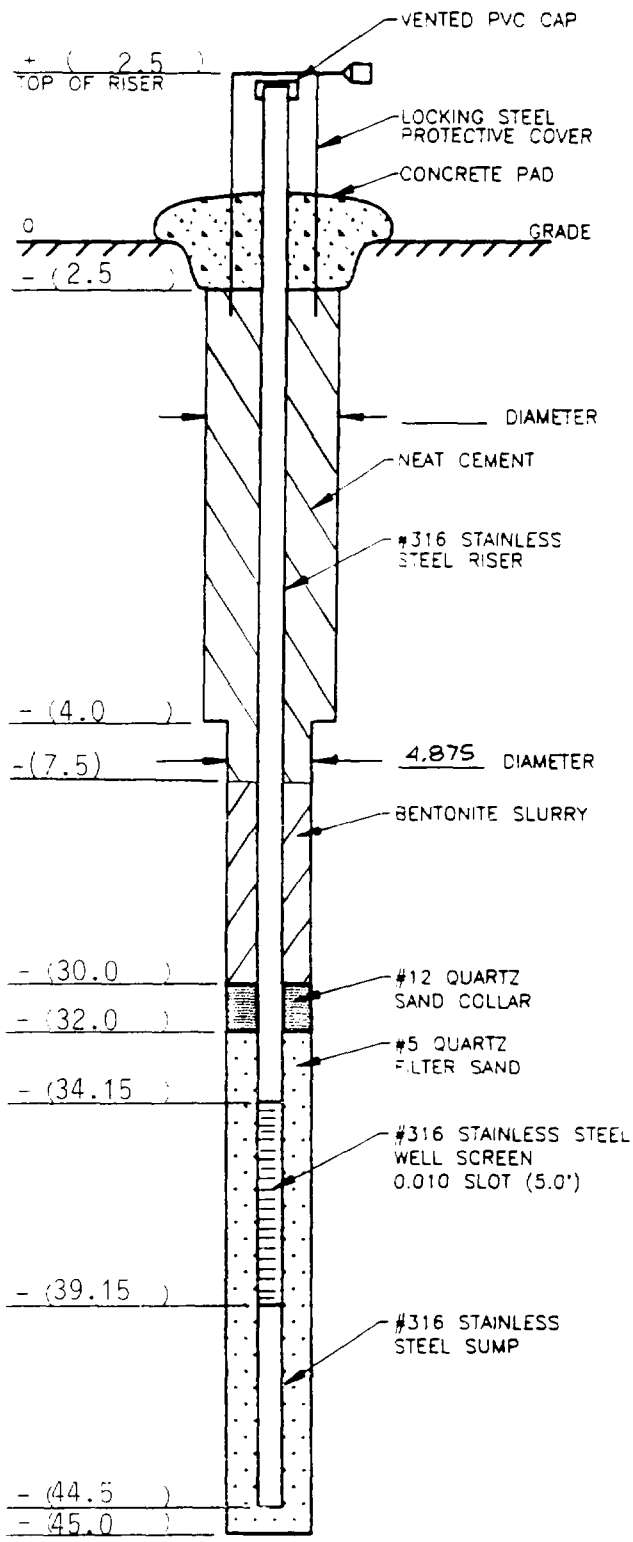
PREPARED BY Dirk Kaiser, ERM

NOT DRAWN TO SCALE

PROJECT: 0252 | REPORT: TM3 | DRAWN: CMM | CHECKED: | DATE: 8/20/91 | APPROVED: | CLIENT NAME: KMZ - LENZ OIL

ERM

WELL CONSTRUCTION LOG



NOT DRAWN TO SCALE

ERM JOB # 0252

PROJECT Lenz Oil WELL MW03D
TOWN/CITY Lemont
COUNTY DuPage STATE IL
ELEVATION
GRADE 595.31 MSL
TOP OF CASING 597.87 MSL (M.P.)
SURVEY BY Patrick Engineering, Inc.
INSTALLATION DATE(S) 3/21-3/22, 1991
DRILLING METHOD HSA/Rotory
DRILLING CONTRACTOR Fox Drilling, Inc.
DRILLING FLUID DuPage County
Municipal Water Supply
DEVEOLPMENT TECHNIQUE(S) AND DATE(S)
Centrifugal Pump
Bailing

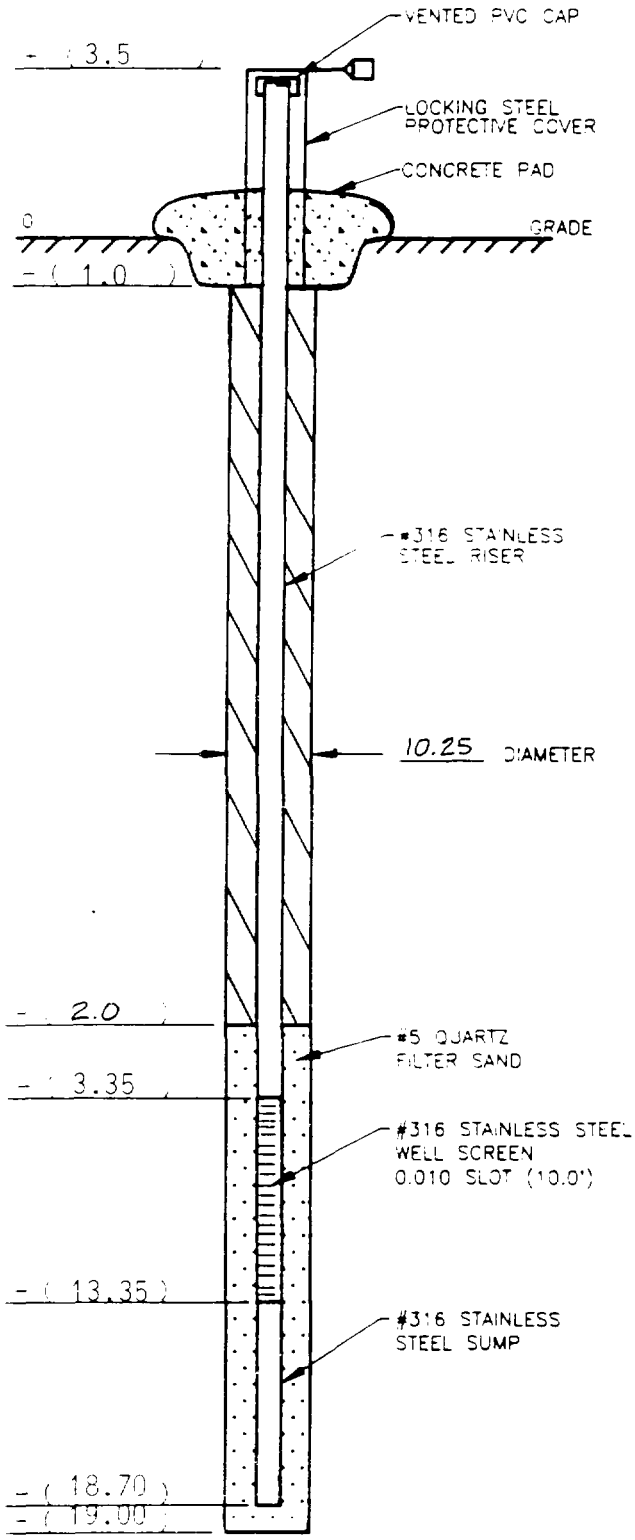
FLUID LOSS DURING DRILLING 3500 GAL
WATER REMOVED DURING DEVELOPMENT
3530 GAL
STATIC DEPTH TO WATER
FEET BELOW M.P. 5.83 DATE 5 / 9 / 91
PUMPING DURATION _____ HOURS
YIELD _____ gpm DATE ___/___/___
REMARKS

PREPARED BY Dirk Kaiser, ERM

PROJECT: 0252 | REPORT: TM3 | DRAWN: CMM | CHECKED: | DATE: 6/20/91 | APPROVED: | CLIENT NAME: KMZ - LENZ OIL

ERM

WELL CONSTRUCTION LOG



NOT DRAWN TO SCALE

ERM JOB # 0252

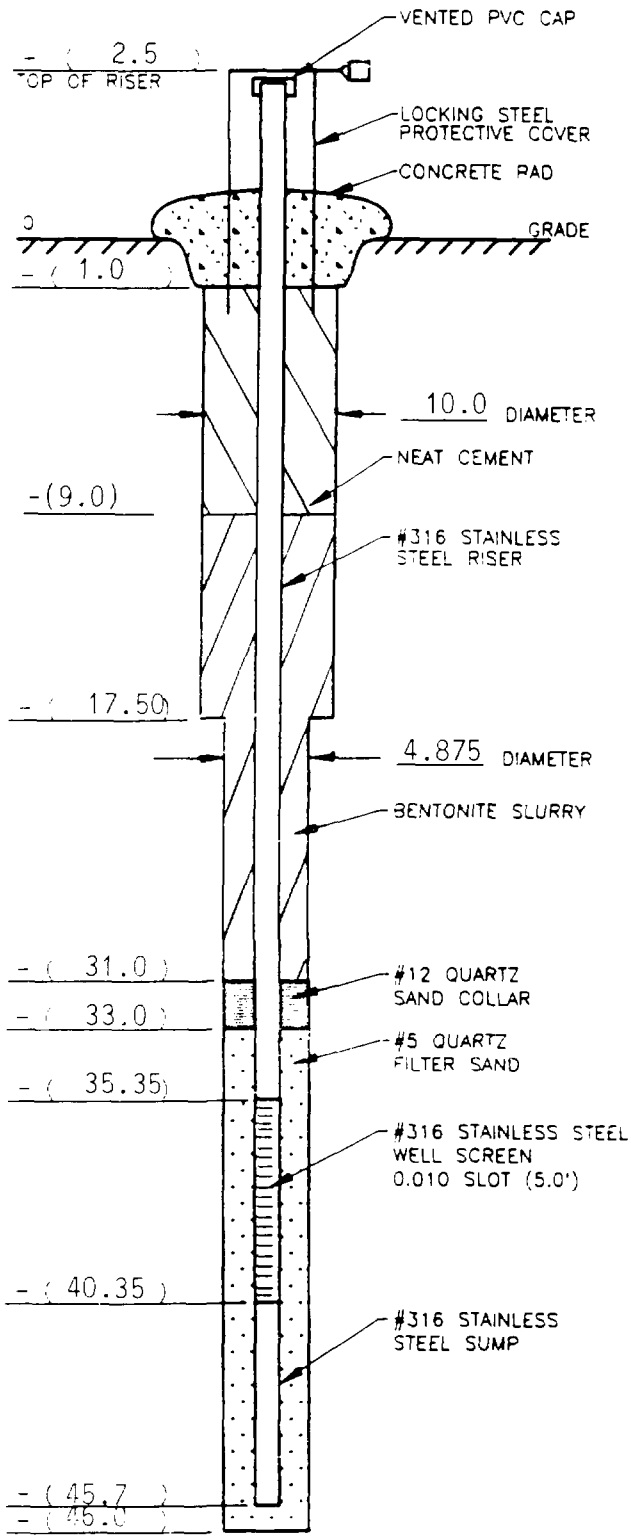
PROJECT Lenz Oil WELL MW04S
TOWN/CITY Lemont
COUNTY DuPage STATE IL
ELEVATION
GRADE 600.55 MSL
TOP OF CASING 603.35 MSL (M.P.)
SURVEY BY Patrick Engineering, Inc.
INSTALLATION DATE(S) 4/15/91
DRILLING METHOD HSA
DRILLING CONTRACTOR Fox Drilling, Inc.
DRILLING FLUID DuPage County Municipal Water Supply
DEVELOPMENT TECHNIQUE(S) AND DATE(S) Centrifugal Pump/Bailing

FLUID LOSS DURING DRILLING 400 GAL
WATER REMOVED DURING DEVELOPMENT 415 GAL
STATIC DEPTH TO WATER
FEET BELOW M.P. 7.97 DATE 5 / 9 / 91
PUMPING DURATION HOURS
YIELD gpm DATE / /
REMARKS

PREPARED BY Dirk Kaiser, ERM

PROJECT: 0252 | REPORT: TM3 | DRAWN: CMM | CHECKED: | DATE: 8/20/91 | APPROVED: | CLIENT NAME: KMZ - LENZ OIL

WELL CONSTRUCTION LOG



ERM JOB # 0252

PROJECT Lenz Oil WELL MW04D
TOWN/CITY Lemont
COUNTY DuPage STATE Il
ELEVATION
GRADE 600.51 MSL
TOP OF CASING 602.80 MSL (M.P.)
SURVEY BY Patrick Engineering, Inc.
INSTALLATION DATE(S) 3/14/91
DRILLING METHOD HSA/Rotory
DRILLING CONTRACTOR Fox Drilling, Inc.
DRILLING FLUID DuPage County Municipal Water Supply
DEVEOLPMENT TECHNIQUE(S) AND DATE(S)
Centrifugal Pump
Bailing
FLUID LOSS DURING DRILLING 3000 GAL
WATER REMOVED DURING DEVELOPMENT 3075 GAL
STATIC DEPTH TO WATER
FEET BELOW M.P. 10.16 DATE 5 / 9 / 91
PUMPING DURATION HOURS
YIELD gpm DATE / /
REMARKS

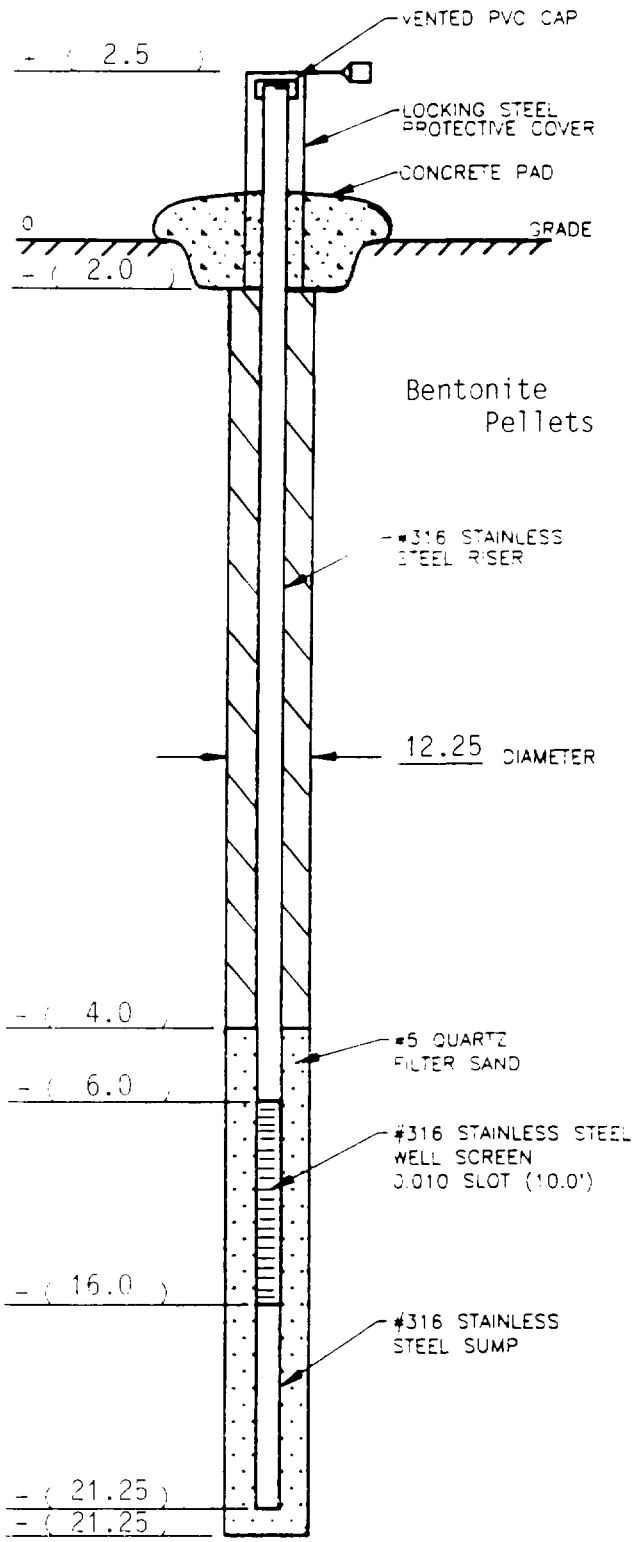
PREPARED BY Dirk Kaiser, ERM

NOT DRAWN TO SCALE

PROJECT 0252 | REPORT TM3 | DRAWN CMN | CHECKED | DATE 8/20/91 | APPROVED | CLIENT NAME KMZ - LENZ OIL

ERM

WELL CONSTRUCTION LOG



ERM JOB # 0252

PROJECT Lenz Oil WELL MW05S
TOWN/CITY Lemont
COUNTY DuPage STATE IL
ELEVATION
GRADE 600.07 MSL
TOP OF CASING 603.92 MSL (M.P.)
SURVEY BY Patrick Engineering, Inc.
INSTALLATION DATE(S) 3/5/91
DRILLING METHOD HSA
DRILLING CONTRACTOR Fox Drilling, Inc.
DRILLING FLUID DuPage County Municipal Water Supply
DEVELOPMENT TECHNIQUE(S) AND DATE(S) Centrifugal Pump/Bailing

FLUID LOSS DURING DRILLING 0 GAL
WATER REMOVED DURING DEVELOPMENT 90 GAL
STATIC DEPTH TO WATER
FEET BELOW M.P. 8.85 DATE 5 / 9 / 91
PUMPING DURATION ____ HOURS
YIELD ____ gpm DATE ___/___/___
REMARKS

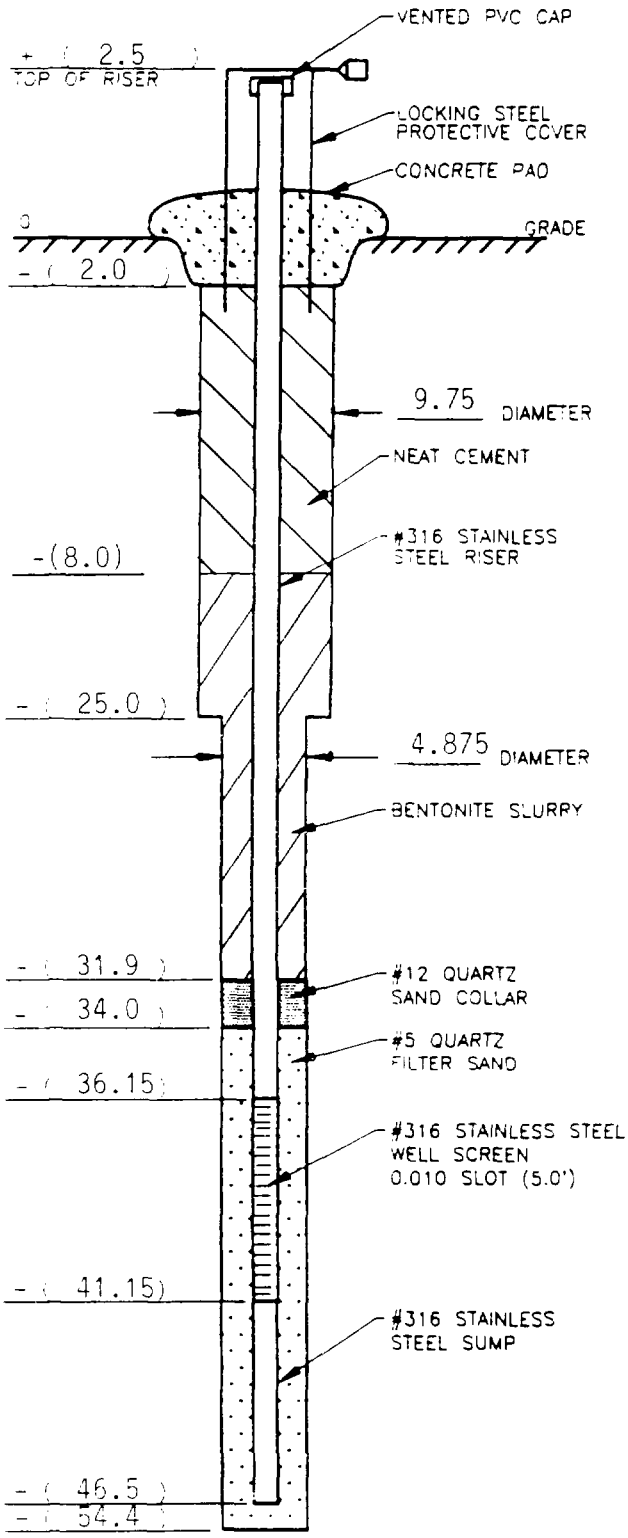
PREPARED BY Dirk Kaiser, ERM

NOT DRAWN TO SCALE

PROJECT: 0252 | REPORT: TM3 | DRAWN: CNM | CHECKED: | DATE: 8/20/91 | APPROVED: | CLIENT NAME: KMZ - LENZ OIL

ERM

WELL CONSTRUCTION LOG



NOT DRAWN TO SCALE

ERM JOB # 0252

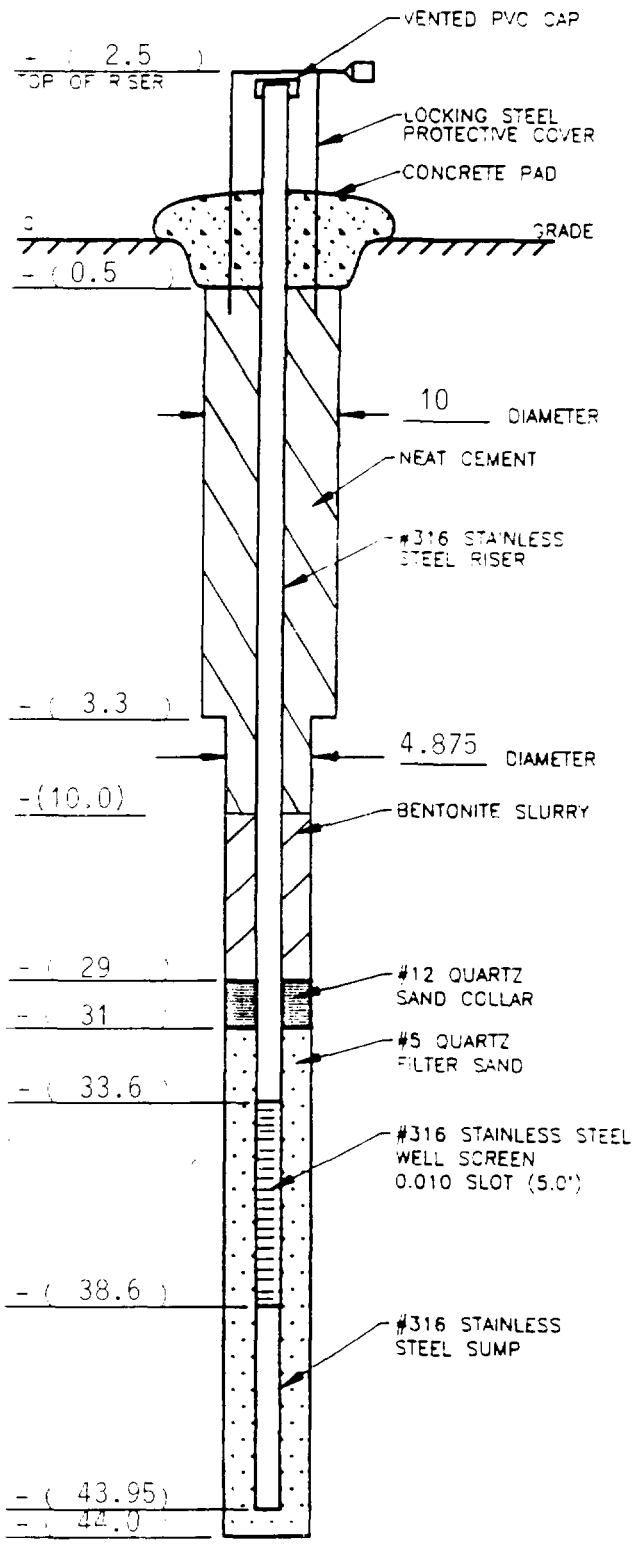
PROJECT Lenz Oil WELL MW050
TOWN/CITY Lemont
COUNTY DuPage STATE IL
ELEVATION
GRADE 601.26 MSL
TOP OF CASING 603.91 MSL (M.P.)
SURVEY BY Patrick Engineering, Inc.
INSTALLATION DATE(S) 3/4/91
DRILLING METHOD HSA/Rotory
DRILLING CONTRACTOR Fox Drilling, Inc.
DRILLING FLUID DuPage County Municipal Water Supply
DEVELOPMENT TECHNIQUE(S) AND DATE(S)
Centrifugal Pump
Bailing
FLUID LOSS DURING DRILLING 1865 GAL
WATER REMOVED DURING DEVELOPMENT 1920 GAL
STATIC DEPTH TO WATER
FEET BELOW M.P. 11.37 DATE 5 / 9 / 91
PUMPING DURATION HOURS
YIELD gpm DATE / /
REMARKS

PREPARED BY Dirk Kaiser, ERM

PROJECT	0252
REPORT	TM3
DRAWN	CMW
DECKED	
DATE	8/20/91
APPROVED	
CLIENT NAME	KMZ - LENZ OIL

ERM

WELL CONSTRUCTION LOG



NOT DRAWN TO SCALE

ERM JOB # 0252

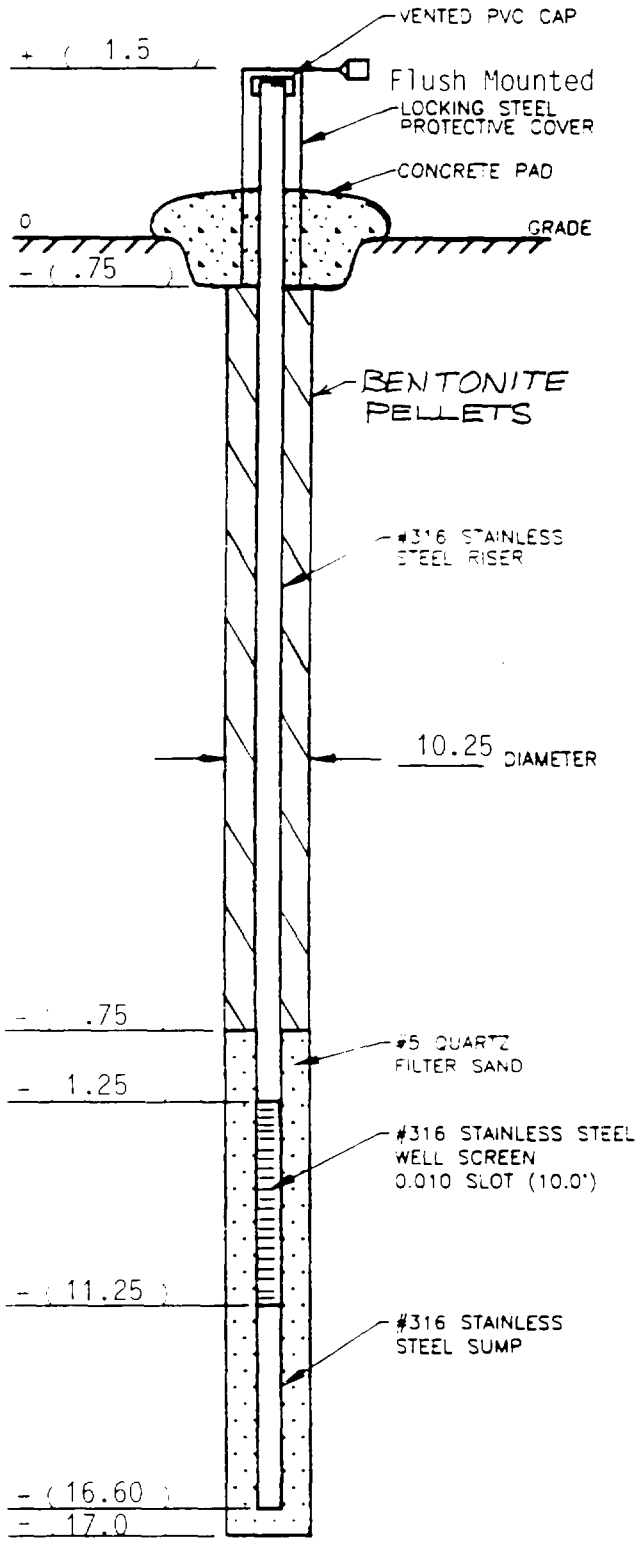
PROJECT Lenz Oil WELL MW06D
TOWN/CITY Lemont
COUNTY DuPage STATE IL
ELEVATION
GRADE 593.37 MSL
TOP OF CASING 595.95 MSL (M.P.)
SURVEY BY Patrick Engineering, Inc.
INSTALLATION DATE(S) 3/19/91
DRILLING METHOD HSA/Rotory
DRILLING CONTRACTOR Fox Drilling, Inc.
DRILLING FLUID DuPage County Municipal Water Supply
DEVELOPMENT TECHNIQUE(S) AND DATE(S)
Centrifugal Pump
Bailing
FLUID LOSS DURING DRILLING 800 GAL
WATER REMOVED DURING DEVELOPMENT 825 GAL
STATIC DEPTH TO WATER
FEET BELOW M.P. 4.26 DATE 5 / 9 / 91
PUMPING DURATION HOURS
YIELD gpm DATE / /
REMARKS

PREPARED BY Dirk Kaiser, ERM

PROJECT:	0252
REVISED:	TMJ
DRAWN:	CMM
CHECKED:	
DATE:	8/20/91
APPROVED:	
CLIENT NAME:	KMZ - LENZ OIL

ERM

WELL CONSTRUCTION LOG



NOT DRAWN TO SCALE

ERM JOB # 0252

PROJECT Lenz Oil WELL MW06S
TOWN/CITY Lemont
COUNTY DuPage STATE IL
ELEVATION
GRADE 593.60 MSL
TOP OF CASING 594.04 MSL (M.P.
SURVEY BY Patrick Engineering, Inc.
INSTALLATION DATE(S) 3/20/91
DRILLING METHOD HSA
DRILLING CONTRACTOR Fox Drilling, Inc.
DRILLING FLUID DuPage County
Municipal Water Supply
DEVELOPMENT TECHNIQUE(S) AND DATE(S)
Centrifugal Pump/Bailing

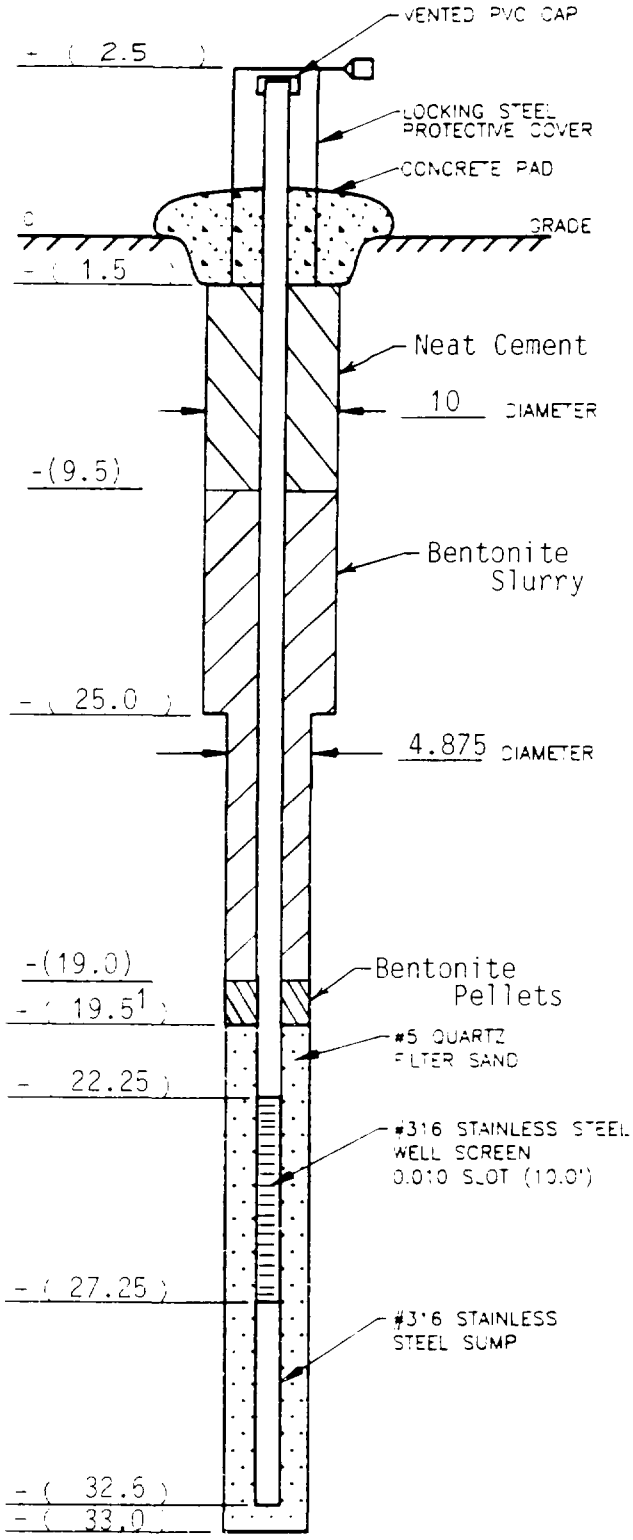
FLUID LOSS DURING DRILLING 150 GAL
WATER REMOVED DURING DEVELOPMENT
180 GAL
STATIC DEPTH TO WATER
FEET BELOW M.P. 1.63 DATE 5 / 9 / 91
PUMPING DURATION _____ HOURS
YIELD _____ gpm DATE _____
REMARKS _____

PREPARED BY Dirk Kaiser, ERM

ERM

PROJECT: 0252 | REPORT: TM3 | CHECKED: CMM | DATE: 8/20/91 | APPROVED: | CLIENT NAME: KMZ - LENZ OIL

WELL CONSTRUCTION LOG



NOT DRAWN TO SCALE

ERM JOB # 0252

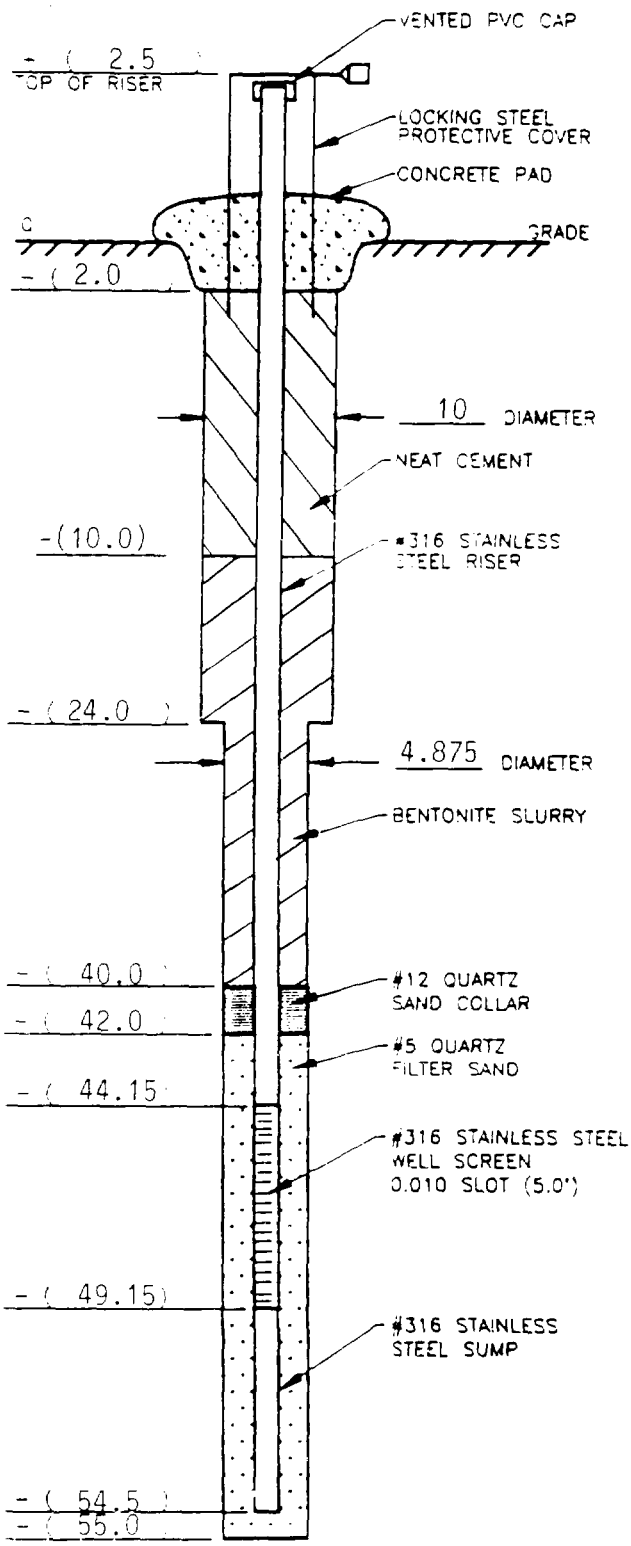
PROJECT Lenz Oil WEL MW07S
TOWN/CITY Lemont
COUNTY DuPage STATE IL
ELEVATION
GRADE 605.59 MSL
TOP OF CASING 608.26 MSL (M.P.)
SURVEY BY Patrick Engineering, Inc.
INSTALLATION DATE(S) 4/3/91
DRILLING METHOD HSA/Rotory
DRILLING CONTRACTOR Fox Drilling, Inc.
DRILLING FLUID DuPage County Municipal Water Supply
DEVELOPMENT TECHNIQUE(S) AND DATE(S)
Centrifugal Pump
Bailing
FLUID LOSS DURING DRILLING 50 GAL
WATER REMOVED DURING DEVELOPMENT
Hand Bailed GAL
STATIC DEPTH TO WATER
FEET BELOW M.P. 16.31 DATE 5 / 9 / 91
PUMPING DURATION HOURS
YIELD gpm DATE / /
REMARKS

PREPARED BY Dirk Kaiser, ERM

PROJECT:	0252
REPORT:	TM3
DRAWN	CMM
CHECKED	
DATE	8/20/91
APPROVED	
CLIENT NAME	KMZ - LENZ OIL

ERM

WELL CONSTRUCTION LOG



NOT DRAWN TO SCALE

ERM JOB # 0252

PROJECT Lenz Oil WELL MW07D
TOWN/CITY Lemont
COUNTY DuPage STATE IL
ELEVATION
GRADE 605.41 MSL
TOP OF CASING 607.98 MSL (M.P.)
SURVEY BY Patrick Engineering, Inc.
INSTALLATION DATE(S) 4/1/91
DRILLING METHOD HSA/Rotory
DRILLING CONTRACTOR Fox Drilling, Inc.
DRILLING FLUID DuPage County Municipal Water Supply
DEVEOLPMENT TECHNIQUE(S) AND DATE(S)
Centrifugal Pump
Bailing

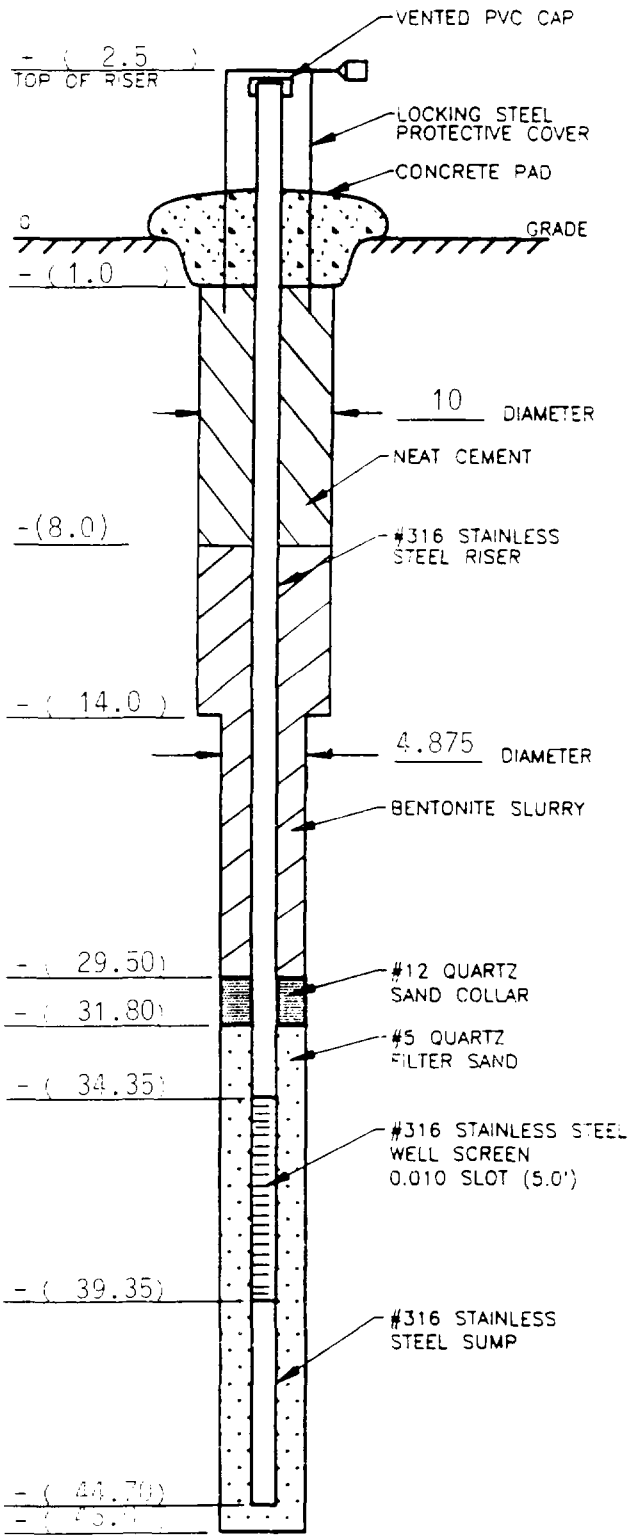
FLUID LOSS DURING DRILLING 549 GAL
WATER REMOVED DURING DEVELOPMENT 650 GAL
STATIC DEPTH TO WATER
FEET BELOW M.P. 15.80 DATE 5/ 9/ 91
PUMPING DURATION HOURS
YIELD gpm DATE / /
REMARKS

PREPARED BY Dirk Kaiser, ERM

PROJECT	0252
REPORT	TW3
DRAWN	CMM
CHECKED	
DATE	6/20/91
APPROVED	
CLIENT MAG	KMZ - LENZ OIL

ERM

WELL CONSTRUCTION LOG



NOT DRAWN TO SCALE

ERM JOB # 0252

PROJECT Lenz Oil WELL G106DR
TOWN/CITY Lemont
COUNTY DuPage STATE IL
ELEVATION
GRADE 601.11 MSL
TOP OF CASING 603.28 MSL (M.P.)
SURVEY BY Patrick Engineering, Inc.
INSTALLATION DATE(S) 3/25-3/26 1991
DRILLING METHOD HSA/Rotory
DRILLING CONTRACTOR Fox Drilling, Inc.
DRILLING FLUID DuPage County Municipal Water Supply
DEVEOLPMENT TECHNIQUE(S) AND DATE(S)
Centrifugal Pump
Bailing
FLUID LOSS DURING DRILLING 1022 GAL
WATER REMOVED DURING DEVELOPMENT 1030 GAL
STATIC DEPTH TO WATER
FEET BELOW M.P. 10.86 DATE 5 / 9 / 91
PUMPING DURATION HOURS
YIELD gpm DATE / /
REMARKS

PREPARED BY Dirk Kaiser, ERM

PROJECT	0252
REPORT	TM3
DRAWN	CMM
CHECKED	
DATE	8/20/91
APPROVED	
CLIENT NAME	KMZ - LENZ OIL

ERM

APPENDIX C

GEOTECHNICAL TESTING RESULTS

APPENDIX C

GEOTECHNICAL TESTING RESULTS

Geotechnical soil samples were collected from the screened zones of monitoring wells MW-01S, MW-02S, MW-04S, and MW-05S and were sent to ATEC and Associates, Inc. (Indianapolis, Indiana) for laboratory testing. A duplicate soil sample was collected from monitoring well MW-04S. Table 3-1 summarizes the results of the geotechnical analysis and the collection interval. The laboratory report containing the testing results is presented in this Appendix.

ATEC and Associates, Inc. tested the soil samples for grain size, porosity, and total organic carbon content. The grain-size distribution curves for each of the soil samples are provided in the laboratory report. The results of the geotechnical tests indicate that the porosity of the soil samples varies from 19.1 to 57%. These results also show that the total organic carbon content of the soil sample ranges from 1,608 ppm to 15,000 ppm.

The geotechnical tests provided approximate values for the effective porosity of the unconsolidated aquifer materials that were used to calculate the average linear ground water velocity in the unconsolidated deposits. In addition, the total organic carbon content was utilized to estimate the retardation factor for various adsorbing site specific compound which provides values for the plume velocities of different compounds.

ATEC Associates, Inc.
5150 East 65th Street
Indianapolis, Indiana 46220-4871
[317] 849-4990, FAX # [317] 849-4278

RECEIVED
JUN 17 1991
ERM-NORTH CENTRAL, INC.

June 12, 1991

ERM North Central
102 Wilmot, Suite 300
Deerfield, IL 60015

Attention: Mr. Dave Edwards

Re: Lenz Oil
ATEC Project No. 21-02463

Gentlemen:

Enclosed are the laboratory results of the tests of the materials shown below.

Number	Test	Material
5	Grain-size Analysis	Soil Samples
4	Porosity (Moisture Content, Density, & Specific Gravity)	Soil Samples
4	TOC	Soil Samples

We appreciate the opportunity to be of service to you on this project. If you have any questions, please feel free to contact our office.

Very truly yours,
ATEC Associates, Inc.

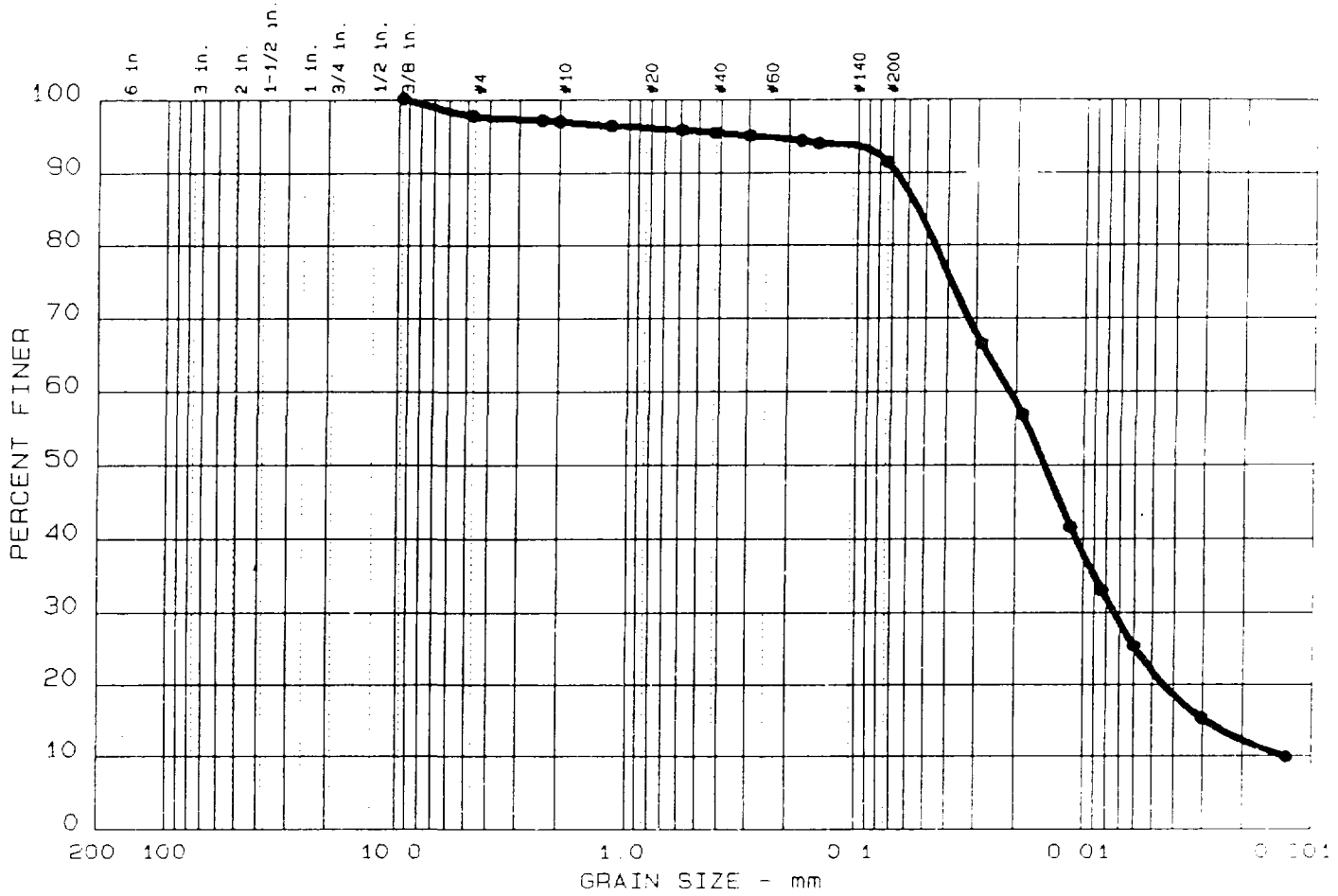
Gordon L. Pickett

Gordon L. Pickett
Laboratory Manager

James T. Sherer, P.E.
Assistant Vice President

copies: (2) Client

GRAIN SIZE DISTRIBUTION TEST REPORT



	%+75mm	% GRAVEL	% SAND	% SILT	% CLAY
●	0.0	2.3	6.4	69.6	21.7

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●					0.01	0.007	0.0029	0.0013	1.97	16.1

MATERIAL DESCRIPTION	USCS	AASHTO
●		

Project No.: 21-02463

Project: Lenz Oil / ERM Project No. 0252JI

● Location: LC MW 01S (3-11-91)

Date: 5-13-91

Remarks:

Moisture Content 16.4%

Dry Density (pcf): 116.1

Porosity 0.314

GRAIN SIZE DISTRIBUTION TEST REPORT

ATEC Associates, Inc.

Figure No.

GRAIN SIZE DISTRIBUTION TEST DATA

Test No.: 14

Date: 6-12-91
Project No.: 21-02463
Project: Lenz Oil / ERM Project No. 0252JI

Sample Data

Location of Sample: LO MW 01S (3-11-91)
Sample Description:
USCS Class: Liquid limit:
AASHTO Class: Plasticity index:

Notes

Remarks: Moisture Content: 16.4% Dry Density (pcf): 116.1
Porosity: 0.314
Fig. No.:

Mechanical Analysis Data

	Initial
Dry sample and tare=	243.82
Tare =	2.17
Dry sample weight =	241.65

Sample split on number 10 sieve
Split sample data:
mple and tare = 173.28 Tare = 123.4 Sample weight = 49.88
mulative weight retained tare= 123.4
Tare for cumulative weight retained= 2.17

Sieve	Cumul. Wt. retained	Percent finer
0.375 inches	2.17	100.0
# 4	7.76	97.7
# 8	9.21	97.1
# 10	9.63	96.9
16	123.70	96.3
# 30	124.03	95.7
# 40	124.21	95.3
# 50	124.39	95.0
# 80	124.76	94.3
# 100	124.96	93.9
# 200	126.29	91.3

Hydrometer Analysis Data

Separation sieve is number 10
Percent -# 10 based on complete sample= 96.9
Weight of hydrometer sample: 50.03
Hygroscopic moisture correction:
Moist weight & tare = 35.00

Dry weight & tare = 34.92
Tare = 11.31
Hygroscopic moisture= 0.3 %
Calculated biased weight= 51.45
T e of composite correction values:
Temp, deg C: 20.0 27.0
Comp. corr: - 6.5 - 4.5
Meniscus correction only= 0
Specific gravity of solids= 2.71
Specific gravity correction factor= 0.987
Hydrometer type: 152H Effective depth L= 16.294964 - 0.164 x Rm

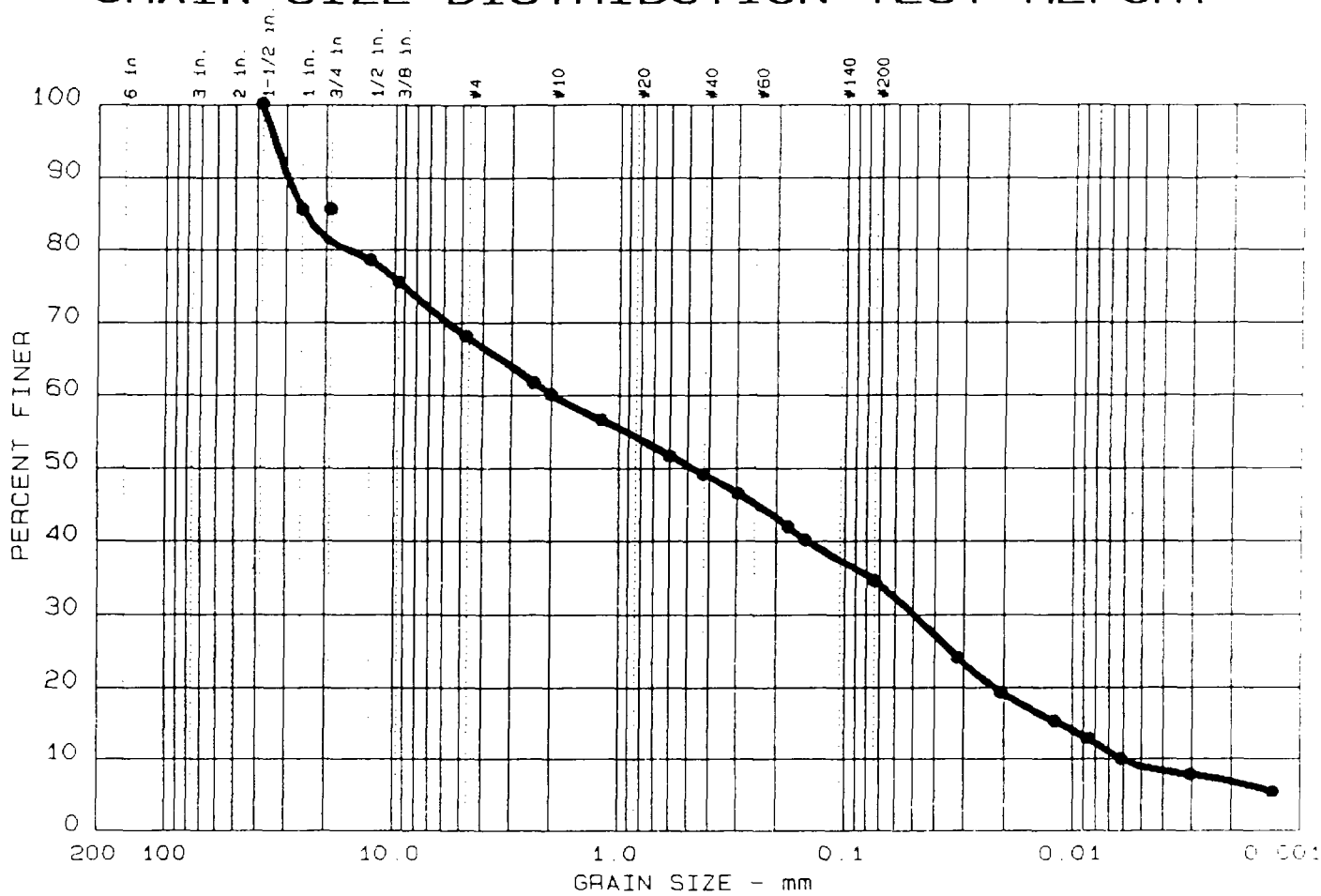
Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
2.0	24.0	40.0	34.6	0.0128	40.0	9.7	0.0282	66.4
5.0	24.0	35.0	29.6	0.0128	35.0	10.6	0.0186	56.9
15.0	24.0	27.0	21.6	0.0128	27.0	11.9	0.0114	41.5
30.0	24.0	22.5	17.1	0.0128	22.5	12.6	0.0083	32.9
60.0	24.0	18.5	13.1	0.0128	18.5	13.3	0.0060	25.2
250.0	25.0	13.0	7.9	0.0126	13.0	14.2	0.0030	15.2
1440.0	24.0	10.5	5.1	0.0128	10.5	14.6	0.0013	9.9

Fractional Components

% + 3 in. = 0.0 % GRAVEL = 2.3 % SAND = 6.4
% SILT = 69.6 % CLAY = 21.7

D85= 0.05 D60= 0.021 D50= 0.015
D30= 0.0074 D15= 0.00294 D10= 0.00131
Cc = 1.9679 Cu = 16.0694

GRAIN SIZE DISTRIBUTION TEST REPORT



	%+75mm	% GRAVEL	% SAND	% SILT	% CLAY
●	0.0	31.9	33.6	25.6	8.9

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			24.77	1.97	0.47	0.049	0.0116	0.0061	0.20	323.5

	MATERIAL DESCRIPTION	USCS	AASHTO
●			

Project No.: 21-02463
Project: Lenz Oil / ERM Project No. 0252JI
● Location: LC MW 02S

Date: 6-12-91

Remarks:
Moisture Content 10.4%
This sample was not suitable for density, sp. grav, & porosity

GRAIN SIZE DISTRIBUTION TEST REPORT

ATEC Associates, Inc.

Figure No.

GRAIN SIZE DISTRIBUTION TEST DATA Test No.: 11

Date: 6-12-91
P ect No.: 21-02463
P ject: Lenz Oil / ERM Project No. 0252JI

Sample Data

Location of Sample: LO MW 02S
Sample Description:
USCS Class: Liquid limit:
AASHTO Class: Plasticity index:

Notes

Remarks: Moisture Content: 10.4% This sample was not suitable for density, sp. grav, & porosity.
Fig. No.:

Mechanical Analysis Data

	Initial
Dry sample and tare=	687.60
Tare =	106.70
Dry sample weight =	580.90

Sample split on number 10 sieve
Split sample data:
mple and tare = 157.53 Tare = 107.63 Sample weight = 49.9
mulative weight retained tare= 107.63
Tare for cumulative weight retained= 106.7

Sieve		Cumul. Wt. retained	Percent finer
1.5	inches	106.70	100.0
1	inches	190.40	85.6
0.75	inches	190.40	85.6
0.5	inches	230.80	78.6
0.375	inches	248.70	75.6
# 4		292.00	68.1
# 8		328.80	61.8
# 10		338.60	60.1
# 16		110.54	56.6
# 30		114.67	51.6
# 40		116.72	49.1
# 50		118.92	46.5
# 80		122.77	41.9
# 100		124.23	40.1
# 200		128.87	34.5

Hydrometer Analysis Data

Separation sieve is number 10
P ent -# 10 based on complete sample= 60.1
Weight of hydrometer sample: 50
Hygroscopic moisture correction:
Moist weight & tare = 34.89
Dry weight & tare = 34.84
Tare = 11.80
Hygroscopic moisture= 0.2 %
Calculated biased weight= 83.04
Table of composite correction values:
Temp, deg C: 20.0 27.0
Comp. corr: - 6.5 - 4.5
Meniscus correction only= 0
Specific gravity of solids= 2.7
Specific gravity correction factor= 0.989
Hydrometer type: 152H Effective depth L= 16.294964 - 0.164 x Rm

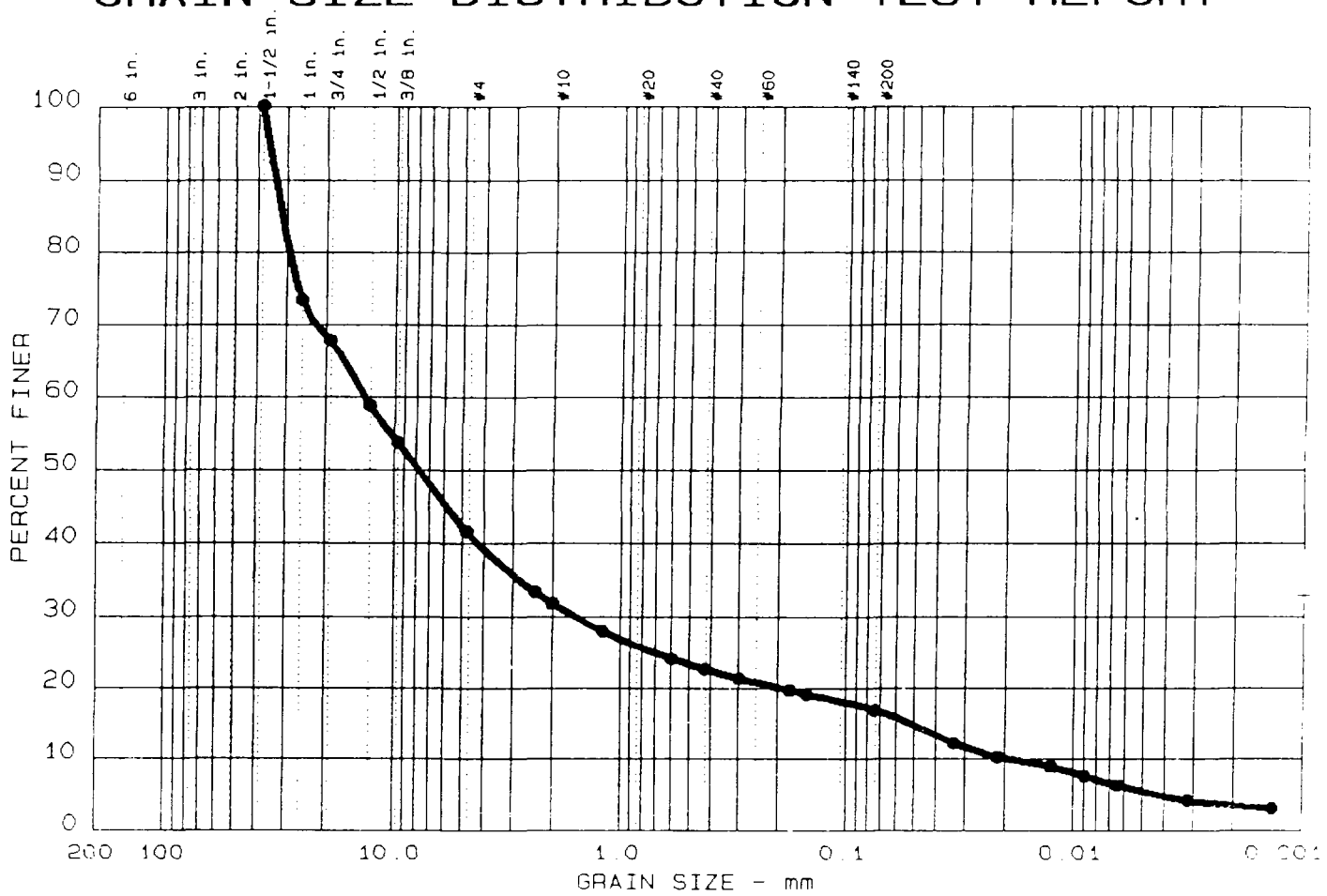
Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
2.0	24.0	25.5	20.1	0.0128	25.5	12.1	0.0316	24.0
5.0	24.0	21.5	16.1	0.0128	21.5	12.8	0.0205	19.2
15.0	24.5	18.0	12.8	0.0127	18.0	13.3	0.0120	15.2
30.0	24.5	16.0	10.8	0.0127	16.0	13.7	0.0086	12.8
60.0	25.0	13.5	8.4	0.0127	13.5	14.1	0.0061	10.0
250.0	25.5	11.5	6.6	0.0126	11.5	14.4	0.0030	7.8
1440.0	22.0	10.5	4.6	0.0131	10.5	14.6	0.0013	5.4

Fractional Components

% + 3 in. = 0.0 % GRAVEL = 31.9 % SAND = 33.6
% SILT = 25.6 % CLAY = 8.9

D85= 24.77 D60= 1.968 D50= 0.467
D30= 0.0494 D15= 0.01159 D10= 0.00608
Cc = 0.2042 Cu = 323.5937

GRAIN SIZE DISTRIBUTION TEST REPORT



	%+75mm	% GRAVEL	% SAND	% SILT	% CLAY
●	0.0	58.5	24.8	11.3	5.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			31.26	13.34	7.67	1.585	0.0519	0.0191	9.89	699.5

	MATERIAL DESCRIPTION	USCS	AASHTO
●			

Project No.: 21-02463

Project: Lenz Oil / ERM Project No. 02E2JI

● Location: LO MW 04S

Date: 6-18-91

Remarks:

Moisture Content: 51.1%

Dry Density (pcf): 68.7

Porosity: 0.570

GRAIN SIZE DISTRIBUTION TEST REPORT

ATEC Associates, Inc.

Figure No.

GRAIN SIZE DISTRIBUTION TEST DATA Test No.: 13

Date: 6-12-91
P ect No.: 21-02463
Project: Lenz Oil / ERM Project No. 0252JI

Sample Data

Location of Sample: LO MW 04S
Sample Description:
USCS Class: Liquid limit:
AASHTO Class: Plasticity index:

Notes

Remarks: Moisture Content: 51.1% Dry Density (pcf): 68.7
Porosity: 0.570
Fig. No.:

Mechanical Analysis Data

	Initial
Dry sample and tare=	714.90
Tare =	110.40
Dry sample weight =	604.50

Sample split on number 10 sieve
Split sample data:
mple and tare = 172.57 Tare = 122.97 Sample weight = 49.6
umulative weight retained tare= 122.97
Tare for cumulative weight retained= 110.4

Sieve	Cumul. Wt. retained	Percent finer
1.5 inches	110.40	100.0
1 inches	271.30	73.4
0.75 inches	305.30	67.8
5 inches	359.80	58.7
.375 inches	390.60	53.6
# 4	463.80	41.5
# 8	513.60	33.3
# 10	523.00	31.7
# 16	129.02	27.9
# 30	135.10	24.0
# 40	137.39	22.5
# 50	139.46	21.2
# 80	141.97	19.6
# 100	142.88	19.0
# 200	146.36	16.8

Hydrometer Analysis Data

Separation sieve is number 10
P ent -# 10 based on complete sample= 31.7
Weight of hydrometer sample: 50
Hygroscopic moisture correction:
Moist weight & tare = 29.53
Dry weight & tare = 29.38
Tare = 11.49
Hygroscopic moisture= 0.8 %
Calculated biased weight= 156.19
Table of composite correction values:
Temp, deg C: 20.0 27.0
Comp. corr: - 6.5 - 4.5
Meniscus correction only= 0
Specific gravity of solids= 2.57
Specific gravity correction factor= 1.019
Hydrometer type: 152H Effective depth L= 16.294964 - 0.164 x Rm

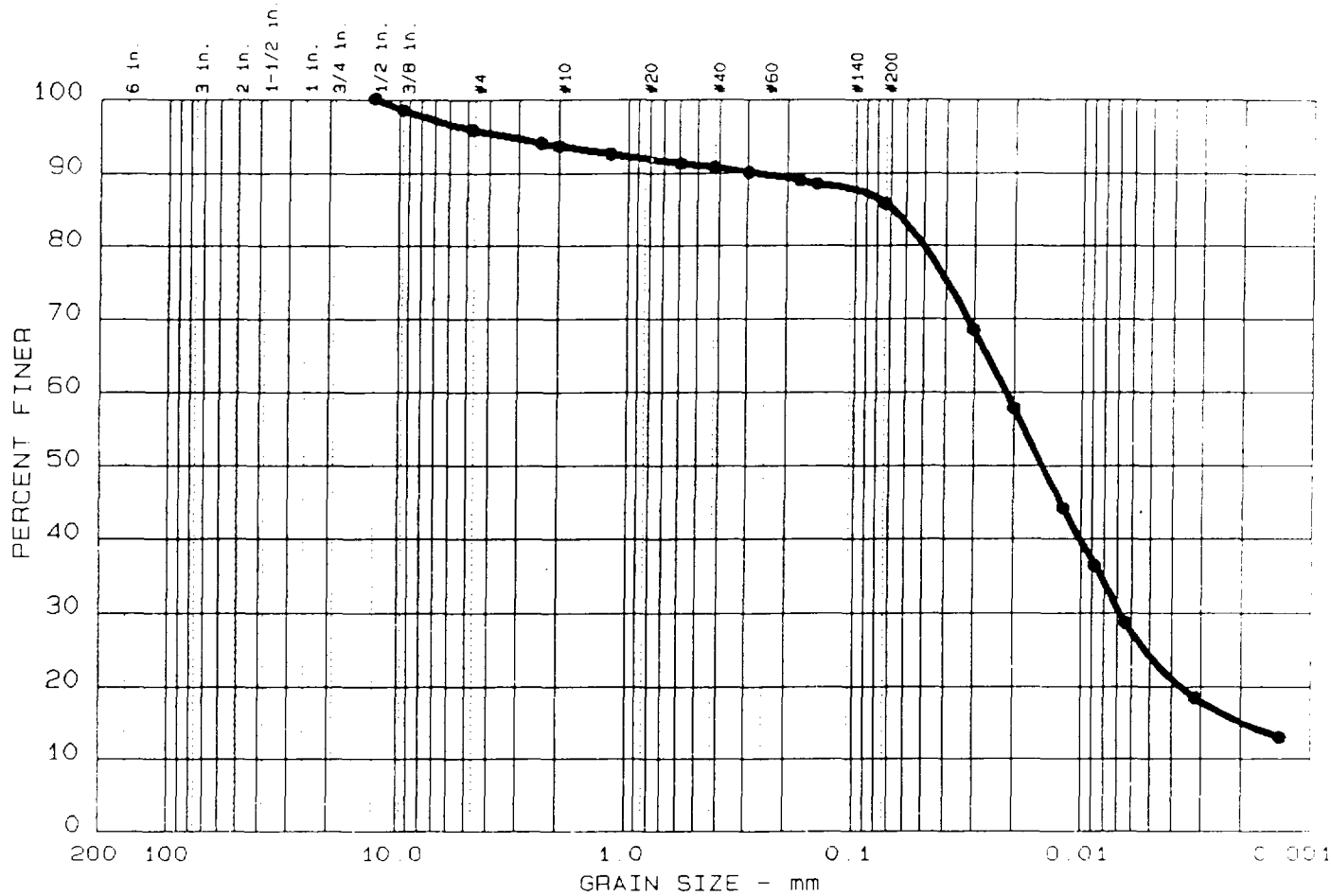
Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
2.0	24.0	24.0	18.6	0.0133	24.0	12.4	0.0332	12.2
5.0	24.0	21.0	15.6	0.0133	21.0	12.9	0.0214	10.2
15.0	24.0	19.0	13.6	0.0133	19.0	13.2	0.0125	8.9
30.0	24.0	17.0	11.6	0.0133	17.0	13.5	0.0090	7.6
60.0	24.0	15.0	9.6	0.0133	15.0	13.8	0.0064	6.3
250.0	25.0	11.5	6.4	0.0132	11.5	14.4	0.0032	4.2
1440.0	24.0	10.0	4.6	0.0133	10.0	14.7	0.0013	3.0

Fractional Components

% + 3 in. = 0.0 % GRAVEL = 58.5 % SAND = 24.8
% SILT = 11.3 % CLAY = 5.4

D85= 31.26 D60= 13.335 D50= 7.674
D30= 1.5849 D15= 0.05188 D10= 0.01905
Cc = 9.8855 Cu = 699.8420

GRAIN SIZE DISTRIBUTION TEST REPORT



	%+75mm	% GRAVEL	% SAND	% SILT	% CLAY
●	0.0	4.2	10.0	61.8	24.0

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●					0.01	0.007	0.0020			

	MATERIAL DESCRIPTION	USCS	AASHTO
●			

Project No.: 21-02463

Project: Lenz Oil / ERM Project No. 0252JI

● Location: LO MW 04S-D

Date: 8-12-91

Remarks:

Moisture Content 42.5%

Dry Density (pcf): 78.7

Porosity 0.537

GRAIN SIZE DISTRIBUTION TEST REPORT

ATEC Associates, Inc.

Figure No

GRAIN SIZE DISTRIBUTION TEST DATA

Test No.: 12

Date: 6-12-91
Project No.: 21-02463
Project: Lenz Oil / ERM Project No. 0252JI

Sample Data

Location of Sample: LO MW 04S-D
Sample Description:
USCS Class: Liquid limit:
AASHTO Class: Plasticity index:

Notes

Remarks: Moisture Content: 42.5% Dry Density (pcf): 72.5
Porosity: 0.537
Fig. No.:

Mechanical Analysis Data

	Initial
Dry sample and tare=	238.97
Tare =	2.07
Dry sample weight =	236.90

Sample split on number 10 sieve
Split sample data:
mple and tare = 172.7 Tare = 123.02 Sample weight = 49.68
umulative weight retained tare= 123.02
Tare for cumulative weight retained= 2.07

Sieve	Cumul. Wt. retained	Percent finer
0.5 inches	2.07	100.0
0.375 inches	5.80	98.4
# 4	12.10	95.8
# 8	16.38	94.0
# 10	17.37	93.5
# 16	123.55	92.5
# 30	124.25	91.2
# 40	124.53	90.7
# 50	124.89	90.0
# 80	125.46	88.9
# 100	125.72	88.5
# 200	127.14	85.8

Hydrometer Analysis Data

Separation sieve is number 10
P ent -# 10 based on complete sample= 93.5
Weight of hydrometer sample: 50.03
Hygroscopic moisture correction:
Moist weight & tare = 31.24
Dry weight & tare = 31.11
Tare = 11.64
Hygroscopic moisture= 0.7 %
Calculated biased weight= 53.13
Table of composite correction values:
Temp, deg C: 20.0 27.0
Comp. corr: - 6.5 - 4.5
Meniscus correction only= 0
Specific gravity of solids= 2.51
Specific gravity correction factor= 1.035
Hydrometer type: 152H Effective depth L= 16.294964 - 0.164 x Rm

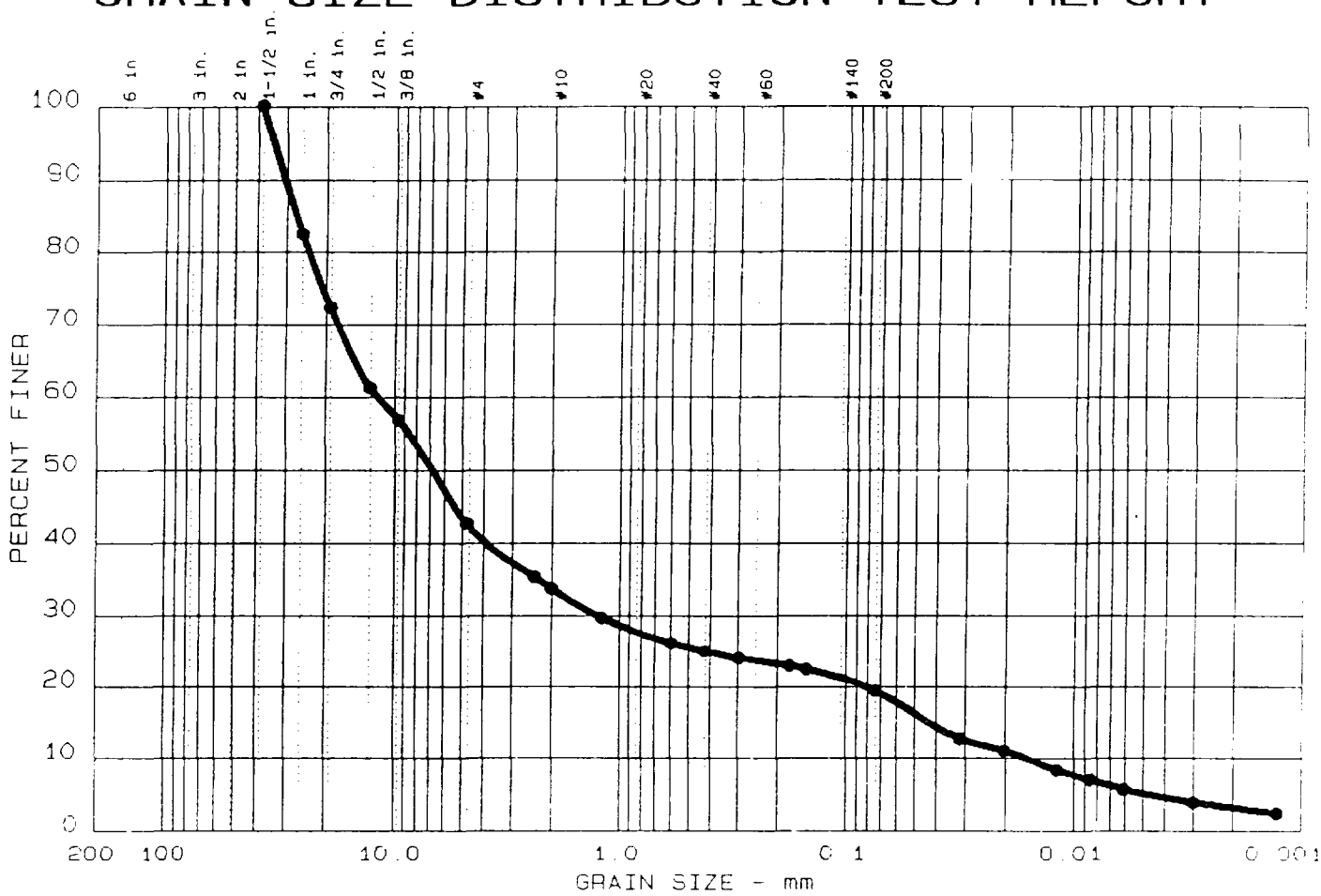
Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
2.0	24.0	40.5	35.1	0.0136	40.5	9.7	0.0299	68.5
5.0	24.0	35.0	29.6	0.0136	35.0	10.6	0.0198	57.7
15.0	24.0	28.0	22.6	0.0136	28.0	11.7	0.0120	44.1
30.0	24.0	24.0	18.6	0.0136	24.0	12.4	0.0087	36.3
60.0	24.0	20.0	14.6	0.0136	20.0	13.0	0.0063	28.5
250.0	25.0	14.5	9.4	0.0134	14.5	13.9	0.0032	18.4
1440.0	24.0	12.0	6.6	0.0136	12.0	14.3	0.0014	12.9

Fractional Components

% + 3 in. = 0.0 % GRAVEL = 4.2 % SAND = 10.0
% SILT = 61.8 % CLAY = 24.0

D85= 0.07 D60= 0.021 D50= 0.015
D30= 0.0068 D15= 0.00199

GRAIN SIZE DISTRIBUTION TEST REPORT



	%+75mm	% GRAVEL	% SAND	% SILT	% CLAY
●	0.0	57.4	23.3	14.2	5.1

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			27.10	11.69	6.73	1.253	0.0435	0.0158	8.51	741.3

	MATERIAL DESCRIPTION	USCS	AASHTO
●			

Project No.: 21-02463
Project: Lenz Oil / EAM Project No. 0252JI
● Location: LO MW 05S (3-5-91)

Date: 8-12-91

Remarks:
Moisture Content 8.4%
Dry Density (pcf): 139.1
Porosity 0.181

GRAIN SIZE DISTRIBUTION TEST REPORT

ATEC Associates, Inc.

Figure No

GRAIN SIZE DISTRIBUTION TEST DATA

Test No.: 15

Date: 6-12-91
Project No.: 21-02463
Project: Lenz Oil / ERM Project No. 0252JI

Sample Data

Location of Sample: LO MW 05S (3-5-91)
Sample Description:
USCS Class: Liquid limit:
AASHTO Class: Plasticity index:

Notes

Remarks: Moisture Content: 8.4% Dry Density (pcf): 139.0
Porosity: 0.191
Fig. No.:

Mechanical Analysis Data

	Initial
Dry sample and tare=	808.30
Tare =	105.50
Dry sample weight =	702.80

Sample split on number 10 sieve
Split sample data:
Sample and tare = 157.47 Tare = 107.84 Sample weight = 49.63
Cumulative weight retained tare= 107.84
Tare for cumulative weight retained= 105.5

Sieve	Cumul. Wt. retained	Percent finer
1.5 inches	105.50	100.0
1 inches	229.20	82.4
0.75 inches	299.80	72.4
0.5 inches	377.90	61.2
.375 inches	408.90	56.8
# 4	508.70	42.6
# 8	560.40	35.3
# 10	571.90	33.6
# 16	113.81	29.6
# 30	119.07	26.0
# 40	120.75	24.9
# 50	122.15	23.9
# 80	123.81	22.8
# 100	124.61	22.3
# 200	128.97	19.3

Hydrometer Analysis Data

Separation sieve is number 10
P ent -# 10 based on complete sample= 33.6
Weight of hydrometer sample: 50.03
Hygroscopic moisture correction:
Moist weight & tare = 35.37
Dry weight & tare = 35.18
Tare = 11.75
Hygroscopic moisture= 0.8 %
Calculated biased weight= 147.54
Table of composite correction values:
Temp, deg C: 20.0 27.0
Comp. corr: - 6.5 - 4.5
Meniscus correction only= 0
Specific gravity of solids= 2.76
Specific gravity correction factor= 0.976
Hydrometer type: 152H Effective depth L= 16.294964 - 0.164 x Rm

Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
2.0	24.0	24.5	19.1	0.0126	24.5	12.3	0.0312	12.7
5.0	24.0	22.0	16.6	0.0126	22.0	12.7	0.0201	11.0
15.0	24.0	18.0	12.6	0.0126	18.0	13.3	0.0119	8.4
30.0	24.0	16.0	10.6	0.0126	16.0	13.7	0.0085	7.0
60.0	24.0	14.0	8.6	0.0126	14.0	14.0	0.0061	5.7
250.0	25.0	11.0	5.9	0.0125	11.0	14.5	0.0030	3.9
1440.0	24.0	9.0	3.6	0.0126	9.0	14.8	0.0013	2.4

Fractional Components

% + 3 in. = 0.0 % GRAVEL = 57.4 % SAND = 23.3
% SILT = 14.2 % CLAY = 5.1

D85= 27.10 D60= 11.695 D50= 6.730
D30= 1.2531 D15= 0.04345 D10= 0.01578
Cc = 8.5114 Cu = 741.3102

REPORT OF TEST RESULTS

ATEC Project Number 21-02463

Date: April 8, 1991

Client: ERM North Central
102 Wilmot
Suite 300
Deerfield, IL 60015

Sample Identification: Total Organic Carbon Analysis
SW 846 Method 9060

Sample Matrix: Soil
Date Received: March 14, 1991
Date Analyzed: March 21, 1991
Analyst: KAW
Verified By: DSS
ATEC Lab Number: 9103184

Sample I.D.	TOC	Detection Limit
LOMW01S	15,000 ppm	100 ppm

Respectfully submitted,
ATEC Associates, Inc.

Environmental/Analytical Testing Division

Date: May 28, 1991

Client: ERM North Central
102 Wilmot Road, Suite 300
Deerfield, IL 60015

Client Project Number: 21-02463
Sample Matrix: Soil
Date Sample Received: April 26, 1991
Date Sample Analyzed: April 26, 1991
Analytical Equipment: Dohrmann DC-80

TOTAL ORGANIC CARBON
ANALYTICAL RESULTS

ATEC Lab No. 9104283

Sample I.D.	Concentration (mg/L or mg/kg)	Detection Limit (mg/L or mg/kg)
MW02S	1608	100

Analytical Method: SW 846 Method 9060

Analyst: K. Kline
Verified: R. Gehlbach
Date Verified: May 24, 1991

Respectfully submitted,

Environmental/Analytical Testing Division

REPORT OF TEST RESULTS

ATEC Project Number 21-02463

Date: April 11, 1991

Client: ERM North Central
102 Wilmot Road, Suite 300
Deerfield, IL 60015

Sample Identification: Lenz Oil
Total Organic Carbon Analysis
SW 846 Method 9060

Sample Matrix: Soil
Date Received: March 19, 1991
Date Analyzed: April 9, 1991
Analyst: LLS
Verified By: DSS
ATEC Lab Number: 9103228

==========

Sample I.D.	TOC	Detection Limit
LOMW04S	14,000 ppm	100 ppm
LOMW04S-D	15,000 ppm	100 ppm

Respectfully submitted,
ATEC Associates, Inc.

Environmental/Analytical Testing Division

REPORT OF TEST RESULTS

ATEC Project Number 21-02463

Date: April 1, 1991

Client: ERM-North Central
102 Wilmont Road
Suite 300
Deerfield, IL 60015

Sample Identification: Total Organic Carbon Analysis
SW 846 Method 9060

Sample Matrix: Soil
Date Received: March 11, 1991
Date Analyzed: March 21, 1991
Analyst: KAW
Verified By: DSS
ATEC Lab Number: 9103138

Sample I.D.	TOC	Detection Limit
LOMW05S	21,000 ppm	100 ppm

Respectfully submitted,
ATEC Associates, Inc.

Environmental/Analytical Testing Division

#10

PARTICLE SIZE

Date: 4/15/91 Project No.: 21-02463 (Graduate No.: 85)

Project: Lens Oil / ERM Project No. 0252JI

Location of Sample: LO MW 01S (3-11-91)

Sample Description:

USCS: AASHTO: LL: PI:

Remarks:

1(client): Moisture Content (%): 16.4 2: Dry Density (pcf): 116.1

3: sample no. Porosity: 0.314 4:

Fig. 13 Specification? Y / (N) (-200 Only? Y / (N)) Mechanical Analysis? (Y) / N Hydrometer Analysis? (Y) / N (Hydrometer No. 90-6725)

	Initial	After Wash
Dry Sample & Tare:	243.82	
5-1 Tare (+10):	2.17	

(Use Cummulative Basis for Calculations!)

	Split Sieve
Dry Sample & Tare:	173.28
63 Tare (-10):	123.40

Sieve	Cummul. Wt. Retained	% Finer
1 1/2 (1.5)	—	
1	—	
3/4 (.75)	—	
1/2 (.5)	—	
3/8 (.375)	— 2.17	
#4	7.76	
#8	9.21	
#10	9.63	
#16	123.70	
#30	124.03	
#40	124.21	
#50	124.39	
#80	124.76	
#100	124.96	
#200	125.29	

Hydrometer Sample Wt.: 50.03

Moist Wt. & Tare: 35.00

Dry Wt. & Tare: 34.92

172 Tare Wt.: 11.31

Hygroscopic Moisture %: .3

Correction @ 20: -6 Meniscus = 0

Specific Gravity: 2.71 (Hydrometer = 152H)

(Time)	Time min.	Temp C	Actual Reading	Diam. (mm)	% Finer
9:22	0	24	0		
9:24	2	24	40		
9:27	5	24	35		
9:37	15	24	27		
9:52	30	24	22.5		
10:22	60	24	18.5		
[illegible]	250	25	13		
[illegible]	1440	24	10.5		

Print test summary? (Y) / N

Date: 5/2/91 PARTICLE SIZE Project No.: 21-02463 (Graduate No.: 1)

Project: Long Oil / ERM Project No. 0252 JI

Location of Sample: LO MW 025

Sample Description:

USCS: AASHTO: LL: PI:

Remarks:
1(client): Moisture Content (%): 10.4 2: Dry Density (pcf): not suitable

3:sample no. Porosity: Not Suitable 4:

Fig. Specification? Y / (N) Mechanical Analysis? (Y) / N Hydrometer Analysis? (Y) / N
(-200 Only? Y / (N)) (Hydrometer No. 90-6725

	Initial	After Wash		Split Sieve
Dry Sample & Tare:	687.6		Dry Sample & Tare:	157.53
155 Tare (+10):	106.7		171 Tare (-10):	107.63

(Use Cummulative Basis for Calculations!)

Sieve	Cummul. Wt. Retained	% Finer
1 1/2 (1.5)	106.7	
1	190.4	
3/4 (.75)	—	
1/2 (.5)	230.8	
3/8 (.375)	248.7	
#4	292.0	
#8	328.8	
#10	338.6	
#16	110.54	
#30	114.67	
#40	116.72	
#50	118.92	
#80	122.77	
#100	124.23	
#200	128.27	

Hydrometer Sample Wt.: 50.00

Moist Wt. & Tare:	34.89
Dry Wt. & Tare:	34.84
193 Tare Wt.:	11.90
Hygroscopic Moisture %:	.2

Correction @ 20: -.60 Meniscus = 0
Specific Gravity: 2.7 (Hydrometer = 152H)

(Time)	Time min.	Temp C	Actual Reading	Diam. (mm)	% Finer
9.42	0	24	0		
9.44	2	24	35.5		
9.47	5	24	31.5		
9.57	15	24.5	18.0		
10.12	30	24.5	16.0		
[illegible]	60	25	13.5		
	250	25.5	11.5		
	1440	[illegible]	[illegible]		

Print test summary? Y / N

PARTICLE SIZE

Date: 4/15/91 Project No.: 21- 02463 (Graduate No.: 30)

Project: Lenz Oil / ERM Project No. 0252 II

Location of Sample: LO MW 045 (3-15-91)

Sample Description:

USCS: AASHTO: LL: PI:

Remarks:

1(client): Moisture Content (%): 51.1 2: Dry Density (pcf): 58.7

3:sample no. Porosity : 0.570 4:

Fig. 12 Specification? Y / (N) Mechanical Analysis? (Y) / N Hydrometer Analysis? (Y) / N

(-200 Only? Y / (N)) (Hydrometer No. 70-6725)

	Initial	After Wash		Split Sieve
Dry Sample & Tare:	714.9		Dry Sample & Tare:	172.57
Tare (+10):	110.4		18 Tare (-10):	122.97

(Use Cummulative Basis for Calculations!)

Sieve	Cummul. Wt. Retained	% Finer
1 1/2 (1.5)	110.4	
1	271.3	
3/4 (.75)	305.3	
1/2 (.5)	359.8	
3/8 (.375)	390.6	
#4	463.8	
#8	513.6	
#10	[illegible]	
#16	129.02	
#30	135.10	
#40	137.39	
#50	139.46	
#80	141.97	
#100	142.88	
#200	146.36	

Hydrometer Sample Wt.: 50.00

Moist Wt. & Tare:	29.53
Dry Wt. & Tare:	29.38
1/2 Tare Wt.:	11.79
Hygroscopic Moisture %:	.8

Correction @ 20:- 6 Meniscus = 0

Specific Gravity: 2.57 (Hydrometer = 152H)

(Time)	Time min.	Temp C	Actual Reading	Diam. (mm)	% Finer
9:26	0	24	0		
9:28	2	24	24		
9:31	5	24	21		
9:41	15	24	19		
9:56	30	24	17		
10:26	60	24	15		
[illegible]	250	25	11.5		
[illegible]	1440	24	10		

Print test summary? (Y) / N

#12

PARTICLE SIZE

Date: 4/15/91 Project No.: 21-02463 (Graduate No.: 1)

roject: Long Oil / ERM LO MW 045

Location of Sample: LO MW 045-D (3-15-91)

Sample Description:

USCS: AASHTO: LL: PI:

Remarks:

1(client): Moisture Content (%): 42.52: Dry Density (pcf): 72.5

3: sample no. Porosity: 0.537 4:

Fig. Specification? Y / (N) (-200 Only? Y / (N)) Mechanical Analysis? (Y) / N Hydrometer Analysis? (Y) / N (Hydrometer No. 70-6725)

	Initial	After Wash		Split Sieve
Dry Sample & Tare:	238.97		Dry Sample & Tare:	172.70
50 Tare (+10):	2.07		57 Tare (-10):	123.02

(Use Cummulative Basis for Calculations!)

Sieve	Cummul. Wt. Retained	% Finer
1 1/2 (1.5)	—	
1	—	
3/4 (.75)	—	
1/2 (.5)	— 2.07	
3/8 (.375)	5.80	
#4	12.10	
#8	16.38	
#10	17.37	
#16	123.55	
#30	124.25	
#40	124.53	
#50	124.89	
#80	125.46	
#100	125.72	
#200	127.14	

Hydrometer Sample Wt.: 50.03

Moist Wt. & Tare: 31.24

Dry Wt. & Tare: 31.11

218 Tare Wt.: 11.64

Hygroscopic Moisture %: .7

Correction @ 20: - 6 Meniscus = 0

Specific Gravity: 2.51 (Hydrometer = 152H)

(Time)	Time min.	Temp C	Actual Reading	Diam. (mm)	% Finer
9:24	0	24	[illegible]		
9:26	2	24	40.5		
9:29	5	24	35		
9:39	15	24	28		
9:54	30	24	24		
10:24	60	24	20		
[illegible]	250	25	14.5		
[illegible]	1440	[illegible]	12		

Print test summary? (Y) / N

#15

PARTICLE SIZE

Date: 4/15/91 Project No.: 21-02463 (Graduate No.: 40)

Project: [illegible] Project No. 025255

Location of Sample: LO MW 055 (3-5-91)

Sample Description:

USCS: AASHTO: LL: PI:

Remarks:

1(client): Moisture Content (%): 8.4 2: Dry Density (pcf): 139.0

3:sample no. Porosity : 0.191 4:

Fig. 11 Specification? Y / (N) Mechanical Analysis? (Y) / N Hydrometer Analysis? (Y) / N

(-200 Only? Y / (N)) (Hydrometer No. 90-6725)

	Initial	After Wash		Split Sieve
Dry Sample & Tare:	808.3		Dry Sample & Tare:	157.47
136 Tare (+10):	105.50		143 Tare (-10):	107.84

(Use Cummulative Basis for Calculations!)

Sieve	Cummul. Wt. Retained	% Finer
1 1/2 (1.5)	105.50	
1	229.2	
3/4 (.75)	299.8	
1/2 (.5)	377.9	
3/8 (.375)	408.9	
#4	508.7	
#8	560.4	
#10	571.9	
#16	113.81	
#30	119.07	
#40	120.75	
#50	122.15	
#80	123.81	
#100	124.61	
#200	128.97	

Hydrometer Sample Wt.: 50.03

Moist Wt. & Tare:	35.37
Dry Wt. & Tare:	35.18
306 Tare Wt.:	11.75
Hygroscopic Moisture %:	.8

Correction @ 20:- [illegible] Meniscus = 0

Specific Gravity: 2.76 (Hydrometer = 152H)

(Time)	Time min.	Temp C	Actual Reading	Diam. (mm)	% Finer
9:20	0	24	[illegible]		
9:22	2	24	24.5		
9:25	5	24	22		
9:35	15	24	18		
9:50	30	24	16		
10:20	60	24	14		
	250	25	11		
	1440	24	9		

Print test summary? (Y) / N

ATEC Associates, Inc.

LABORATORY THINWALL TUBE LOG

Client: ERM North Central
ATEC Project No.: 21-02463
Project: Long Oil
Client Job No.:
Location:
Date: 5-6-91

Boring No.: Sample No.: MW015 Depth: ft. Recovery: in.
Ground Surface Elevation: Datum: Logged By:

Scale, inches	Soil Description	Laboratory Tests / Remarks
0		length of tube 6.00"
		inside diam of tube 1.38"
		wt of tube & soil 566.7
		wt of empty tube = 248.26
6		
12		
18		
24		
30		

WATER CONTENT

Can No.	107
Weight - Wet (Gm.)	77.41
Weight - Dry (Gm.)	69.24
Weight Water (Gm.)	
Weight Can (Gm.)	19.46
Weight Solids (Gm.)	
Moisture (%)	16.4

UNIT WEIGHT

Diameter - Av. (in.)	1.38
Area - Av. (Sq. cm.)	
Height (in.)	6.00
Volume (cu. cm.)	[illegible]
Weight - Wet (Gm.)	3[illegible]
Weight - Dry (Gm.)	272.5
Density - Dry (Lbs./cu. ft.)	116.1

ATEC Associates, Inc.

LABORATORY THINWALL TUBE LOG

Client: ERM North Central
ATEC Project No.: 21-02463
Project: Leny Oil
Client Job No.:
Location:
Date: 4-30-91
Boring No.: MW025 Sample No.: Depth: ft. Recovery: in.
Ground Surface Elevation: Datum: Logged By:

Scale, inches	Soil Description	Laboratory Tests / Remarks
0	Brownsand + gravel.	unsuitable for density and specific gravity tests
6		
12		
18		
24		
30		

WATER CONTENT

Can No.	602
Weight - Wet (Gm.)	49.78
Weight - Dry (Gm.)	47.66
Weight Water (Gm.)	
Weight Can (Gm.)	20.84
Weight Solids (Gm.)	
Moisture (%)	10.4

UNIT WEIGHT

Diameter - Av. (in.)	
Area - Av. (Sq. cm.)	
Height (in.)	
Volume (cu. cm.)	
Weight - Wet (Gm.)	
Weight - Dry (Gm.)	
Density - Dry (Lbs./cu. ft.)	

ATEC Associates, Inc.

LABORATORY THINWALL TUBE LOG

Client: ERM North Central
ATEC Project No.: 21-02463
Project: Lenz Oil
Client Job No.:
Location:
Date: 5-6-91

Boring No.: Sample No.: Depth: ft. Recovery: in.

Ground Surface Elevation: MW-04/5 Datum: Logged By:

Scale, inches	Soil Description	Laboratory Tests/Remarks
0		length of tube = 5.98"
		inside diam of tube 1.38"
		wt of tube + soil 491.6 gm
		wt empty tube = 247.8
6		
12		
18		
24		
30		

WATER CONTENT

Can No.	602
Weight - Wet (Gm.)	63.41
Weight - Dry (Gm.)	49.04
Weight Water (Gm.)	
Weight Can (Gm.)	20.90
Weight Solids (Gm.)	
Moisture (%)	51.1

UNIT WEIGHT

Diameter - Av. (in.)	1.38
Area - Av. (Sq. cm.)	
Height (in.)	5.98
Volume (cu. cm.)	[illegible]
Weight - Wet (Gm.)	243.80
Weight - Dry (Gm.)	161.35
Density - Dry (Lbs./cu. ft.)	68.7

ATEC Associates, Inc.

LABORATORY THINWALL TUBE LOG

Client: ERM North Central

ATEC Project No.: 21-02463

Project: Lenz Oil

Client Job No.:

Location:

Date: 5-6-91

Boring No.: Sample No.: Depth: ft. Recovery: in.

Ground Surface Elevation: MW-045-D Datum: Logged By: TK

Scale, inches	Soil Description	Laboratory Tests / Remarks
0		length of tube 5.98"
		inside diam of tube 1.38
		wt tube + soil = 494.3 gm
6		wt empty tube = 251.72
12		
18		
24		
30		

WATER CONTENT

Can No.	529
Weight - Wet (Gm.)	74.49
Weight - Dry (Gm.)	59.75
Weight Water (Gm.)	
Weight Can (Gm.)	25.08
Weight Solids (Gm.)	
Moisture (%)	42.5

UNIT WEIGHT

Diameter - Av. (in.)	1.38
Area - Av. (Sq. cm.)	
Height (in.)	[illegible]
Volume (cu. cm.)	[illegible]
Weight - Wet (Gm.)	[illegible]
Weight - Dry (Gm.)	170.2
Density - Dry (Lbs./cu. ft.)	72.5

[illegible] .537

ATEC Associates, Inc.

LABORATORY THINWALL TUBE LOG

Client: ERM North Central
ATEC Project No.: 21-02463
Project: Lenz Oil
Client Job No.:
Location:
Date: 5-6-91

Boring No.: Sample No.: Depth: ft. Recovery: in.

Ground Surface Elevation: MW 055 Datum: Logged By:

Scale, inches	Soil Description	Laboratory Tests / Remarks
0		length of tube 6.00 inside diam of tube 1.38 wt of tube + soil 601.6 wt of empty tube 246.66
6		
12		
18		
24		
30		

WATER CONTENT

Can No.	528
Weight - Wet (Gm.)	121.36
Weight - Dry (Gm.)	115.96
Weight Water (Gm.)	
Weight Can (Gm.)	25.15
Weight Solids (Gm.)	
Moisture (%)	4.4

UNIT WEIGHT

Diameter - Av. (in.)	1.38
Area - Av. (Sq. cm.)	
Height (in.)	6.00
Volume (cu. cm.)	[illegible]
Weight - Wet (Gm.)	[illegible]
Weight - Dry (Gm.)	327.[illegible]
Density - Dry (Lbs./cu. ft.)	139.[illegible]

SPECIFIC GRAVITY
SOIL

PROJECT Lenz Oil NO. 21-[illegible]

CLIENT ERM N.C. TECHNICIAN T+T

SAMPLE

TEST (ASTM NO. & TITLE)

DATE 5-6-91

Sample no.	MW015
Pycnometer no.	151
Pycnometer wt.	178.53
Pycn+wter wt.	676.1
Pycn+water+ sample wt.	709.8
Water temp. (C)	[illegible]
Tare no.	140
Tare wt.	107.11
Dry sample+tare wt.	[illegible]
Dry sample wt.	[illegible]
Correction factor K	[illegible]

SPECFIC GRAVITY (20 deg.) 2.706[illegible]

SPECIFIC GRAVITY
SOIL

PROJECT [illegible] NO. [illegible]

CLIENT [illegible] TECHNICIAN

SAMPLE

TEST (ASTM NO. & TITLE)

DATE 5-6-91

Sample no.	MW045
Pycnometer no.	151
Pycnometer wt.	178.53
Pycn+wter wt.	676.9
Pycn+water+ sample wt.	701.3
Water temp. (C)	23
Tare no.	150
Tare wt.	107.59
Dry sample+tare wt.	[illegible]
Dry sample wt.	[illegible]
Correction factor K	[illegible]

SPECFIC GRAVITY (20 deg.) [illegible]

SPECIFIC GRAVITY
SOIL

PROJECT Lenz 016 NO. 21-02463

CLIENT [illegible] N.C. TECHNICIAN T&T

SAMPLE

TEST (ASTM NO. & TITLE)

DATE 5-6-91

Sample no.	MW 045-L
Pycnometer no.	151
Pycnometer wt.	178.53
Pycn+wter wt.	676.9
Pycn+water+ sample wt.	701.0
Water temp. (C)	23
Tare no.	144
Tare wt.	108.94
Dry sample+tare wt.	[illegible]
Dry sample wt.	40.[illegible]
Correction factor K	[illegible]

SPECFIC GRAVITY (20 deg.) [illegible]

SPECIFIC GRAVITY
SOIL

PROJECT Lenz oil NO. 21-02403

CLIENT EBM N.C. TECHNICIAN TT

SAMPLE

TEST (ASTM NO. & TITLE)

DATE 5-6-91

Sample no.	MW055
Pycnometer no.	151
Pycnometer wt.	178.53
Pycn+wter wt.	676.9
Pycn+water+ sample wt.	699.0
Water temp. (C)	23
Tare no.	153
Tare wt.	106.14
Dry sample+tare wt.	[illegible]
Dry sample wt.	[illegible]
Correction factor K	[illegible]

SPECFIC GRAVITY (20 deg.) [illegible]

ERM-North Central, inc.

Sample Chain of Custody

W.O.No.: 0252JI

Project Name: LENZ OIL RI/FS

Sampler: DIRK KAISER

ERM Sample Number	Date	Time	COMP	GRAB	Station Location	Number of Containers	6" BRASS TOTAL PORTION (TP)	1 LIT. PARTICULAR SIZE (PS)	4 OZ TOC				Remarks MATRIX
LO-MW05 S.	03/05/91	09:30		X	MONITORING WELL #5 SHALLOW	1	✓						SOIL
LO MW05 S	03/05/91	09:30		X	MONITORING Well #5 SHALLOW	1		✓					SOIL
LO MW05 S	03/05/91	09:30		X	MONITORING Well #5 SHALLOW	1			✓				SOIL

SAMPLES ICED TO 4°C
SAMPLES SHIPPED VIA
FED EX AIRBILL #8194625386
TO ATEC, INDIANAPOLIS

Sample Relinquished by:	Date	Time	Sample Received by:	Date	Time	Reason for Transfer
[signature]	3/5/91	1300	[signature]	3-6-91		

COPIES: W Yellow copie accompany sample shipment to laboratory. Yellow retained by laboratory. W by to be ied to ERM f . Pink copy retained by sampler. Gold copy extra copy as

ERM-North Central, inc.

Sample Chain of Custody

W.O.No.: 0252JI

Project Name: Lenz Oil

Sampler: Dirk Kaiser

ERM Sample Number	Date	Time	COMP	GRAB	Station Location	Number of Containers	1 or Partial Size	6" Brass Tot. Porosity	4 oz Total Volume Cond.				Remarks
MN055-5	3/11/91	0915		X	Monitoring Well 01 Shallow	3	1	1	1				Matrix Soil
													All samples kept to 4°C
													Shipped to Atec, Indianapolis
													Airbill # 8194625353

Sample Relinquished by:	Date	Time	Sample Received by:	Date	Time	Reason for Transfer
[signature]	3/11/91	11:20	Gordon C Pickett	3-12-91		

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ERM-North Central, inc.

Sample Chain of Custody

W.O.No.: 0225

Project Name:

Sampler:

ERM Sample Number	Date	Time	COMP	GRAB	Station Location	Number of Containers							Remarks
LC-MW [illegible]	3/15/91	1200		X	LC-MW[illegible]	3	1	1	1				
LC-MW [illegible]-D	3/15/91	1200		X	LC-MW[illegible]-D	3	1	1	1				
													All samples kept [illegible]
													4°C. Shipped via [illegible]
													Ex [illegible] Air [illegible]
													Airbill #: [illegible]

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[illegible]	3/16/91	15:00	[illegible]	3-19-91		

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Sample Chain of Custody

W.O.No.: [illegible]

Project Name: [illegible]

Sampler: [illegible]

ERM Sample Number	Date	Time	COMP	GRAB	Station Location	Number of Containers	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Remarks
[illegible]	[illegible]	[illegible]		X	[illegible]								[illegible]
													[illegible]
													[illegible]
													[illegible]
													SHIPMENT [illegible]
													[illegible]
													[illegible]

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[illegible]	[illegible]	[illegible]	[illegible]			

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6 ☐ DRY ICE _____ Lbs.
7 ☐ OTHER SPECIAL SERVICE
8 ☐
9 ☐ SATURDAY PICK-UP (Extra charge)
10 ☐
11 ☐
12 ☐ HOLIDAY DELIVERY (If offered) (Extra charge)

PACKAGES	WEIGHT In Pounds Only	YOUR DECLARED VALUE
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Total 1	Total 12	Total

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☐ Cash Received
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☐ Third Party ☐ Chg. To Del ☐ Chg. To Hold
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Date/Time Received FedEx Employee Number

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Date/Time

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4 ☐ DANGEROUS GOODS (Extra charge)
5 ☐
6 ☐ DRY ICE _____ Lbs.
7 ☐ OTHER SPECIAL SERVICE
8 ☐
9 ☐ SATURDAY PICK-UP (Extra charge)
10 ☐
11 ☐

PACKAGES	WEIGHT In Pounds Only	YOUR DECLARED VALUE
1		
Total 1	Total 13	Total

DIM SHIPMENT (Chargeable Weight) ☐ _____ lbs.

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☐ Third Party ☐ Chg. To Del ☐ Chg. To Hold
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City State Zip
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5
6 DRY ICE ____ Lbs.
7 OTHER SPECIAL SERVICE
8
9 SATURDAY PICK-UP (Extra charge)
10
11
12 HOLIDAY DELIVERY (If offered) (Extra charge)

PACKAGES	WEIGHT In Pounds Only	YOUR DECLARED VALUE
1	15	
Total	Total	Total
1	15	

DIM SHIPMENT (Chargeable Weight) [ ] ____ lbs.

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13 [ ] FEDEX BOX
14 [ ] FEDEX TUBE

Standard Overnight Service (Delivery by next business afternoon†)
51 [ ]
56 [ ] FEDEX LETTER *
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1 [ ] HOLD FOR PICK-UP (Fill in Box H)
2 [X] DELIVER WEEKDAY
3 DELIVER SATURDAY (Extra charge) (Not available to all locations) [ ]
4 DANGEROUS GOODS (Extra charge)
5
6 DRY ICE ____ Lbs.
7 OTHER SPECIAL SERVICE
8
9 SATURDAY PICK-UP (Extra charge)
10
11

PACKAGES	WEIGHT In Pounds Only	YOUR DECLARED VALUE
Total	Total	Total
1	7	

DIM SHIPMENT (Chargeable Weight) [ ] ____ lbs.

Received At: 1 [ ] Regular Stop 3 [X] Drop Box 4 [ ] B.S.C. 2 [ ] On-Call Stop 5 [ ] Station

Emp. No. Date
[ ] Cash Received
[ ] Return Shipment
[ ] Third Party [ ] Chg. To Del. [ ] Chg. To Hold
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APPENDIX D

HYDRAULIC CONDUCTIVITY TESTING RESULTS

Hydraulic conductivity values of the aquifer materials beneath the Lenz Oil site were determined by conducting rising and falling head hydraulic conductivity tests, as described in Section 2.2.3 of this Technical Memorandum. Conventional rising head slug testing was performed in all wells in which the well screens intersected the water table or for those wells in which the water table was within 4 feet of the screen top (e.g., MW-01S, MW-02S, MW-03S, MW-04S, G101M, G101D, G101L, G102L, MW-05S, MW-06S and MW-07S). Pressure testing was conducted in the monitoring wells in which the well screen was submerged at least 4 feet below the water level (e.g. MW-01D, MW-02D, MW-03D, MW-04D, MW-05D, MW-06D, MW-07D, G102D, G104D, and G106DR). Monitoring wells MW-03S, MW-05D, and MW-06D were retested to examine the precision of calculated permeability values; G104L was not tested because it could not be pressurized; and G106S was not tested because of the presence of free product in the well.

The hydraulic conductivity values calculated from this testing are summarized in Table D-1. Supporting documentation included in this appendix includes: (1) spreadsheets showing the raw test data, the slug test parameters, and the analytical procedure, and (2) graphs indicating the recovery rate of each well. The method and assumptions of the analysis procedure are summarized below.

The Bouwer and Rice (1976) method was used to analyze the hydraulic conductivity test data because of its applicability to both fully and partially penetrating wells. The main assumptions of this method are: (1) steady radial flow based on the Thiem equation (i.e., storage effects are negligible), (2) a homogeneous and isotropic zone of influence, and (3) a clean well screen.

The wells screened in the unconsolidated deposits satisfy these assumption reasonably well. Some heterogeneity is present in the screened interval of some of the wells because of interbeded

sand, silt, and clay. The computed hydraulic conductivity values for these heterogeneous screened intervals are, therefore, a weighted average of each of the contributing water bearing units. In other words, the hydraulic conductivity values are an average for the aquifer materials in the screened interval and not of any single sand or clay bed.

The calculated hydraulic conductivity values for the wells screened in the dolomite bedrock only partially satisfy the assumptions of the Bouwer and Rice (1976) method. Some wells are screened in highly fractured zones, which can be considered an equivalent porous medium. Other wells are screened in zones where there are few or single fractures which contradicts the assumption of flow through a porous medium. Since the extent to which a fractured zone can be considered an equivalent porous medium is difficult to infer, the calculated hydraulic conductivity values for the Silurian dolomite are relatively inaccurate and should not be compared with the more accurate values for the unconsolidated deposits. These tests are still useful in assessing the relative differences in hydraulic conductivity for each of the screened intervals in the dolomite.

The procedure for analyzing the slug test and pressure test data is summarized in the hydraulic conductivity test spreadsheets. The raw data consist of rising head test data vs. time. The net decrease in induced head vs. time is obtained by subtracting the final head value at the end of each test from each rising head test value. Data points for determining the line of best fit are subjectively chosen. To standardize this subjective choice of data points, ERM-North Central considered the first data point in each series of test data that showed a steady decrease in induced head as the beginning of the test (Pandit and Miner, 1986). The last data point for the least squares linear fit was generally taken at the point when 80% of the initial induced head had dissipated. This standardization minimizes the subjectivity of the analysis procedure. The close agreement of test values and retest values indicates good precision in the testing procedure and consistency in the analysis.

Since most of the monitoring wells were similarly constructed, the radius of the developed zone was assumed to be 0.25 feet, which was based on the monitoring well construction diagrams.

Because of differences in well construction, monitoring wells G101M, MW-01S, MW-01D, and MW-03S had slightly different values for the radius of the developed zone. The effective length of inflow was calculated as the sum of the thicknesses of all contributing water bearing units in the screened zone. The saturated thickness and the effective length and flow were determined for each well from the soil boring logs.

As shown in Table D-1, hydraulic conductivity values in the unconsolidated deposits range from 52.1 to 1200.3 gal/day/ft^2, with a geometric mean of 341 gal/day/ft^2. For the monitoring wells screened in the fractured dolomite, the hydraulic conductivity values ranged from 12.1 to 239.7 gal/day/ft^2, with a geometric mean of 85.1 gal/day/ft^2. The lower hydraulic conductivity values of the dolomite may be due to the inability of slug and pressure testing to influence a wide enough zone of interconnected fractures. Single hole packer testing at Argonne National Laboratory in 10 ft. vertical intervals by Nicholas and Shapiro (1986) yielded hydraulic conductivity values for the joint sets in the range 1292-6462 gal/day/ft^2. Interpretation of pump test data by Nicholas and Healy (1988) at Argonne National Laboratory showed that hydraulic conductivity values range from 250-400 gal/day/ft^2 in the Silurian dolomite assuming a saturated thickness of 175'. These tests suggest that the values determined by slug and air pressure testing are lower than the actual bedrock hydraulic conductivity. The calculated permeability value for monitoring well G102D is unreliable because of the slow decay of head at the beginning of the test. This violates the assumption of an instantaneous change in head at the beginning of the test.

The close agreement of permeability test values and retested values indicates good precision in permeability calculations, which demonstrates that the testing procedure is reliable and reproducible. Furthermore, this good precision also shows that the subjective choice of data points in the linear fit had a limited effect on the calculated values. The calculated radius of influence in the Bouwer and Rice method depends only on the well geometry; Since its value also depends on drawdown and the permeability of the surrounding materials, its calculated value in the spreadsheet is only approximate.

TABLE D-1

HYDRAULIC CONDUCTIVITY TESTS SUMMARY

WELL	TEST	HYDRAULIC CONDUCTIVITY gal/day-ft**2	cm/sec	
	Wells screened in unconsolidated deposits			
G101L	Slug	370.1	1.75E-02	
G106S	ND	NC	ND	(3)
MW01S	Slug	1200.3	5.66E-02	
MW02S	Slug	481.6	2.27E-02	
MW04S	Slug	487	2.30E-02	
MW05S	Slug	52.1	2.46E-03	
MW07S	Slug	314.8	1.48E-02	
MW07S	2' Air pressure drawdown	298.8	1.41E-02	
MW07S	5' Air pressure drawdown	261.2	1.23E-02	
	Geometric average:	341.2093	1.61E-02	
	Wells screened in dolomite bedrock			
G101M	Slug	213.6	1.01E-02	
G102L	Slug	16.9	7.97E-04	
G104L	ND	ND	ND	(2)
MW03S	Slug	135.8	6.41E-03	
MW03S	Slug (retest)	126.8	5.98E-03	
MW06S	Slug	239.7	1.13E-02	
G101D	Slug	169.3	7.99E-03	
G102D	Pressure	12.4	5.85E-04	(1)
G104D	Pressure	13.2	6.23E-04	
G106DR	Pressure	31.9	1.50E-03	
MW01D	Pressure	51.4	2.42E-03	
MW02D	Pressure	111.7	5.27E-03	
MW03D	Pressure	117	5.52E-03	
MW04D	Pressure	115.6	5.45E-03	
MW05D	Pressure	151.4	7.14E-03	
MW05D	Pressure (retest)	154.4	7.28E-03	
MW06D	Pressure	164.2	7.75E-03	
MW06D	Pressure (retest)	161.20	7.60E-03	
MW07D	Pressure	66.7	3.15E-03	
	Geometric average:	85.08901	4.01E-03	

(1): Assumption of sudden change of water level. Value not used in geometric average.

(2): Value not determined because well could not be pressurized

(3): Value not determined due to presence of free product

LENSE OIL

G101L RISING HEAD SLUG TEST DATA (5-24-91)

THIS SPREADSHEET CALCULATES HYDRAULIC CONDUCTIVITY BASED ON THE BOUWER AND RICE (1976) METHOD.

THE FOLLOWING STEPS ARE REQUIRED TO CALCULATE HYDRAULIC CONDUCTIVITY:
1.) IMPORT HERMIT DATA INTO COLUMNS UNDER RAW DATA
2.) DECIDE WHICH DATA IS APPROPRIATE, CHOOSE THE INITIAL INDUCED HEAD, TRANSLATE TIME VALUES
3.) DO THE REGRESSION CALCULATION FOR LEAST SQUARES FIT
4.) CHOOSE APPROPRIATE SLUG TEST PARAMETERS
5.) CHOOSE A VALUE FOR TIME t AND ITS CORRESPONDING Yt

Note: Values of time are translated to the first meaningful data point. The initial theoretical induced head (Yo) is chosen on the regression line at the translated time t=0. (see Pandit and and Miner, 1986. Ground Water. V. 24, No. 6, p. 743-749).

LINEAR REGRESSION DATA

Regression Output:

Constant	0.318088
Std Err of Y Est	0.01279
R Squared	0.999489
No. of Observations	12
Degrees of Freedom	10
X Coefficient(s)	-0.21988
Std Err of Coef.	0.001572

Regression line equation:

Ln Y = -0.21988 t+0.318088

Ln Y intercept: 0.318088

SLUG TEST PARAMETERS

Length of slug (Ls)=	3	ft.
Slug diameter (Ds)=	0.14	ft.
Initial theoret. induced head (Yo)=	1.374497	ft.
Actual initial induced head (Ho)=	1.4	ft.
Radius of developed zone (rw)=	0.25	ft.
Radius of well casing (rc)=	0.0833	ft.
Effective length of inflow (L)=	2	ft.
Saturated thickness of aquifer (D)=	175	ft.
L/rw=	8	
A=	1.7898	
Constants based on L/rw: B=	0.2457	
C=	1.0907	
Distance between top of aquifer and screen bottom (H)=	17.8	ft.
D > H Ln (R/rw)=	1.501764	
D = H Ln (R/rw)=	2.536649	
Note: Ln((D-H)/rw)=	6	

If Ln((D-H)/rw)>6, set Ln((D-H)/rw)=6

where:

D > H Ln(R/rw)=[1.1/Ln(H/rw)+(A+BLn[(D-H)/rw])/L/rw]**-1

D = H Ln(R/rw)=[1.1/Ln(H/rw)+C/(L/rw)]**-1

K=rc**2*Ln(R/rw)*Ln(Yo/Yt))/2Lt

Initial theoret. induced head (Yo):
Induced head (Yt) at time t:
Ordered pair on regression line (t,Yt):

Note: Choose Yt and t

Yo =	1.374497 ft.
Yt =	0.88466 ft.
t =	2.004 sec.

RADIUS OF INFLUENCE

R= 1.122401 ft.

CALCULATION OF HYDRAULIC CONDUCTIVITY

K= 0.01746 cm/sec

K= 370.1425 gal/day-ft**2

RAW DATA

Time (min.)	Transducer Head (ft.)	Translated Time (min.)	Induced head Value Y (ft)	Translated Time (sec.)	Data used in linear fit	Ln (Y)	Ln (Yt) (theor.)	Yt
0	-2.44	-0.0166	2.44	-0.996		0.891998	0.537089	1.711018
0.0033	-1.16	-0.0133	1.16	-0.798		0.14842	0.493552	1.638125
0.0066	-1.45	-0.01	1.45	-0.6		0.371564	0.450016	1.568337
0.0099	-1.47	-0.0067	1.47	-0.402		0.385262	0.40648	1.501523
0.0133	-1.45	-0.0033	1.45	-0.198		0.371564	0.361624	1.435659
0.0166	-1.4	0	1.4	0	*	0.336472	0.318088	1.374497
0.02	-1.33	0.0034	1.33	0.204	*	0.285179	0.273232	1.314205
0.0233	-1.26	0.0067	1.26	0.402	*	0.231112	0.229696	1.258217
0.0266	-1.2	0.01	1.2	0.6	*	0.182322	0.18616	1.204615
0.03	-1.15	0.0134	1.15	0.804	*	0.139762	0.141304	1.151775
0.0333	-1.1	0.0167	1.1	1.002	*	0.09531	0.097768	1.102707
0.05	-0.87	0.0334	0.87	2.004	*	-0.13926	-0.12255	0.88466
0.0666	-0.7	0.05	0.7	3	*	-0.35667	-0.34155	0.710666
0.0833	-0.57	0.0667	0.57	4.002	*	-0.56212	-0.56187	0.57014
0.1	-0.45	0.0834	0.45	5.004	*	-0.79851	-0.78219	0.457402
0.1166	-0.37	0.1	0.37	6	*	-0.99425	-1.00119	0.36744
0.1333	-0.3	0.1167	0.3	7.002	*	-1.20397	-1.22151	0.294784
0.15	-0.24	0.1334	0.24	8.004		-1.42712	-1.44183	0.236494
0.1666	-0.19	0.15	0.19	9		-1.66073	-1.66083	0.18998
0.1833	-0.16	0.1667	0.16	10.002		-1.83258	-1.88115	0.152414
0.2	-0.13	0.1834	0.13	11.004		-2.04022	-2.10147	0.122276
0.2166	-0.11	0.2	0.11	12		-2.20727	-2.32048	0.098227
0.2333	-0.09	0.2167	0.09	13.002		-2.40795	-2.5408	0.078804
0.25	-0.07	0.2334	0.07	14.004		-2.65926	-2.76112	0.063221
0.2666	-0.06	0.25	0.06	15		-2.81341	-2.98012	0.050787
0.2833	-0.05	0.2667	0.05	16.002		-2.99573	-3.20044	0.040744
0.3	-0.04	0.2834	0.04	17.004		-3.21888	-3.42076	0.032688
0.3166	-0.04	0.3	0.04	18		-3.21888	-3.63976	0.026259
0.3333	-0.03	0.3167	0.03	19.002		-3.50656	-3.86008	0.021066
0.4167	-0.01	0.4001	0.01	24.006		-4.60517	-4.96036	0.00701

LENSE OIL

G101M RISING HEAD SLUG TEST DATA (5-24-91)

THIS SPREADSHEET CALCULATES HYDRAULIC CONDUCTIVITY BASED ON THE BOUWER AND RICE (1976) METHOD.

THE FOLLOWING STEPS ARE REQUIRED TO CALCULATE HYDRAULIC CONDUCTIVITY:
1.) IMPORT HERMIT DATA INTO COLUMNS UNDER RAW DATA
2.) DECIDE WHICH DATA IS APPROPRIATE, CHOOSE THE INITIAL INDUCED HEAD, TRANSLATE TIME VALUES
3.) DO THE REGRESSION CALCULATION FOR LEAST SQUARES FIT
4.) CHOOSE APPROPRIATE SLUG TEST PARAMETERS
5.) CHOOSE A VALUE FOR TIME t AND ITS CORRESPONDING Yt

Note: Values of time are translated to the first meaningful data point. The initial theoretical induced head (Yo) is chosen on the regression line at the translated time t=0. (see Pandit and and Miner, 1986. Ground Water. V. 24, No. 6, p. 743-749).

LINEAR REGRESSION DATA

Regression Output:

Constant	0.329873
Std Err of Y Est	0.010055
R Squared	0.999591
No. of Observations	12
Degrees of Freedom	10
X Coefficient(s)	-0.26962
Std Err of Coef.	0.001724

Regression line equation:

Ln Y = -0.26962 t+0.329873

Ln Y intercept: 0.329873

SLUG TEST PARAMETERS

Length of slug (Ls)=	3	ft.
Slug diameter (Ds)=	0.14	ft.
Initial theoret. induced head (Yo)=	1.390791	ft.
Actual initial induced head (Ho)=	1.38	ft.
Radius of developed zone (rw)=	0.33	ft.
Radius of well casing (rc)=	0.0833	ft.
Effective length of inflow (L)=	5	ft.
Saturated thickness of aquifer (D)=	175	ft.
L/rw=	15.15152	
A=	2.0044	
Constants based on L/rw: B=	0.2904	
C=	1.4847	
Distance between top of aquifer and screen bottom (H)=	10.4	ft.
D > H Ln (R/rw)=	1.766516	
D = H Ln (R/rw)=	2.399304	
Note: Ln((D-H)/rw)=	6	

If Ln((D-H)/rw)>6, set Ln((D-H)/rw)=6

where:

D > H Ln(R/rw)=[1.1/Ln(H/rw)+(A+BLn[(D-H)/rw])/L/rw]**-1

D = H Ln(R/rw)=[1.1/Ln(H/rw)+C/(L/rw)]**-1

K=rc**2*Ln(R/rw)*Ln(Yo/Yt))/2Lt

Initial theoret. induced head (Yo):

Induce head (Yt) at time t:

Ordered pair on regression line (t,Yt):

Note: Choose Yt and t

Yo = 1.390791 ft.

Yt = 0.726997 ft.

t = 2.406 sec.

RADIUS OF INFLUENCE

R= 1.930643 ft.

CALCULATION OF HYDRAULIC CONDUCTIVITY

K= 0.010073 cm/sec

K= 213.5554 gal/day-ft**2

RAW DATA

Time (min.)	Transducer Head (ft.)	Translated Time (min.)	Induced head Value Y (ft)	Translated Time (sec.)	Data used in linear fit	Ln (Y)	Ln (Yt) (theor.)	Yt
0	-1.86	-0.0099	1.86	-0.594		0.620576	0.490027	1.632361
0.0033	-0.65	-0.0066	0.65	-0.396		-0.43078	0.436642	1.547503
0.0066	-1.58	-0.0033	1.58	-0.198		0.457425	0.383258	1.467056
0.0099	-1.38	0	1.38	0	*	0.322083	0.329873	1.390791
0.0133	-1.33	0.0034	1.33	0.204	*	0.285179	0.27487	1.31636
0.0166	-1.26	0.0067	1.26	0.402	*	0.231112	0.221486	1.247929
0.02	-1.19	0.0101	1.19	0.606	*	0.173953	0.166483	1.181144
0.0233	-1.12	0.0134	1.12	0.804	*	0.113329	0.113098	1.119742
0.0266	-1.06	0.0167	1.06	1.002	*	0.058269	0.059714	1.061533
0.03	-1	0.0201	1	1.206	*	0	0.004711	1.004722
0.0333	-0.95	0.0234	0.95	1.404	*	-0.05129	-0.04867	0.952492
0.05	-0.72	0.0401	0.72	2.406	*	-0.3285	-0.31883	0.726997
0.0666	-0.55	0.0567	0.55	3.402	*	-0.59784	-0.58737	0.555785
0.0833	-0.42	0.0734	0.42	4.404	*	-0.8675	-0.85753	0.424207
0.1	-0.33	0.0901	0.33	5.406	*	-1.10866	-1.12769	0.323779
0.1166	-0.24	0.1067	0.24	6.402		-1.42712	-1.39623	0.247527
0.1333	-0.19	0.1234	0.19	7.404		-1.66073	-1.66639	0.188927
0.15	-0.15	0.1401	0.15	8.406		-1.89712	-1.93655	0.1442
0.1666	-0.12	0.1567	0.12	9.402		-2.12026	-2.20509	0.11024
0.1833	-0.1	0.1734	0.1	10.404		-2.30259	-2.47525	0.084142
0.2	-0.08	0.1901	0.08	11.406		-2.52573	-2.74541	0.064222
0.2166	-0.06	0.2067	0.06	12.402		-2.81341	-3.01395	0.049097
0.2333	-0.05	0.2234	0.05	13.404		-2.99573	-3.28411	0.037474
0.25	-0.04	0.2401	0.04	14.406		-3.21888	-3.55427	0.028602
0.2666	-0.04	0.2567	0.04	15.402		-3.21888	-3.82282	0.021866
0.2833	-0.03	0.2734	0.03	16.404		-3.50656	-4.09297	0.01669
0.3	-0.03	0.2901	0.03	17.406		-3.50656	-4.36313	0.012738
0.3166	-0.02	0.3067	0.02	18.402		-3.91202	-4.63168	0.009738
0.3333	-0.02	0.3234	0.02	19.404		-3.91202	-4.90183	0.007433
0.4167	-0.01	0.4068	0.01	24.408		-4.60517	-6.25101	0.001928

LENSE OIL

G101D RISING HEAD SLUG TEST DATA (5-24-91)

THIS SPREADSHEET CALCULATES HYDRAULIC CONDUCTIVITY BASED ON THE BOUWER AND RICE (1976) METHOD.

THE FOLLOWING STEPS ARE REQUIRED TO CALCULATE HYDRAULIC CONDUCTIVITY:
1.) IMPORT HERMIT DATA INTO COLUMNS UNDER RAW DATA
2.) DECIDE WHICH DATA IS APPROPRIATE, CHOOSE THE INITIAL INDUCED HEAD, TRANSLATE TIME VALUES
3.) DO THE REGRESSION CALCULATION FOR LEAST SQUARES FIT
4.) CHOOSE APPROPRIATE SLUG TEST PARAMETERS
5.) CHOOSE A VALUE FOR TIME t AND ITS CORRESPONDING Yt

Note: Values of time are translated to the first meaningful data point. The initial theoretical induced head (Yo) is chosen on the regression line at the translated time t=0. (see Pandit and and Miner, 1986. Ground Water. V. 24, No. 6, p. 743-749).

LINEAR REGRESSION DATA

Regression Output:

Constant	0.488574
Std Err of Y Est	0.01353
R Squared	0.999389
No. of Observations	21
Degrees of Freedom	19
X Coefficient(s)	-0.09817
Std Err of Coef.	0.000557

Regression line equation:

Ln Y = -0.09817 t+0.488574

Ln Y intercept: 0.488574

SLUG TEST PARAMETERS

Length of slug (Ls)=	3	ft.
Slug diameter (Ds)=	0.14	ft.
Initial theoret. induced head (Yo)=	1.629991	ft.
Actual initial induced head (Ho)=	1.65	ft.
Radius of developed zone (rw)=	0.25	ft.
Radius of well casing (rc)=	0.0833	ft.
Effective length of inflow (L)=	2	ft.
Saturated thickness of aquifer (D)=	175	ft.
L/rw=	8	
A=	1.7898	
Constants based on L/rw: B=	0.2457	
C=	1.0907	
Distance between top of aquifer and screen bottom (H)=	23.6	ft.
D > H Ln (R/rw)=	1.538724	
D = H Ln (R/rw)=	2.643919	
Note: Ln((D-H)/rw)=	6	

If Ln((D-H)/rw)>6, set Ln((D-H)/rw)=6

where:

D > H Ln(R/rw)=[1.1/Ln(H/rw)+(A+BLn[(D-H)/rw])/L/rw]**-1

D = H Ln(R/rw)=[1.1/Ln(H/rw)+C/(L/rw)]**-1

K=rc**2*Ln(R/rw)*Ln(Yo/Yt))/2Lt

Initial theoret. induced head (Yo):
Induced head (Yt) at time t:
Ordered pair on regression line (t,Yt):

Note: Choose Yt and t

Yo = 1.629991 ft.
Yt = 1.338881 ft.
t = 2.004 sec.

RADIUS OF INFLUENCE

R= 1.164661 ft.

CALCULATION OF HYDRAULIC CONDUCTIVITY

K= 0.007987 cm/sec
K= 169.3312 gal/day-ft**2

RAW DATA

Time (min.)	Transducer Head (ft.)	Translated Time (min.)	Induced head Value Y (ft)	Translated Time (sec.)	Data used in linear fit	Ln (Y)	Ln (Yt) (theor.)	Yt
0	-0.31	-0.0166	0.31	-0.996		-1.17118	0.586356	1.797426
0.0033	-1.05	-0.0133	1.05	-0.798		0.04879	0.566917	1.762824
0.0066	-0.97	-0.01	0.97	-0.6		-0.03046	0.547479	1.728889
0.0099	-0.76	-0.0067	0.76	-0.402		-0.27444	0.52804	1.695606
0.0133	-1.21	-0.0033	1.21	-0.198		0.19062	0.508013	1.661985
0.0166	-1.65	0	1.65	0	*	0.500775	0.488574	1.629991
0.02	-1.6	0.0034	1.6	0.204	*	0.470004	0.468547	1.597671
0.0233	-1.55	0.0067	1.55	0.402	*	0.438255	0.449109	1.566915
0.0266	-1.52	0.01	1.52	0.6	*	0.41871	0.42967	1.536751
0.03	-1.5	0.0134	1.5	0.804	*	0.405465	0.409643	1.50628
0.0333	-1.48	0.0167	1.48	1.002	*	0.392042	0.390204	1.477283
0.05	-1.33	0.0334	1.33	2.004	*	0.285179	0.291834	1.338881
0.0666	-1.22	0.05	1.22	3	*	0.198851	0.194053	1.214161
0.0833	-1.1	0.0667	1.1	4.002	*	0.09531	0.095683	1.10041
0.1	-1.01	0.0834	1.01	5.004	*	0.00995	-0.00269	0.997317
0.1166	-0.91	0.1	0.91	6	*	-0.09431	-0.10047	0.904414
0.1333	-0.82	0.1167	0.82	7.002	*	-0.19845	-0.19884	0.819683
0.15	-0.75	0.1334	0.75	8.004	*	-0.28768	-0.29721	0.742889
0.1666	-0.67	0.15	0.67	9	*	-0.40048	-0.39499	0.673687
0.1833	-0.61	0.1667	0.61	10.002	*	-0.4943	-0.49336	0.610572
0.2	-0.55	0.1834	0.55	11.004	*	-0.59784	-0.59173	0.553369
0.2166	-0.5	0.2	0.5	12	*	-0.69315	-0.68951	0.501822
0.2333	-0.45	0.2167	0.45	13.002	*	-0.79851	-0.78788	0.454808
0.25	-0.41	0.2334	0.41	14.004	*	-0.8916	-0.88625	0.412198
0.2666	-0.39	0.25	0.39	15	*	-0.94161	-0.98403	0.373801
0.2833	-0.33	0.2667	0.33	16.002	*	-1.10866	-1.0824	0.338781
0.3	-0.3	0.2834	0.3	17.004		-1.20397	-1.18077	0.307042
0.3166	-0.27	0.3	0.27	18		-1.30933	-1.27855	0.27844
0.3333	-0.25	0.3167	0.25	19.002		-1.38629	-1.37692	0.252354
0.4167	-0.14	0.4001	0.14	24.006		-1.96611	-1.86818	0.154404
0.5	-0.08	0.4834	0.08	29.004		-2.52573	-2.35886	0.094528
0.5833	-0.05	0.5667	0.05	34.002		-2.99573	-2.84953	0.057872
0.6667	-0.03	0.6501	0.03	39.006		-3.50656	-3.34079	0.035409
0.75	-0.02	0.7334	0.02	44.004		-3.91202	-3.83146	0.021678
0.8333	-0.01	0.8167	0.01	49.002		-4.60517	-4.32214	0.013272

LENSE OIL

G102L RISING HEAD SLUG TEST DATA (5-24-91)

THIS SPREADSHEET CALCULATES HYDRAULIC CONDUCTIVITY BASED ON THE BOUWER AND RICE (1976) METHOD.

THE FOLLOWING STEPS ARE REQUIRED TO CALCULATE HYDRAULIC CONDUCTIVITY:
1.) IMPORT HERMIT DATA INTO COLUMNS UNDER RAW DATA
2.) DECIDE WHICH DATA IS APPROPRIATE, CHOOSE THE INITIAL INDUCED HEAD, TRANSLATE TIME VALUES
3.) DO THE REGRESSION CALCULATION FOR LEAST SQUARES FIT
4.) CHOOSE APPROPRIATE SLUG TEST PARAMETERS
5.) CHOOSE A VALUE FOR TIME t AND ITS CORRESPONDING Yt

Note: Values of time are translated to the first meaningful data point. The initial theoretical induced head (Yo) is chosen on the regression line at the translated time t=0. (see Pandit and and Miner, 1986. Ground Water. V. 24, No. 6, p. 743-749).

LINEAR REGRESSION DATA

Regression Output:

Constant	0.481363
Std Err of Y Est	0.004508
R Squared	0.994846
No. of Observations	18
Degrees of Freedom	16
X Coefficient(s)	-0.01138
Std Err of Coef.	0.000205

Regression line equation:

Ln Y = -0.01138 t+0.481363

Ln Y intercept: 0.481363

SLUG TEST PARAMETERS

Length of slug (Ls)=	3	ft.
Slug diameter (Ds)=	0.14	ft.
Initial theoret. induced head (Yo)=	1.618279	ft.
Actual initial induced head (Ho)=	1.63	ft.
Radius of developed zone (rw)=	0.25	ft.
Radius of well casing (rc)=	0.0833	ft.
Effective length of inflow (L)=	2	ft.
Saturated thickness of aquifer (D)=	175	ft.
L/rw=	8	
A=	1.7898	
Constants based on L/rw: B=	0.2457	
C=	1.0907	
Distance between top of aquifer and screen bottom (H)=	5.9	ft.
D > H Ln (R/rw)=	1.322814	
D = H Ln (R/rw)=	2.06483	
Note: Ln((D-H)/rw)=	6	

If Ln((D-H)/rw)>6, set Ln((D-H)/rw)=6

where:

D > H Ln(R/rw)=[1.1/Ln(H/rw)+(A+BLn[(D-H)/rw])/L/rw]**-1

D = H Ln(R/rw)=[1.1/Ln(H/rw)+C/(L/rw)]**-1

K=rc**2*Ln(R/rw)*Ln(Yo/Yt))/2Lt

Initial theoret. induced head (Yo):

Indu d head (Yt) at time t:

Ordered pair on regression line (t,Yt):

Note: Choose Yt and t

Yo = 1.618279 ft.

Yt = 1.528788 ft.

t = 4.998 sec.

RADIUS OF INFLUENCE

R= 0.938493 ft.

CALCULATION OF HYDRAULIC CONDUCTIVITY

K= 0.000796 cm/sec

K= 16.87724 gal/day-ft**2

RAW DATA

Time (min.)	Transducer Head (ft.)	Translated Time (min.)	Induced head Value Y (ft)	Translated Time (sec.)	Data used in linear fit	Ln (Y)	Ln (Yt) (theor.)	Yt
0	-1.25	-0.05	1.25	-3		0.223144	0.515509	1.674491
0.0033	-1.83	-0.0467	1.83	-2.802		0.604316	0.513256	1.670722
0.0066	-1.75	-0.0434	1.75	-2.604		0.559616	0.511002	1.666961
0.0099	-1.75	-0.0401	1.75	-2.406		0.559616	0.508748	1.663208
0.0133	-1.73	-0.0367	1.73	-2.202		0.548121	0.506426	1.659351
0.0166	-1.7	-0.0334	1.7	-2.004		0.530628	0.504173	1.655615
0.02	-1.68	-0.03	1.68	-1.8		0.518794	0.501851	1.651776
0.0233	-1.69	-0.0267	1.69	-1.602		0.524729	0.499597	1.648057
0.0266	-1.7	-0.0234	1.7	-1.404		0.530628	0.497343	1.644347
0.03	-1.68	-0.02	1.68	-1.2		0.518794	0.495022	1.640534
0.0333	-1.67	-0.0167	1.67	-1.002		0.512824	0.492768	1.636841
0.05	-1.63	0	1.63	0	*	0.48858	0.481363	1.618279
0.0666	-1.61	0.0166	1.61	0.996	*	0.476234	0.470026	1.600037
0.0833	-1.59	0.0333	1.59	1.998	*	0.463734	0.458622	1.581892
0.1	-1.56	0.05	1.56	3	*	0.444686	0.447217	1.563953
0.1166	-1.54	0.0666	1.54	3.996	*	0.431782	0.43588	1.546324
0.1333	-1.52	0.0833	1.52	4.998	*	0.41871	0.424475	1.528788
0.15	-1.51	0.1	1.51	6	*	0.41211	0.413071	1.511452
0.1666	-1.49	0.1166	1.49	6.996	*	0.398776	0.401734	1.494414
0.1833	-1.47	0.1333	1.47	7.998	*	0.385262	0.390329	1.477467
0.2	-1.45	0.15	1.45	9	*	0.371564	0.378924	1.460713
0.2166	-1.44	0.1666	1.44	9.996	*	0.364643	0.367588	1.444247
0.2333	-1.43	0.1833	1.43	10.998	*	0.357674	0.356183	1.427869
0.25	-1.41	0.2	1.41	12	*	0.34359	0.344778	1.411677
0.2666	-1.4	0.2166	1.4	12.996	*	0.336472	0.333442	1.395763
0.2833	-1.38	0.2333	1.38	13.998	*	0.322083	0.322037	1.379935
0.3	-1.37	0.25	1.37	15	*	0.314811	0.310632	1.364287
0.3166	-1.35	0.2666	1.35	15.996	*	0.300105	0.299295	1.348908
0.3333	-1.34	0.2833	1.34	16.998	*	0.29267	0.28789	1.333611
0.4167	-1.28	0.3667	1.28	22.002		0.24686	0.230935	1.259777
0.5	-1.22	0.45	1.22	27		0.198851	0.174047	1.190111
0.5833	-1.17	0.5333	1.17	31.998		0.157004	0.117159	1.124298
0.6667	-1.12	0.6167	1.12	37.002		0.113329	0.060203	1.062052
0.75	-1.08	0.7	1.08	42		0.076961	0.003316	1.003321
0.8333	-1.04	0.7833	1.04	46.998		0.039221	-0.05357	0.947838
0.9167	-1	0.8667	1	52.002		0	-0.11053	0.895361
1	-0.96	0.95	0.96	57		-0.04082	-0.16742	0.845848
1.0833	-0.93	1.0333	0.93	61.998		-0.07257	-0.2243	0.799073
1.1667	-0.89	1.1167	0.89	67.002		-0.11653	-0.28126	0.754833
1.25	-0.86	1.2	0.86	72		-0.15082	-0.33815	0.713091
1.3333	-0.83	1.2833	0.83	76.998		-0.18633	-0.39503	0.673657
1.4166	-0.8	1.3666	0.8	81.996		-0.22314	-0.45192	0.636404
1.5	-0.77	1.45	0.77	87		-0.26136	-0.50888	0.60117
1.5833	-0.75	1.5333	0.75	91.998		-0.28768	-0.56577	0.567925
1.6667	-0.72	1.6167	0.72	97.002		-0.3285	-0.62272	0.536482
1.75	-0.69	1.7	0.69	102		-0.37106	-0.67961	0.506815
1.8333	-0.67	1.7833	0.67	106.998		-0.40048	-0.7365	0.478788
1.9167	-0.65	1.8667	0.65	112.002		-0.43078	-0.79345	0.452281
2	-0.63	1.95	0.63	117		-0.46204	-0.85034	0.42727

2.5	-0.51	2.45	0.51	147	-0.67334	-1.1918	0.303673
3	-0.43	2.95	0.43	177	-0.84397	-1.53326	0.21583
3.5	-0.36	3.45	0.36	207	-1.02165	-1.87473	0.153397
4	-0.3	3.95	0.3	237	-1.20397	-2.21619	0.109024
4.5	-0.25	4.45	0.25	267	-1.38629	-2.55765	0.077486
5	-0.21	4.95	0.21	297	-1.56065	-2.89911	0.055072
5.5	-0.18	5.45	0.18	327	-1.7148	-3.24058	0.039141
6	-0.16	5.95	0.16	357	-1.83258	-3.58204	0.027819
6.5	-0.14	6.45	0.14	387	-1.96611	-3.9235	0.019772
7	-0.12	6.95	0.12	417	-2.12026	-4.26496	0.014052

LENZ OIL
G102D RISING HEAD SLUG TEST DATA (5-30-91)

THIS SPREADSHEET CALCULATES HYDRAULIC CONDUCTIVITY BASED ON THE BOUWER AND RICE (1976) METHOD. AIR PRESSURE WAS USED TO PUSH THE WATER DOWN IN THE WELL AND RECOVERY RATE WAS MEASURED.

THE FOLLOWING STEPS ARE REQUIRED TO CALCULATE HYDRAULIC CONDUCTIVITY:
1.) IMPORT HERMIT DATA INTO COLUMNS UNDER RAW DATA
2.) DECIDE WHICH DATA IS APPROPRIATE, CHOOSE THE INITIAL INDUCED HEAD, TRANSLATE TIME VALUES
3.) DO THE REGRESSION CALCULATION FOR LEAST SQUARES FIT
4.) CHOOSE APPROPRIATE SLUG TEST PARAMETERS
5.) CHOOSE A VALUE FOR TIME t AND ITS CORRESPONDING Yt

Note: Values of time are translated to the first meaningful data point. The initial theoretical induced head (Yo) is chosen on the regression line at the translated time t=0. (see Pandit and and Miner, 1986. Ground Water. V. 24, No. 6, p. 743-749).

LINEAR REGRESSION DATA

Regression Output:

Constant		-0.4442
Constant		-0.4442
Std Err of Y Est		0.012758
R Squared		0.993986
No. of Observations		41
Degrees of Freedom		39
X Coefficient(s)	-0.00744	
X Coefficient(s)	-0.00744	
Std Err of Coef.	9.27E-05	

Regression line equation:

Ln Y = ERR t+ ERR

Ln Y intercept: ERR

SLUG TEST PARAMETERS

Length of slug (Ls)=		ft.
Slug diameter (Ds)=		ft.
Initial theoret. induced head (Yo)=	0.64134	ft.
Actual initial induced head (Ho)=	0.63813	ft.
Radius of developed zone (rw)=	0.25	ft.
Radius of well casing (rc)=	0.0833	ft.
Effective length of inflow (L)=	2	ft.
Saturated thickness of aquifer (D)=	175	ft.
L/rw=	8	
A=	1.7898	
Constants based on L/rw: B=	0.2457	
C=	1.0907	
Distance between top of aquifer and screen bottom (H)=	12.4	ft.
D > H Ln (R/rw)=	1.449773	
D = H Ln (R/rw)=	2.39177	
Note: Ln((D-H)/rw)=	6	

If Ln((D-H)/rw)>6, set Ln((D-H)/rw)=6

where:
D > H Ln(R/rw)=[1.1/Ln(H/rw)+(A+BLn[(D-H)/rw])/L/rw]**-1
D = H Ln(R/rw)=[1.1/Ln(H/rw)+C/(L/rw)]**-1

K=rc**2*Ln(R/rw)*Ln(Yo/Yt))/2Lt

Initial theoret. induced head (Yo):
Induced head (Yt) at time t:
Ordered pair on regression line (t,Yt):

Note: Choose Yt and t

Yo = 0.64134 ft.
Yt = 0.63375 ft.
t = 1.6 sec.

RADIUS OF INFLUENCE

R= 1.065537 ft.

CALCULATION OF HYDRAULIC CONDUCTIVITY

K= 0.00057 cm/sec
K= 12.09241 gal/day-ft**2

RAW DATA Note: 1 ft. head = 0.00506 volts

Induced head = final head reading-transducer head at time t

Time (sec.)	Transducer Head (Volts)	Time (min.)	Induced head Value Y (ft)	Translated Time (sec.)	Data used in linear fit	Ln (Y)	Ln (Yt) (theor.)	Yt
0.1	0.041113	0.0017	0.725089	-19.5		-0.32146	-0.2991	0.741488
0.2	0.041108	0.0033	0.726053	-19.4		-0.32013	-0.29984	0.740937
0.3	0.041107	0.0050	0.726375	-19.3		-0.31969	-0.30058	0.740386
0.4	0.041055	0.0067	0.736502	-19.2		-0.30584	-0.30133	0.739835
0.5	0.041112	0.0083	0.725251	-19.1		-0.32124	-0.30207	0.739285
0.6	0.04106	0.0100	0.735538	-19		-0.30715	-0.30282	0.738735
0.7	0.0411	0.0117	0.727662	-18.9		-0.31792	-0.30356	0.738185
0.8	0.041087	0.0133	0.730233	-18.8		-0.31439	-0.3043	0.737636
0.9	0.041032	0.0150	0.741164	-18.7		-0.29953	-0.30505	0.737088
1	0.041088	0.0167	0.730073	-18.6		-0.31461	-0.30579	0.736539
1.1	0.041107	0.0183	0.726215	-18.5		-0.31991	-0.30654	0.735991
1.2	0.041073	0.0200	0.733126	-18.4		-0.31044	-0.30728	0.735444
1.3	0.041107	0.0217	0.726215	-18.3		-0.31991	-0.30802	0.734897
1.4	0.0411	0.0233	0.727662	-18.2		-0.31792	-0.30877	0.73435
1.5	0.041109	0.0250	0.725893	-18.1		-0.32035	-0.30951	0.733804
1.6	0.04109	0.0267	0.729591	-18		-0.31527	-0.31026	0.733258
1.7	0.041078	0.0283	0.732002	-17.9		-0.31197	-0.311	0.732713
1.8	0.041093	0.0300	0.729109	-17.8		-0.31593	-0.31175	0.732168
1.9	0.041088	0.0317	0.730073	-17.7		-0.31461	-0.31249	0.731623
2	0.041107	0.0333	0.726375	-17.6		-0.31969	-0.31323	0.731079
2.1	0.041087	0.0350	0.730233	-17.5		-0.31439	-0.31398	0.730535
2.2	0.041069	0.0367	0.733769	-17.4		-0.30956	-0.31472	0.729992
2.3	0.041064	0.0383	0.734733	-17.3		-0.30825	-0.31547	0.729449
2.4	0.041088	0.0400	0.730073	-17.2		-0.31461	-0.31621	0.728906
2.5	0.041073	0.0417	0.733126	-17.1		-0.31044	-0.31695	0.728364
2.6	0.041081	0.0433	0.73152	-17		-0.31263	-0.3177	0.727822
2.7	0.041078	0.0450	0.732002	-16.9		-0.31197	-0.31844	0.727281
2.8	0.041026	0.0467	0.742289	-16.8		0.29802	-0.31919	0.72674
2.9	0.041057	0.0483	0.73618	-16.7		-0.30628	-0.31993	0.726199
3	0.041053	0.0500	0.736984	-16.6		-0.30519	-0.32067	0.725659
3.1	0.041038	0.0517	0.740038	-16.5		-0.30105	-0.32142	0.72512
3.2	0.041061	0.0533	0.735377	-16.4		-0.30737	-0.32216	0.72458
3.3	0.041033	0.0550	0.740842	-16.3		-0.29997	-0.32291	0.724041
3.4	0.041077	0.0567	0.732162	-16.2		-0.31175	-0.32365	0.723503
3.5	0.041011	0.0583	0.745342	-16.1		-0.29391	-0.3244	0.722965
3.6	0.041027	0.0600	0.742126	-16		-0.29824	-0.32514	0.722427
3.7	0.043396	0.0617	0.273899	-15.9		-1.295	-0.32588	0.721889
3.8	0.04158	0.0633	0.632826	-15.8		-0.45756	-0.32663	0.721352
3.9	0.04133	0.0650	0.682172	-15.7		-0.38247	-0.32737	0.720816
4	0.041277	0.0667	0.692621	-15.6		-0.36727	-0.32812	0.72028
4.1	0.041371	0.0683	0.674136	-15.5		-0.39432	-0.32886	0.719744
4.2	0.041438	0.0700	0.660955	-15.4		-0.41407	-0.3296	0.719209
4.3	0.041354	0.0717	0.677512	-15.3		-0.38933	-0.33035	0.718674
4.4	0.041333	0.0733	0.68169	-15.2		-0.38318	-0.33109	0.718139
4.5	0.041295	0.0750	0.689245	-15.1		-0.37216	-0.33184	0.717605
4.6	0.041334	0.0767	0.68153	-15		-0.38342	-0.33258	0.717071
4.7	0.04133	0.0783	0.682332	-14.9		-0.38224	-0.33332	0.716538
4.8	0.041347	0.0800	0.678796	-14.8		-0.38743	-0.33407	0.716005
4.9	0.041341	0.0817	0.680083	-14.7		-0.38554	-0.33481	0.715472

5	0.041327	0.0833	0.682816	-14.6	-0.38153	-0.33556	0.71494
5.1	0.041338	0.0850	0.680725	-14.5	-0.3846	-0.3363	0.714408
5.2	0.041238	0.0867	0.700496	-14.4	-0.35597	-0.33704	0.713877
5.3	0.041328	0.0883	0.682654	-14.3	-0.38177	-0.33779	0.713346
5.4	0.041335	0.0900	0.681208	-14.2	-0.38389	-0.33853	0.712815
5.5	0.041334	0.0917	0.68153	-14.1	-0.38342	-0.33928	0.712285
5.6	0.041312	0.0933	0.68587	-14	-0.37707	-0.34002	0.711755
5.7	0.041325	0.0950	0.683138	-13.9	-0.38106	-0.34077	0.711226
5.8	0.041332	0.0967	0.681852	-13.8	-0.38294	-0.34151	0.710697
5.9	0.041327	0.0983	0.682816	-13.7	-0.38153	-0.34225	0.710168
6	0.041324	0.1000	0.683458	-13.6	-0.38059	-0.343	0.70964
6.1	0.041346	0.1017	0.679119	-13.5	-0.38696	-0.34374	0.709112
6.2	0.041345	0.1033	0.679279	-13.4	-0.38672	-0.34449	0.708585
6.3	0.041333	0.1050	0.68169	-13.3	-0.38318	-0.34523	0.708057
6.4	0.041351	0.1067	0.678154	-13.2	-0.38838	-0.34597	0.707531
6.5	0.041311	0.1083	0.68603	-13.1	-0.37683	-0.34672	0.707005
6.6	0.041347	0.1100	0.678796	-13	-0.38743	-0.34746	0.706479
6.7	0.041318	0.1117	0.684583	-12.9	-0.37895	-0.34821	0.705953
6.8	0.041337	0.1133	0.680887	-12.8	-0.38436	-0.34895	0.705428
6.9	0.041325	0.1150	0.683138	-12.7	-0.38106	-0.34969	0.704903
7	0.041347	0.1167	0.678958	-12.6	-0.3872	-0.35044	0.704379
7.1	0.041356	0.1183	0.67719	-12.5	-0.3898	-0.35118	0.703855
7.2	0.04134	0.1200	0.680243	-12.4	-0.38531	-0.35193	0.703332
7.3	0.041357	0.1217	0.676868	-12.3	-0.39028	-0.35267	0.702808
7.4	0.041334	0.1233	0.68153	-12.2	-0.38342	-0.35342	0.702286
7.5	0.041344	0.1250	0.679441	-12.1	-0.38649	-0.35416	0.701763
7.6	0.041345	0.1267	0.679279	-12	-0.38672	-0.3549	0.701241
7.7	0.041326	0.1283	0.682976	-11.9	-0.3813	-0.35565	0.70072
7.8	0.041369	0.1300	0.674619	-11.8	-0.39361	-0.35639	0.700198
7.9	0.041348	0.1317	0.678636	-11.7	-0.38767	-0.35714	0.699678
8	0.041351	0.1333	0.678154	-11.6	-0.38838	-0.35788	0.699157
8.1	0.041346	0.1350	0.679119	-11.5	-0.38696	-0.35862	0.698637
8.2	0.04136	0.1367	0.676225	-11.4	-0.39123	-0.35937	0.698117
8.3	0.041186	0.1383	0.710623	-11.3	-0.34161	-0.36011	0.697598
8.400001	0.041353	0.1400	0.677672	-11.2	-0.38909	-0.36086	0.697079
8.5	0.041344	0.1417	0.679441	-11.1	-0.38649	-0.3616	0.696561
8.6	0.041351	0.1433	0.678154	-11	-0.38838	-0.36234	0.696043
8.7	0.041357	0.1450	0.676868	-10.9	-0.39028	-0.36309	0.695525
8.8	0.04135	0.1467	0.678314	-10.8	-0.38814	-0.36383	0.695008
8.900001	0.041358	0.1483	0.676708	-10.7	-0.39052	-0.36458	0.694491
9	0.041378	0.1500	0.67269	-10.6	-0.39647	-0.36532	0.693974
9.1	0.041347	0.1517	0.678958	-10.5	-0.3872	-0.36606	0.693458
9.2	0.041351	0.1533	0.677994	-10.4	-0.38862	-0.36681	0.692942
9.3	0.041364	0.1550	0.675583	-10.3	-0.39218	-0.36755	0.692427
9.400001	0.041337	0.1567	0.680887	-10.2	-0.38436	-0.3683	0.691912
9.5	0.041393	0.1583	0.669796	-10.1	-0.40078	-0.36904	0.691397
9.6	0.041363	0.1600	0.675743	-10	-0.39194	-0.36979	0.690883
9.7	0.041351	0.1617	0.678154	-9.9	-0.38838	-0.37053	0.690369
9.8	0.041374	0.1633	0.673492	-9.8	-0.39528	-0.37127	0.689855
9.900001	0.0414	0.1650	0.66835	-9.7	-0.40294	-0.37202	0.689342
10	0.041387	0.1667	0.670921	-9.6	-0.3991	-0.37276	0.688829
10.2	0.041396	0.1700	0.669152	-9.4	-0.40174	-0.37425	0.687805
10.4	0.041422	0.1733	0.66401	-9.2	-0.40946	-0.37574	0.686782
10.6	0.041351	0.1767	0.678154	-9	-0.38838	-0.37723	0.685761
10.8	0.041416	0.1800	0.665294	-8.8	-0.40753	-0.37871	0.684741
11	0.041422	0.1833	0.66401	-8.6	-0.40946	-0.3802	0.683723

11.2	0.041412	0.1867	0.666099	-8.4		-0.40632	-0.38169	0.682706
11.4	0.041404	0.1900	0.667545	-8.2		-0.40415	-0.38318	0.681691
11.6	0.041434	0.1933	0.661599	-8		-0.4131	-0.38467	0.680677
11.8	0.041447	0.1967	0.659188	-7.8		-0.41675	-0.38616	0.679665
12	0.041422	0.2000	0.66401	-7.6		-0.40946	-0.38764	0.678654
12.2	0.041441	0.2033	0.660312	-7.4		-0.41504	-0.38913	0.677645
12.4	0.041408	0.2067	0.666741	-7.2		-0.40535	-0.39062	0.676637
12.6	0.041446	0.2100	0.659348	-7		-0.4165	-0.39211	0.675631
12.8	0.04142	0.2133	0.66449	-6.8		-0.40874	-0.3936	0.674626
13	0.041445	0.2167	0.659508	-6.6		-0.41626	-0.39508	0.673623
13.2	0.041473	0.2200	0.654043	-6.4		-0.42458	-0.39657	0.672621
13.4	0.041466	0.2233	0.65533	-6.2		-0.42262	-0.39806	0.671621
13.6	0.041469	0.2267	0.654848	-6		-0.42335	-0.39955	0.670622
13.8	0.041449	0.2300	0.658706	-5.8		-0.41748	-0.40104	0.669625
14	0.041473	0.2333	0.653883	-5.6		-0.42483	-0.40253	0.668629
14.2	0.04143	0.2367	0.662401	-5.4		-0.41188	-0.40401	0.667635
14.4	0.041475	0.2400	0.653561	-5.2		-0.42532	-0.4055	0.666642
14.6	0.041474	0.2433	0.653721	-5		-0.42507	-0.40699	0.665651
14.8	0.041497	0.2467	0.649221	-4.8		-0.43198	-0.40848	0.664661
15	0.041506	0.2500	0.647453	-4.6		-0.43471	-0.40997	0.663672
15.2	0.041506	0.2533	0.647453	-4.4		-0.43471	-0.41145	0.662685
15.4	0.041515	0.2567	0.645686	-4.2		-0.43744	-0.41294	0.6617
15.6	0.041491	0.2600	0.650346	-4		-0.43025	-0.41443	0.660716
15.8	0.041485	0.2633	0.651632	-3.8		-0.42827	-0.41592	0.659733
16	0.0415	0.2667	0.648579	-3.6		-0.43297	-0.41741	0.658752
16.2	0.041522	0.2700	0.644239	-3.4		-0.43969	-0.4189	0.657773
16.4	0.041521	0.2733	0.644559	-3.2		-0.43919	-0.42038	0.656794
16.6	0.041512	0.2767	0.646328	-3		-0.43645	-0.42187	0.655818
16.8	0.04153	0.2800	0.64263	-2.8		-0.44219	-0.42336	0.654842
17	0.041479	0.2833	0.652757	-2.6		-0.42655	-0.42485	0.653869
17.2	0.041556	0.2867	0.637648	-2.4		-0.44997	-0.42634	0.652896
17.4	0.041558	0.2900	0.637166	-2.2		-0.45073	-0.42783	0.651925
17.6	0.041517	0.2933	0.645364	-2		-0.43794	-0.42931	0.650956
17.8	0.041547	0.2967	0.639417	-1.8		-0.4472	-0.4308	0.649988
18	0.041514	0.3000	0.645846	-1.6		-0.43719	-0.43229	0.649021
18.2	0.041562	0.3033	0.636362	-1.4		-0.45199	-0.43378	0.648056
18.4	0.041554	0.3067	0.637968	-1.2		-0.44947	-0.43527	0.647092
18.6	0.041566	0.3100	0.635559	-1		-0.45325	-0.43675	0.64613
18.8	0.041565	0.3133	0.635879	-0.8		-0.45275	-0.43824	0.645169
19	0.041569	0.3167	0.635077	-0.6		-0.45401	-0.43973	0.64421
19.2	0.04157	0.3200	0.634755	-0.4		-0.45452	-0.44122	0.643252
19.4	0.041567	0.3233	0.635397	-0.2		-0.4535	-0.44271	0.642295
19.6	0.041553	0.3267	0.63813	0	*	-0.44921	-0.4442	0.64134
19.8	0.041592	0.3300	0.630415	0.2	*	-0.46138	-0.44568	0.640386
20	0.041574	0.3333	0.633951	0.4	*	-0.45578	-0.44717	0.639434
20.2	0.041591	0.3367	0.630575	0.6	*	-0.46112	-0.44866	0.638483
21.2	0.041606	0.3533	0.627684	1.6	*	-0.46572	-0.4561	0.63375
22.2	0.041643	0.3700	0.620449	2.6	*	-0.47731	-0.46354	0.629052
23.2	0.041669	0.3867	0.615306	3.6	*	-0.48564	-0.47098	0.624388
24.2	0.041688	0.4033	0.611449	4.6	*	-0.49192	-0.47842	0.619759
25.2	0.041663	0.4200	0.616431	5.6	*	-0.48381	-0.48587	0.615165
26.2	0.041708	0.4367	0.607589	6.6	*	-0.49826	-0.49331	0.610604
27.2	0.041731	0.4533	0.603089	7.6	*	-0.50569	-0.50075	0.606078
28.2	0.04172	0.4700	0.605178	8.6	*	-0.50223	-0.50819	0.601585
29.2	0.041758	0.4867	0.597625	9.6	*	-0.51479	-0.51563	0.597125
30.2	0.041781	0.5033	0.593125	10.6	*	-0.52235	-0.52307	0.592698

31.2	0.041808	0.5200	0.58782
32.2	0.041818	0.5367	0.585729
33.2	0.04184	0.5533	0.581389
34.2	0.041883	0.5700	0.573032
35.2	0.041896	0.5867	0.57046
36.2	0.041922	0.6033	0.565156
37.2	0.041945	0.6200	0.560654
38.2	0.041943	0.6367	0.561136
39.2	0.041988	0.6533	0.552134
40.2	0.042	0.6700	0.549885
41.2	0.041988	0.6867	0.552296
42.2	0.042022	0.7033	0.545385
43.2	0.042052	0.7200	0.539599
44.2	0.042076	0.7367	0.534777
45.2	0.042073	0.7533	0.535419
46.2	0.042117	0.7700	0.526739
47.2	0.042021	0.7867	0.545708
48.2	0.042144	0.8033	0.521275
49.2	0.042141	0.8200	0.521917
50.2	0.042178	0.8367	0.514684
51.2	0.042186	0.8533	0.513077
61.2	0.042371	1.0200	0.476429
71.2	0.042537	1.1867	0.443798
81.2	0.042699	1.3533	0.41165
91.2	0.042879	1.5200	0.376128
101.2	0.043066	1.6867	0.339158
111.2	0.043187	1.8533	0.315208
121.2	0.043364	2.0200	0.315208
131.2	0.043538	2.1867	0.315208
141.2	0.043699	2.3533	0.315208
151.2	0.043822	2.5200	0.315208
161.2	0.043984	2.6867	0.315208
171.2	0.044134	2.8533	0.315208
181.2	0.04427	3.0200	0.315208
191.2	0.044411	3.1867	0.315208
201.2	0.044527	3.3533	0.315208
211.2	0.04466	3.5200	0.315208
221.2	0.044782	3.6867	0.315208

11.6	*	-0.53133	-0.53051	0.588304
12.6	*	-0.5349	-0.53795	0.583943
13.6	*	-0.54233	-0.54539	0.579614
14.6	*	-0.55681	-0.55283	0.575317
15.6	*	-0.56131	-0.56028	0.571052
16.6	*	-0.57065	-0.56772	0.566818
17.6	*	-0.57865	-0.57516	0.562616
18.6	*	-0.57779	-0.5826	0.558446
19.6	*	-0.59396	-0.59004	0.554306
20.6	*	-0.59805	-0.59748	0.550196
21.6	*	-0.59367	-0.60492	0.546117
22.6	*	-0.60626	-0.61236	0.542069
23.6	*	-0.61693	-0.6198	0.53805
24.6	*	-0.62591	-0.62724	0.534062
25.6	*	-0.62471	-0.63469	0.530102
26.6	*	-0.64105	-0.64213	0.526172
27.6	*	-0.60567	-0.64957	0.522272
28.6	*	-0.65148	-0.65701	0.5184
29.6	*	-0.65025	-0.66445	0.514557
30.6	*	-0.6642	-0.67189	0.510742
31.6	*	-0.66733	-0.67933	0.506956
41.6	*	-0.74144	-0.75374	0.470603
51.6	*	-0.81238	-0.82815	0.436856
61.6	*	-0.88758	-0.90256	0.40553
71.6	*	-0.97782	-0.97697	0.376449
81.6	*	-1.08129	-1.05138	0.349455
91.6	*	-1.15452	-1.12579	0.324396
101.6		-1.15452	-1.2002	0.301133
111.6		-1.15452	-1.27461	0.279539
121.6		-1.15452	-1.34902	0.259494
131.6		-1.15452	-1.42343	0.240886
141.6		-1.15452	-1.49784	0.223612
151.6		-1.15452	-1.57225	0.207577
161.6		-1.15452	-1.64666	0.192692
171.6		-1.15452	-1.72107	0.178874
181.6		-1.15452	-1.79548	0.166047
191.6		-1.15452	-1.86989	0.15414
201.6		-1.15452	-1.9443	0.143087

LENZ OIL
G104D RISING HEAD SLUG TEST DATA (5-30-91)

THIS SPREADSHEET CALCULATES HYDRAULIC CONDUCTIVITY BASED ON THE BOUWER AND RICE (1976) METHOD. AIR PRESSURE WAS USED TO PUSH THE WATER DOWN IN THE WELL AND RECOVERY RATE WAS MEASURED.

THE FOLLOWING STEPS ARE REQUIRED TO CALCULATE HYDRAULIC CONDUCTIVITY:
1.) IMPORT HERMIT DATA INTO COLUMNS UNDER RAW DATA
2.) DECIDE WHICH DATA IS APPROPRIATE, CHOOSE THE INITIAL INDUCED HEAD, TRANSLATE TIME VALUES
3.) DO THE REGRESSION CALCULATION FOR LEAST SQUARES FIT
4.) CHOOSE APPROPRIATE SLUG TEST PARAMETERS
5.) CHOOSE A VALUE FOR TIME t AND ITS CORRESPONDING Yt

Note: Values of time are translated to the first meaningful data point. The initial theoretical induced head (Yo) is chosen on the regression line at the translated time t=0. (see Pandit and and Miner, 1986. Ground Water. V. 24, No. 6, p. 743-749).

LINEAR REGRESSION DATA

Regression Output:

Constant	1.074373
Std Err of Y Est	0.01303
R Squared	0.997508
No. of Observations	167
Degrees of Freedom	165
X Coefficient(s)	-0.00934
Std Err of Coef.	3.64E-05

Regression line equation:

Ln Y = -0.00934 t+1.074373

Ln Y intercept: 1.074373

SLUG TEST PARAMETERS

Length of slug (Ls)=		ft.
Slug diameter (Ds)=		ft.
Initial theoret. induced head (Yo)=	2.925422	ft.
Actual initial induced head (Ho)=	2.946646	ft.
Radius of developed zone (rw)=	0.25	ft.
Radius of well casing (rc)=	0.0833	ft.
Effective length of inflow (L)=	2	ft.
Saturated thickness of aquifer (D)=	175	ft.
L/rw=	8	
A=	1.7898	
Constants based on L/rw: B=	0.2457	
C=	1.0907	
Distance between top of aquifer and screen bottom (H)=	8.5	ft.
D > H Ln (R/rw)=	1.389012	
D = H Ln (R/rw)=	2.230779	
Note: Ln((D-H)/rw)=	6	

If Ln((D-H)/rw)>6, set Ln((D-H)/rw)=6

where:

D > H Ln(R/rw)=[1.1/Ln(H/rw)+(A+BLn[(D-H)/rw])/L/rw]**-1

D = H Ln(R/rw)=[1.1/Ln(H/rw)+C/(L/rw)]**-1

K=rc**2*Ln(R/rw)*Ln(Yo/Yt))/2Lt

Initial theoret. induced head (Yo):
Induced head (Yt) at time t:
Ordered pair on regression line (t,Yt):

Note: Choose Yt and t

Yo = 2.925422 ft.
Yt = 2.89822 ft.
t = 1.1 sec.

RADIUS OF INFLUENCE

R= 1.002721 ft.

CALCULATION OF HYDRAULIC CONDUCTIVITY

K= 0.000624 cm/sec
K= 13.22274 gal/day-ft**2

RAW DATA Note: 1 ft. head = 0.00506 volts

Induced head = final head reading-transducer head at time t

Time (sec.)	Transducer Head (Volts)	Time (min.)	Induced head Value Y (ft)	Translated Time (sec.)	Data used in linear fit	Ln (Y)	Ln (Yt) (theor.)	Yt
0.1	0.03275	0.0017	3.049358	-2.5		1.114931	1.097727	2.997346
0.2	0.032729	0.0033	3.053375	-2.4		1.116248	1.096793	2.994547
0.3	0.032735	0.0050	3.052251	-2.3		1.115879	1.095859	2.991751
0.4	0.032742	0.0067	3.050964	-2.2		1.115458	1.094925	2.988957
0.5	0.032741	0.0083	3.051126	-2.1		1.115511	1.09399	2.986166
0.6	0.032744	0.0100	3.050482	-2		1.1153	1.093056	2.983378
0.7	0.032735	0.0117	3.052251	-1.9		1.115879	1.092122	2.980592
0.8	0.032741	0.0133	3.051126	-1.8		1.115511	1.091188	2.977809
0.9	0.03275	0.0150	3.049358	-1.7		1.114931	1.090254	2.975029
1	0.032727	0.0167	3.053858	-1.6		1.116406	1.08932	2.972251
1.1	0.032736	0.0183	3.052091	-1.5		1.115827	1.088385	2.969476
1.2	0.032726	0.0200	3.05402	-1.4		1.116459	1.087451	2.966703
1.3	0.032695	0.0217	3.060126	-1.3		1.118456	1.086517	2.963933
1.4	0.03271	0.0233	3.057233	-1.2		1.11751	1.085583	2.961165
1.5	0.032713	0.0250	3.056591	-1.1		1.1173	1.084649	2.9584
1.6	0.032716	0.0267	3.056109	-1		1.117142	1.083714	2.955638
1.7	0.032699	0.0283	3.059324	-0.9		1.118194	1.08278	2.952878
1.8	0.032689	0.0300	3.061413	-0.8		1.118877	1.081846	2.950121
1.9	0.032684	0.0317	3.062377	-0.7		1.119192	1.080912	2.947366
2	0.032799	0.0333	3.039553	-0.6		1.111711	1.079978	2.944614
2.1	0.03711	0.0350	2.187642	-0.5		0.782824	1.079044	2.941865
2.2	0.033234	0.0367	2.953559	-0.4		1.083011	1.078109	2.939118
2.3	0.033169	0.0383	2.966417	-0.3		1.087355	1.077175	2.936373
2.4	0.033226	0.0400	2.955166	-0.2		1.083555	1.076241	2.933632
2.5	0.033413	0.0417	2.918196	-0.1		1.070965	1.075307	2.930892
2.6	0.033282	0.0433	2.944235	0		1.079849	1.074373	2.928156
2.7	0.033269	0.0450	2.946646	0.1	*	1.080668	1.073439	2.925422
2.8	0.033318	0.0467	2.937002	0.2	*	1.077389	1.072504	2.92269
2.9	0.033355	0.0483	2.929769	0.3	*	1.074924	1.07157	2.919961
3	0.033373	0.0500	2.926233	0.4	*	1.073716	1.070636	2.917234
3.1	0.033393	0.0517	2.922213	0.5	*	1.072341	1.069702	2.914511
3.2	0.033431	0.0533	2.91466	0.6	*	1.069753	1.068768	2.911789
3.3	0.033427	0.0550	2.915462	0.7	*	1.070028	1.067834	2.90907
3.4	0.033459	0.0567	2.909194	0.8	*	1.067876	1.066899	2.906354
3.5	0.033478	0.0583	2.905498	0.9	*	1.066605	1.065965	2.90364
3.6	0.033497	0.0600	2.901638	1	*	1.065276	1.065031	2.900929
3.7	0.033526	0.0617	2.895854	1.1	*	1.06328	1.064097	2.89822
3.8	0.033558	0.0633	2.889585	1.2	*	1.061113	1.063163	2.895514
3.9	0.033562	0.0650	2.888781	1.3	*	1.060834	1.062228	2.89281
4	0.033577	0.0667	2.885887	1.4	*	1.059832	1.061294	2.890109
4.1	0.033592	0.0683	2.882834	1.5	*	1.058774	1.06036	2.887411
4.2	0.033597	0.0700	2.881868	1.6	*	1.058439	1.059426	2.884715
4.3	0.033644	0.0717	2.872706	1.7	*	1.055254	1.058492	2.882021
4.4	0.03365	0.0733	2.871421	1.8	*	1.054807	1.057558	2.87933
4.5	0.033661	0.0750	2.86917	1.9	*	1.054023	1.056623	2.876641
4.6	0.033674	0.0767	2.866759	2	*	1.053182	1.055689	2.873955
4.7	0.033696	0.0783	2.862419	2.1	*	1.051667	1.054755	2.871272
4.8	0.033709	0.0800	2.859688	2.2	*	1.050712	1.053821	2.868591
4.9	0.033723	0.0817	2.856955	2.3	*	1.049756	1.052887	2.865912

5	0.033741	0.0833	2.853417	2.4	*	1.048517	1.051953	2.863236
5.1	0.033766	0.0850	2.848595	2.5	*	1.046826	1.051018	2.860563
5.2	0.033775	0.0867	2.846668	2.6	*	1.046149	1.050084	2.857892
5.3	0.033807	0.0883	2.840399	2.7	*	1.043945	1.04915	2.855223
5.4	0.033697	0.0900	2.862099	2.8	*	1.051555	1.048216	2.852557
5.5	0.033821	0.0917	2.837666	2.9	*	1.042982	1.047282	2.849894
5.6	0.033833	0.0933	2.835255	3	*	1.042132	1.046348	2.847233
5.7	0.033696	0.0950	2.862419	3.1	*	1.051667	1.045413	2.844574
5.8	0.033866	0.0967	2.828826	3.2	*	1.039862	1.044479	2.841918
5.9	0.033886	0.0983	2.824806	3.3	*	1.03844	1.043545	2.839264
6	0.033881	0.1000	2.825771	3.4	*	1.038781	1.042611	2.836613
6.1	0.033923	0.1017	2.817573	3.5	*	1.035876	1.041677	2.833965
6.2	0.033942	0.1033	2.813715	3.6	*	1.034506	1.040743	2.831318
6.3	0.033944	0.1050	2.813395	3.7	*	1.034392	1.039808	2.828675
6.4	0.033952	0.1067	2.811787	3.8	*	1.03382	1.038874	2.826034
6.5	0.033966	0.1083	2.809055	3.9	*	1.032848	1.03794	2.823395
6.6	0.033997	0.1100	2.802947	4	*	1.030671	1.037006	2.820758
6.7	0.033988	0.1117	2.804553	4.1	*	1.031244	1.036072	2.818125
6.8	0.034007	0.1133	2.800858	4.2	*	1.029926	1.035137	2.815493
6.9	0.034035	0.1150	2.795391	4.3	*	1.027972	1.034203	2.812864
7	0.034014	0.1167	2.799411	4.4	*	1.029409	1.033269	2.810238
7.1	0.034042	0.1183	2.793945	4.5	*	1.027454	1.032335	2.807614
7.2	0.034078	0.1200	2.786874	4.6	*	1.02492	1.031401	2.804992
7.3	0.034081	0.1217	2.786229	4.7	*	1.024689	1.030467	2.802373
7.4	0.034028	0.1233	2.796678	4.8	*	1.028432	1.029532	2.799756
7.5	0.034125	0.1250	2.777549	4.9	*	1.021569	1.028598	2.797142
7.6	0.034122	0.1267	2.778194	5	*	1.021801	1.027664	2.79453
7.7	0.034155	0.1283	2.771603	5.1	*	1.019426	1.02673	2.791921
7.8	0.034162	0.1300	2.770316	5.2	*	1.018961	1.025796	2.789314
7.9	0.034161	0.1317	2.770476	5.3	*	1.019019	1.024862	2.78671
8	0.034096	0.1333	2.783336	5.4	*	1.02365	1.023927	2.784108
8.1	0.034198	0.1350	2.763083	5.5	*	1.016347	1.022993	2.781508
8.2	0.0342	0.1367	2.762763	5.6	*	1.016231	1.022059	2.778911
8.3	0.034223	0.1383	2.758261	5.7	*	1.0146	1.021125	2.776316
8.400001	0.034245	0.1400	2.753761	5.800001	*	1.012968	1.020191	2.773724
8.5	0.034236	0.1417	2.75569	5.9	*	1.013668	1.019257	2.771134
8.6	0.034257	0.1433	2.75151	6	*	1.01215	1.018322	2.768546
8.7	0.034276	0.1450	2.747652	6.1	*	1.010747	1.017388	2.765961
8.8	0.034275	0.1467	2.747974	6.2	*	1.010864	1.016454	2.763378
8.900001	0.034313	0.1483	2.740419	6.300001	*	1.008111	1.01552	2.760798
9	0.034319	0.1500	2.739134	6.4	*	1.007642	1.014586	2.75822
9.1	0.034319	0.1517	2.739134	6.5	*	1.007642	1.013651	2.755645
9.2	0.034342	0.1533	2.734632	6.6	*	1.005997	1.012717	2.753072
9.3	0.034355	0.1550	2.732061	6.7	*	1.005056	1.011783	2.750501
9.400001	0.034366	0.1567	2.729972	6.800001	*	1.004291	1.010849	2.747933
9.5	0.034382	0.1583	2.726757	6.9	*	1.003113	1.009915	2.745367
9.6	0.034384	0.1600	2.726275	7	*	1.002936	1.008981	2.742804
9.7	0.03441	0.1617	2.721292	7.1	*	1.001107	1.008046	2.740243
9.8	0.034399	0.1633	2.723381	7.2	*	1.001874	1.007112	2.737684
9.900001	0.034424	0.1650	2.718559	7.300001	*	1.000102	1.006178	2.735128
10	0.034439	0.1667	2.715504	7.4	*	0.998978	1.005244	2.732574
10.2	0.034458	0.1700	2.711808	7.6	*	0.997616	1.003376	2.727473
10.4	0.034469	0.1733	2.709559	7.8	*	0.996786	1.001507	2.722382
10.6	0.034527	0.1767	2.698146	8	*	0.992565	0.999639	2.7173
10.8	0.034534	0.1800	2.6967	8.2	*	0.992029	0.997771	2.712228
11	0.034545	0.1833	2.694609	8.4	*	0.991253	0.995902	2.707166

11.2	0.034604	0.1867	2.682875	8.6	*	0.986889	0.994034	2.702112
11.4	0.0346	0.1900	2.68368	8.8	*	0.987189	0.992165	2.697069
11.6	0.034649	0.1933	2.674036	9	*	0.983589	0.990297	2.692034
11.8	0.034652	0.1967	2.673391	9.2	*	0.983348	0.988429	2.687009
12	0.034671	0.2000	2.669696	9.4	*	0.981964	0.98656	2.681994
12.2	0.034707	0.2033	2.662623	9.6	*	0.979312	0.984692	2.676987
12.4	0.034726	0.2067	2.658765	9.8	*	0.977862	0.982824	2.671991
12.6	0.034742	0.2100	2.655709	10	*	0.976712	0.980955	2.667003
12.8	0.034772	0.2133	2.649765	10.2	*	0.974471	0.979087	2.662025
13	0.034816	0.2167	2.641083	10.4	*	0.971189	0.977219	2.657056
13.2	0.034819	0.2200	2.640441	10.6	*	0.970946	0.97535	2.652096
13.4	0.034845	0.2233	2.635296	10.8	*	0.968996	0.973482	2.647146
13.6	0.034873	0.2267	2.629672	11	*	0.966859	0.971614	2.642205
13.8	0.034895	0.2300	2.625332	11.2	*	0.965207	0.969745	2.637273
14	0.034927	0.2333	2.619063	11.4	*	0.962817	0.967877	2.63235
14.2	0.034939	0.2367	2.616652	11.6	*	0.961896	0.966009	2.627436
14.4	0.034964	0.2400	2.61183	11.8	*	0.960051	0.96414	2.622532
14.6	0.035003	0.2433	2.603953	12	*	0.957031	0.962272	2.617637
14.8	0.034998	0.2467	2.605077	12.2	*	0.957462	0.960404	2.612751
15	0.035028	0.2500	2.59913	12.4	*	0.955177	0.958535	2.607874
15.2	0.035053	0.2533	2.594148	12.6	*	0.953258	0.956667	2.603006
15.4	0.035071	0.2567	2.590613	12.8	*	0.951894	0.954799	2.598147
15.6	0.035104	0.2600	2.584022	13	*	0.949347	0.95293	2.593297
15.8	0.035126	0.2633	2.579682	13.2	*	0.947666	0.951062	2.588457
16	0.035142	0.2667	2.576628	13.4	*	0.946482	0.949193	2.583625
16.2	0.03517	0.2700	2.571002	13.6	*	0.944296	0.947325	2.578803
16.4	0.035186	0.2733	2.567789	13.8	*	0.943045	0.945457	2.573989
16.6	0.035195	0.2767	2.56602	14	*	0.942356	0.943588	2.569184
16.8	0.035217	0.2800	2.56184	14.2	*	0.940726	0.94172	2.564389
17	0.035256	0.2833	2.553964	14.4	*	0.937647	0.939852	2.559602
17.2	0.035271	0.2867	2.551069	14.6	*	0.936513	0.937983	2.554824
17.4	0.035299	0.2900	2.545605	14.8	*	0.934368	0.936115	2.550055
17.6	0.035314	0.2933	2.542551	15	*	0.933168	0.934247	2.545295
17.8	0.035352	0.2967	2.534996	15.2	*	0.930192	0.932378	2.540544
18	0.035366	0.3000	2.532265	15.4	*	0.929114	0.93051	2.535802
18.2	0.035393	0.3033	2.52696	15.6	*	0.927017	0.928642	2.531069
18.4	0.035424	0.3067	2.520852	15.8	*	0.924597	0.926773	2.526344
18.6	0.03544	0.3100	2.517636	16	*	0.923321	0.924905	2.521629
18.8	0.035448	0.3133	2.51603	16.2	*	0.922682	0.923037	2.516922
19	0.035469	0.3167	2.512012	16.4	*	0.921084	0.921168	2.512224
19.2	0.035491	0.3200	2.50751	16.6	*	0.91929	0.9193	2.507534
19.4	0.035516	0.3233	2.502688	16.8	*	0.917365	0.917432	2.502854
19.6	0.03554	0.3267	2.497866	17	*	0.915437	0.915563	2.498182
19.8	0.035552	0.3300	2.495615	17.2	*	0.914535	0.913695	2.493519
20	0.03558	0.3333	2.48999	17.4	*	0.912279	0.911827	2.488864
20.2	0.035595	0.3367	2.487097	17.6	*	0.911116	0.909958	2.484219
21.2	0.035722	0.3533	2.461862	18.6	*	0.900918	0.900616	2.46112
22.2	0.035811	0.3700	2.44434	19.6	*	0.893775	0.891275	2.438236
23.2	0.035925	0.3867	2.421838	20.6	*	0.884527	0.881933	2.415564
24.2	0.036019	0.4033	2.403192	21.6	*	0.876798	0.872591	2.393104
25.2	0.03613	0.4200	2.381332	22.6	*	0.86766	0.86325	2.370852
26.2	0.036235	0.4367	2.360597	23.6	*	0.858914	0.853908	2.348808
27.2	0.036332	0.4533	2.341308	24.6	*	0.85071	0.844566	2.326968
28.2	0.036427	0.4700	2.322662	25.6	*	0.842714	0.835224	2.305331
29.2	0.036519	0.4867	2.304338	26.6	*	0.834793	0.825883	2.283896
30.2	0.036624	0.5033	2.283603	27.6	*	0.825754	0.816541	2.262659

31.2	0.036705	0.5200	2.26769	28.6	*	0.818762	0.807199	2.241621
32.2	0.036813	0.5367	2.246312	29.6	*	0.80929	0.797857	2.220778
33.2	0.036913	0.5533	2.226542	30.6	*	0.800449	0.788516	2.200128
34.2	0.037024	0.5700	2.20468	31.6	*	0.790582	0.779174	2.179671
35.2	0.037099	0.5867	2.189731	32.6	*	0.783779	0.769832	2.159404
36.2	0.037199	0.6033	2.170123	33.6	*	0.774784	0.76049	2.139325
37.2	0.03728	0.6200	2.154047	34.6	*	0.767349	0.751149	2.119433
38.2	0.037371	0.6367	2.136045	35.6	*	0.758956	0.741807	2.099726
39.2	0.037465	0.6533	2.117561	36.6	*	0.750265	0.732465	2.080202
40.2	0.037556	0.6700	2.099397	37.6	*	0.74165	0.723124	2.06086
41.2	0.037648	0.6867	2.081233	38.6	*	0.732961	0.713782	2.041698
42.2	0.03774	0.7033	2.063071	39.6	*	0.724196	0.70444	2.022714
43.2	0.037831	0.7200	2.045229	40.6	*	0.71551	0.695098	2.003906
44.2	0.037914	0.7367	2.028834	41.6	*	0.707461	0.685757	1.985273
45.2	0.038019	0.7533	2.007937	42.6	*	0.697108	0.676415	1.966814
46.2	0.038104	0.7700	1.991221	43.6	*	0.688748	0.667073	1.948526
47.2	0.038193	0.7867	1.97354	44.6	*	0.679829	0.657731	1.930408
48.2	0.038281	0.8033	1.95618	45.6	*	0.670994	0.64839	1.912459
49.2	0.038371	0.8200	1.938498	46.6	*	0.661913	0.639048	1.894676
50.2	0.038453	0.8367	1.922265	47.6	*	0.653504	0.629706	1.877059
51.2	0.038538	0.8533	1.905387	48.6	*	0.644685	0.620364	1.859606
61.2	0.039343	1.0200	1.746417	58.6	*	0.557566	0.526947	1.693753
71.2	0.0401	1.1867	1.596771	68.6	*	0.467983	0.43353	1.542693
81.2	0.040831	1.3533	1.452267	78.6	*	0.373126	0.340112	1.405105
91.2	0.041495	1.5200	1.320945	88.6	*	0.278347	0.246695	1.279789
101.2	0.042124	1.6867	1.196694	98.6	*	0.179562	0.153278	1.165649
111.2	0.042701	1.8533	1.082731	108.6	*	0.079487	0.05986	1.061688
121.2	0.04325	2.0200	0.974233	118.6	*	-0.0261	-0.03356	0.967
131.2	0.043774	2.1867	0.870717	128.6	*	-0.13844	-0.12697	0.880756
141.2	0.04425	2.3533	0.776526	138.6	*	-0.25293	-0.22039	0.802204
151.2	0.044688	2.5200	0.690047	148.6	*	-0.37099	-0.31381	0.730658
161.2	0.045099	2.6867	0.608875	158.6	*	-0.49614	-0.40723	0.665493
171.2	0.04542	2.8533	0.545383	168.6		-0.60627	-0.50064	0.60614
181.2	0.045728	3.0200	0.484464	178.6		-0.72471	-0.59406	0.552081
191.2	0.04606	3.1867	0.418883	188.6		-0.87016	-0.68748	0.502842
201.2	0.046367	3.3533	0.358125	198.6		-1.02687	-0.7809	0.457996
211.2	0.046673	3.5200	0.297688	208.6		-1.21171	-0.87431	0.417148
221.2	0.046951	3.6867	0.242715	218.6		-1.41587	-0.96773	0.379944
231.2	0.047155	3.8533	0.20237	228.6		-1.59766	-1.06115	0.346058
241.2	0.047425	4.0200	0.149004	238.6		-1.90378	-1.15457	0.315195
251.2	0.047626	4.1867	0.109302	248.6		-2.21364	-1.24798	0.287083
261.2	0.047839	4.3533	0.06719	258.6		-2.70023	-1.3414	0.261479
271.2	0.048023	4.5200	0.030864	268.6		-3.47818	-1.43482	0.238159

LENZ OIL
G106D RISING HEAD SLUG TEST DATA (5-30-91)

THIS SPREADSHEET CALCULATES HYDRAULIC CONDUCTIVITY BASED ON THE BOUWER AND RICE (1976) METHOD. AIR PRESSURE WAS USED TO PUSH THE WATER DOWN IN THE WELL AND RECOVERY RATE WAS MEASURED.

THE FOLLOWING STEPS ARE REQUIRED TO CALCULATE HYDRAULIC CONDUCTIVITY:
1.) IMPORT HERMIT DATA INTO COLUMNS UNDER RAW DATA
2.) DECIDE WHICH DATA IS APPROPRIATE, CHOOSE THE INITIAL INDUCED HEAD, TRANSLATE TIME VALUES
3.) DO THE REGRESSION CALCULATION FOR LEAST SQUARES FIT
4.) CHOOSE APPROPRIATE SLUG TEST PARAMETERS
5.) CHOOSE A VALUE FOR TIME t AND ITS CORRESPONDING Yt

Note: Values of time are translated to the first meaningful data point. The initial theoretical induced head (Yo) is chosen on the regression line at the translated time t=0. (see Pandit and and Miner, 1986. Ground Water. V. 24, No. 6, p. 743-749).

LINEAR REGRESSION DATA

Regression Output:

Constant	1.121338
Std Err of Y Est	0.021863
R Squared	0.99528
No. of Observations	134
Degrees of Freedom	132
X Coefficient(s)	-0.05218
Std Err of Coef.	0.000313

Regression line equation:

Ln Y = -0.05218 t+1.121338

Ln Y intercept: 1.121338

SLUG TEST PARAMETERS

Length of slug (Ls)=		ft.
Slug diameter (Ds)=		ft.
Initial theoret. induced head (Yo)=	3.068957	ft.
Actual initial induced head (Ho)=	2.987955	ft.
Radius of developed zone (rw)=	0.25	ft.
Radius of well casing (rc)=	0.0833	ft.
Effective length of inflow (L)=	10	ft.
Saturated thickness of aquifer (D)=	175	ft.
L/rw=	40	
A=	2.7266	
Constants based on L/rw: B=	0.4445	
C=	2.3957	
Distance between top of aquifer and screen bottom (H)=	31.3	ft.
D > H Ln (R/rw)=	2.728353	
D = H Ln (R/rw)=	3.476569	

Initial theoret. induced head (Yo):
Induced head (Yt) at time t:
Ordered pair on regression line (t,Yt):

Note: Choose Yt and t

Yo = 3.068957 ft.
Yt = 2.897778 ft.
t = 1.1 sec.

where:
D > H Ln(R/rw)=[1.1/Ln(H/rw)+(A+BLn[(D-H)/rw])/L/rw]**-1
D = H Ln(R/rw)=[1.1/Ln(H/rw)+C/(L/rw)]**-1

K=rc**2*Ln(R/rw)*Ln(Yo/Yt))/2Lt

RADIUS OF INFLUENCE

R= 3.826914 ft.

CALCULATION OF HYDRAULIC CONDUCTIVITY

K= 0.001505 cm/sec
K= 31.9141 gal/day-ft**2

RAW DATA Note: 1 ft. head = 0.00506 volts

Induced head = final head reading-transducer head at time t

Time (sec.)	Transducer Head (Volts)	Time (min.)	Induced head Value Y (ft)	Translated Time (sec.)	Data used in linear fit	Ln (Y)	Ln (Yt) (theor.)	Yt
0.1	0.030685	0.0017	3.18518	-2.5		1.158509	1.251778	3.496554
0.2	0.030701	0.0033	3.182126	-2.4		1.15755	1.24656	3.478358
0.3	0.030697	0.0050	3.182929	-2.3		1.157802	1.241343	3.460256
0.4	0.030701	0.0067	3.182126	-2.2		1.15755	1.236125	3.442249
0.5	0.030701	0.0083	3.182126	-2.1		1.15755	1.230907	3.424335
0.6	0.030716	0.0100	3.179233	-2		1.15664	1.22569	3.406515
0.7	0.030709	0.0117	3.180518	-1.9		1.157044	1.220472	3.388788
0.8	0.030713	0.0133	3.179715	-1.8		1.156792	1.215255	3.371152
0.9	0.030723	0.0150	3.177787	-1.7		1.156185	1.210037	3.353609
1	0.03072	0.0167	3.178269	-1.6		1.156337	1.204819	3.336157
1.1	0.030724	0.0183	3.177625	-1.5		1.156134	1.199602	3.318795
1.2	0.030733	0.0200	3.175858	-1.4		1.155578	1.194384	3.301524
1.3	0.030721	0.0217	3.178107	-1.3		1.156286	1.189167	3.284343
1.4	0.030722	0.0233	3.177947	-1.2		1.156235	1.183949	3.267251
1.5	0.030731	0.0250	3.176178	-1.1		1.155679	1.178731	3.250248
1.6	0.03073	0.0267	3.17634	-1		1.15573	1.173514	3.233334
1.7	0.030737	0.0283	3.175053	-0.9		1.155324	1.168296	3.216508
1.8	0.03074	0.0300	3.174409	-0.8		1.155122	1.163079	3.199769
1.9	0.030751	0.0317	3.17232	-0.7		1.154463	1.157861	3.183117
2	0.030739	0.0333	3.174571	-0.6		1.155173	1.152643	3.166552
2.1	0.031449	0.0350	3.034247	-0.5		1.109963	1.147426	3.150073
2.2	0.032466	0.0367	2.833324	-0.4		1.041451	1.142208	3.13368
2.3	0.031458	0.0383	3.032478	-0.3		1.10938	1.136991	3.117373
2.4	0.031395	0.0400	3.045018	-0.2		1.113507	1.131773	3.10115
2.5	0.031578	0.0417	3.00869	-0.1		1.101505	1.126555	3.085011
2.6	0.031683	0.0433	2.987955	0	*	1.094589	1.121338	3.068957
2.7	0.03174	0.0450	2.976704	0.1	*	1.090816	1.11612	3.052986
2.8	0.03175	0.0467	2.974775	0.2	*	1.090168	1.110903	3.037098
2.9	0.031796	0.0483	2.965613	0.3	*	1.087084	1.105685	3.021293
3	0.031855	0.0500	2.95404	0.4	*	1.083174	1.100467	3.00557
3.1	0.031945	0.0517	2.936198	0.5	*	1.077115	1.09525	2.989929
3.2	0.03204	0.0533	2.917391	0.6	*	1.07069	1.090032	2.97437
3.3	0.03209	0.0550	2.907585	0.7	*	1.067323	1.084814	2.958891
3.4	0.032186	0.0567	2.888619	0.8	*	1.060778	1.079597	2.943493
3.5	0.032262	0.0583	2.87351	0.9	*	1.055534	1.074379	2.928175
3.6	0.032318	0.0600	2.862579	1	*	1.051723	1.069162	2.912936
3.7	0.0324	0.0617	2.846344	1.1	*	1.046035	1.063944	2.897778
3.8	0.032481	0.0633	2.830271	1.2	*	1.040372	1.058726	2.882697
3.9	0.032562	0.0650	2.814358	1.3	*	1.034734	1.053509	2.867696
4	0.032592	0.0667	2.808411	1.4	*	1.032619	1.048291	2.852772
4.1	0.032671	0.0683	2.792818	1.5	*	1.027051	1.043074	2.837926
4.2	0.032743	0.0700	2.778514	1.6	*	1.021916	1.037856	2.823158
4.3	0.032819	0.0717	2.763565	1.7	*	1.016522	1.032638	2.808466
4.4	0.032872	0.0733	2.752957	1.8	*	1.012675	1.027421	2.793851
4.5	0.032922	0.0750	2.74315	1.9	*	1.009107	1.022203	2.779311
4.6	0.032992	0.0767	2.729328	2	*	1.004055	1.016986	2.764848
4.7	0.033073	0.0783	2.713413	2.1	*	0.998207	1.011768	2.75046
4.8	0.03313	0.0800	2.702002	2.2	*	0.993993	1.00655	2.736146
4.9	0.033222	0.0817	2.683838	2.3	*	0.987248	1.001333	2.721907

5	0.033274	0.0833	2.673551	2.4	*	0.983408	0.996115	2.707742
5.1	0.033322	0.0850	2.664067	2.5	*	0.979854	0.990898	2.693651
5.2	0.033374	0.0867	2.653941	2.6	*	0.976046	0.98568	2.679633
5.3	0.033463	0.0883	2.636259	2.7	*	0.969361	0.980462	2.665689
5.4	0.03353	0.0900	2.622919	2.8	*	0.964288	0.975245	2.651816
5.5	0.033609	0.0917	2.607488	2.9	*	0.958387	0.970027	2.638016
5.6	0.033637	0.0933	2.601862	3	*	0.956227	0.96481	2.624288
5.7	0.03369	0.0950	2.591415	3.1	*	0.952204	0.959592	2.610631
5.8	0.033765	0.0967	2.576626	3.2	*	0.946481	0.954374	2.597045
5.9	0.033833	0.0983	2.563125	3.3	*	0.941227	0.949157	2.58353
6	0.033911	0.1000	2.547694	3.4	*	0.935189	0.943939	2.570085
6.1	0.033955	0.1017	2.539014	3.5	*	0.931776	0.938722	2.556711
6.2	0.033997	0.1033	2.530656	3.6	*	0.928479	0.933504	2.543406
6.3	0.034078	0.1050	2.514743	3.7	*	0.922171	0.928286	2.53017
6.4	0.034132	0.1067	2.504134	3.8	*	0.917943	0.923069	2.517003
6.5	0.034201	0.1083	2.49031	3.9	*	0.912407	0.917851	2.503904
6.6	0.034279	0.1100	2.47504	4	*	0.906256	0.912634	2.490874
6.7	0.034329	0.1117	2.465073	4.1	*	0.902221	0.907416	2.477911
6.8	0.034358	0.1133	2.459289	4.2	*	0.899872	0.902198	2.465016
6.9	0.034424	0.1150	2.446269	4.3	*	0.894564	0.896981	2.452188
7	0.034481	0.1167	2.435018	4.4	*	0.889954	0.891763	2.439427
7.1	0.034549	0.1183	2.421676	4.5	*	0.88446	0.886545	2.426732
7.2	0.034619	0.1200	2.407852	4.6	*	0.878735	0.881328	2.414103
7.3	0.034634	0.1217	2.404798	4.7	*	0.877466	0.87611	2.40154
7.4	0.034717	0.1233	2.388401	4.8	*	0.870624	0.870893	2.389043
7.5	0.034771	0.1250	2.377794	4.9	*	0.866173	0.865675	2.37661
7.6	0.034841	0.1267	2.36397	5	*	0.860343	0.860457	2.364242
7.7	0.034888	0.1283	2.354646	5.1	*	0.856391	0.85524	2.351938
7.8	0.034929	0.1300	2.346611	5.2	*	0.852972	0.850022	2.339699
7.9	0.034987	0.1317	2.335038	5.3	*	0.848028	0.844805	2.327523
8	0.035055	0.1333	2.321536	5.4	*	0.842229	0.839587	2.315411
8.1	0.035109	0.1350	2.310927	5.5	*	0.837649	0.834369	2.303361
8.2	0.035178	0.1367	2.297265	5.6	*	0.831719	0.829152	2.291374
8.3	0.035205	0.1383	2.29196	5.7	*	0.829408	0.823934	2.27945
8.400001	0.035266	0.1400	2.279905	5.800001	*	0.824134	0.818717	2.267588
8.5	0.035339	0.1417	2.265439	5.9	*	0.817768	0.813499	2.255787
8.6	0.035377	0.1433	2.258043	6	*	0.814499	0.808281	2.244048
8.7	0.035459	0.1450	2.24181	6.1	*	0.807284	0.803064	2.23237
8.8	0.0355	0.1467	2.233773	6.2	*	0.803692	0.797846	2.220753
8.900001	0.035573	0.1483	2.219306	6.300001	*	0.797195	0.792629	2.209196
9	0.035592	0.1500	2.215449	6.4	*	0.795455	0.787411	2.197699
9.1	0.035669	0.1517	2.20034	6.5	*	0.788612	0.782193	2.186262
9.2	0.035717	0.1533	2.190856	6.6	*	0.784292	0.776976	2.174885
9.3	0.035774	0.1550	2.179443	6.7	*	0.779069	0.771758	2.163567
9.400001	0.035824	0.1567	2.169638	6.800001	*	0.77456	0.766541	2.152307
9.5	0.035852	0.1583	2.164172	6.9	*	0.772038	0.761323	2.141107
9.6	0.035914	0.1600	2.151957	7	*	0.766377	0.756105	2.129965
9.7	0.035951	0.1617	2.144563	7.1	*	0.762936	0.750888	2.11888
9.8	0.036024	0.1633	2.130097	7.2	*	0.756167	0.74567	2.107854
9.900001	0.036092	0.1650	2.116755	7.300001	*	0.749884	0.740452	2.096884
10	0.036095	0.1667	2.116113	7.4	*	0.749581	0.735235	2.085972
10.2	0.036195	0.1700	2.096342	7.6	*	0.740194	0.7248	2.064318
10.4	0.036292	0.1733	2.077213	7.8	*	0.731027	0.714365	2.042888
10.6	0.036418	0.1767	2.0523	8	*	0.718961	0.703929	2.021681
10.8	0.036524	0.1800	2.031403	8.2	*	0.708727	0.693494	2.000694
11	0.036616	0.1833	2.013079	8.4	*	0.699665	0.683059	1.979925

11.2	0.036746	0.1867	1.987362	8.6	*	0.686808	0.672624	1.959371
11.4	0.036802	0.1900	1.976431	8.8	*	0.681293	0.662188	1.939031
11.6	0.036921	0.1933	1.952802	9	*	0.669265	0.651753	1.918902
11.8	0.036997	0.1967	1.937854	9.2	*	0.661581	0.641318	1.898982
12	0.037096	0.2000	1.918243	9.4	*	0.65141	0.630883	1.879269
12.2	0.037223	0.2033	1.89317	9.6	*	0.638253	0.620448	1.85976
12.4	0.037281	0.2067	1.881757	9.8	*	0.632206	0.610012	1.840454
12.6	0.037404	0.2100	1.857324	10	*	0.619137	0.599577	1.821349
12.8	0.037495	0.2133	1.839322	10.2	*	0.609397	0.589142	1.802441
13	0.037587	0.2167	1.821158	10.4	*	0.599473	0.578707	1.78373
13.2	0.037678	0.2200	1.803156	10.6	*	0.589539	0.568272	1.765213
13.4	0.037757	0.2233	1.787565	10.8	*	0.580854	0.557836	1.746889
13.6	0.037845	0.2267	1.770206	11	*	0.571096	0.547401	1.728754
13.8	0.037953	0.2300	1.748986	11.2	*	0.559036	0.536966	1.710808
14	0.038075	0.2333	1.724715	11.4	*	0.545062	0.526531	1.693048
14.2	0.038161	0.2367	1.707838	11.6	*	0.535228	0.516096	1.675473
14.4	0.038225	0.2400	1.69514	11.8	*	0.527766	0.50566	1.65808
14.6	0.038322	0.2433	1.676012	12	*	0.516417	0.495225	1.640868
14.8	0.0384	0.2467	1.660581	12.2	*	0.507168	0.48479	1.623834
15	0.038514	0.2500	1.638077	12.4	*	0.493523	0.474355	1.606977
15.2	0.038588	0.2533	1.623451	12.6	*	0.484554	0.463919	1.590295
15.4	0.038675	0.2567	1.606253	12.8	*	0.473904	0.453484	1.573786
15.6	0.038781	0.2600	1.585356	13	*	0.460809	0.443049	1.557449
15.8	0.038833	0.2633	1.575069	13.2	*	0.454299	0.432614	1.541281
16	0.038937	0.2667	1.554494	13.4	*	0.44115	0.422179	1.525281
16.2	0.039025	0.2700	1.537134	13.6	*	0.42992	0.411743	1.509447
16.4	0.039086	0.2733	1.524919	13.8	*	0.421941	0.401308	1.493778
16.6	0.039197	0.2767	1.503057	14	*	0.407501	0.390873	1.478271
16.8	0.039266	0.2800	1.489395	14.2	*	0.39837	0.380438	1.462925
17	0.039346	0.2833	1.473644	14.4	*	0.387738	0.370003	1.447738
17.2	0.039413	0.2867	1.460462	14.6	*	0.378753	0.359567	1.432709
17.4	0.039482	0.2900	1.4468	14.8	*	0.369354	0.349132	1.417837
17.6	0.039555	0.2933	1.432334	15	*	0.359305	0.338697	1.403118
17.8	0.039657	0.2967	1.412081	15.2	*	0.345065	0.328262	1.388552
18	0.039731	0.3000	1.397455	15.4	*	0.334652	0.317827	1.374138
18.2	0.039809	0.3033	1.382024	15.6	*	0.323549	0.307391	1.359873
18.4	0.039911	0.3067	1.361931	15.8	*	0.308903	0.296956	1.345756
18.6	0.039952	0.3100	1.353893	16	*	0.302984	0.286521	1.331786
18.8	0.040068	0.3133	1.330909	16.2	*	0.285862	0.276086	1.317961
19	0.040123	0.3167	1.319978	16.4	*	0.277615	0.26565	1.304279
19.2	0.040201	0.3200	1.304708	16.6	*	0.265979	0.255215	1.290739
19.4	0.040303	0.3233	1.284455	16.8	*	0.250334	0.24478	1.27734
19.6	0.040356	0.3267	1.274008	17	*	0.242168	0.234345	1.26408
19.8	0.040424	0.3300	1.260506	17.2	*	0.231513	0.22391	1.250958
20	0.040514	0.3333	1.242824	17.4	*	0.217386	0.213474	1.237972
20.2	0.04058	0.3367	1.229644	17.6	*	0.206725	0.203039	1.22512
21.2	0.040974	0.3533	1.151846	18.6	*	0.141366	0.150863	1.162838
22.2	0.041316	0.3700	1.084336	19.6	*	0.080968	0.098687	1.103721
23.2	0.04165	0.3867	1.018273	20.6	*	0.018108	0.046511	1.04761
24.2	0.04197	0.4033	0.955103	21.6	*	-0.04594	-0.00567	0.994351
25.2	0.042319	0.4200	0.885986	22.6	*	-0.12105	-0.05784	0.9438
26.2	0.042602	0.4367	0.830049	23.6	*	-0.18627	-0.11002	0.895819
27.2	0.042901	0.4533	0.771059	24.6	*	-0.25999	-0.16219	0.850277
28.2	0.043182	0.4700	0.715443	25.6	*	-0.33485	-0.21437	0.80705
29.2	0.043445	0.4867	0.663526	26.6		-0.41019	-0.26655	0.766021
30.2	0.043713	0.5033	0.610482	27.6		-0.49351	-0.31872	0.727078

LENZ OIL
MW05D RISING HEAD SLUG TEST DATA (5-30-91)

THIS SPREADSHEET CALCULATES HYDRAULIC CONDUCTIVITY BASED ON THE BOUWER AND RICE (1976) METHOD. AIR PRESSURE WAS USED TO PUSH THE WATER DOWN IN THE WELL AND RECOVERY RATE WAS MEASURED.

THE FOLLOWING STEPS ARE REQUIRED TO CALCULATE HYDRAULIC CONDUCTIVITY:
1.) IMPORT HERMIT DATA INTO COLUMNS UNDER RAW DATA
2.) DECIDE WHICH DATA IS APPROPRIATE, CHOOSE THE INITIAL INDUCED HEAD, TRANSLATE TIME VALUES
3.) DO THE REGRESSION CALCULATION FOR LEAST SQUARES FIT
4.) CHOOSE APPROPRIATE SLUG TEST PARAMETERS
5.) CHOOSE A VALUE FOR TIME t AND ITS CORRESPONDING Yt

Note: Values of time are translated to the first meaningful data point. The initial theoretical induced head (Yo) is chosen on the regression line at the translated time t=0. (see Pandit and and Miner, 1986. Ground Water. V. 24, No. 6, p. 743-749).

LINEAR REGRESSION DATA

Regression Output:		Regression line equation:
Constant	1.274104	
Std Err of Y Est	0.014093	Ln Y = -0.14491 t+1.274104
R Squared	0.998918	
No. of Observations	93	Ln Y intercept: 1.274104
Degrees of Freedom	91	
X Coefficient(s)	-0.14491	
Std Err of Coef.	0.0005	

SLUG TEST PARAMETERS

Length of slug (Ls)=		ft.	Initial theoret. induced head (Yo):
Slug diameter (Ds)=		ft.	Induced head (Yt) at time t:
Initial theoret. induced head (Yo)=	3.575497	ft.	Ordered pair on regression
Actual initial induced head (Ho)=	3.467595	ft.	line (t,Yt):
Radius of developed zone (rw)=	0.25	ft.	
Radius of well casing (rc)=	0.0833	ft.	Note: Choose Yt and t
Effective length of inflow (L)=	5	ft.	
Saturated thickness of aquifer (D)=	175	ft.	Yo = 3.575497 ft.
L/rw=	20		Yt = 2.96156 ft.
A=	2.1686		t = 1.3 sec.
Constants based on L/rw: B=	0.318		
C=	1.6788		
Distance between top of aquifer and screen bottom (H)=	33	ft.	RADIUS OF INFLUENCE
D > H Ln (R/rw)=	2.330402		R= 2.570519 ft.
D = H Ln (R/rw)=	3.233938		
Note: Ln((D-H)/rw)=	6		CALCULATION OF HYDRAULIC CONDUCTIVITY

If Ln((D-H)/rw)>6, set Ln((D-H)/rw)=6

where:

D > H Ln(R/rw)=[1.1/Ln(H/rw)+(A+BLn[(D-H)/rw])/L/rw]**-1

D = H Ln(R/rw)=[1.1/Ln(H/rw)+C/(L/rw)]**-1

K= 0.007142 cm/sec
K= 151.4194 gal/day-ft**2

K=rc**2*Ln(R/rw)*Ln(Yo/Yt))/2Lt

RAW DATA

Time (min.)	Transducer Head (ft.)	Translated Time (min.)	Induced head Value Y (ft)	Translated Time (sec.)	Data used in linear fit	Ln (Y)	Ln (Yt) (theor.)	Yt
0	0	-0.02	0	-1.2		ERR	0.249632	1.283552
0.0033	0	-0.0167	0	-1.002		ERR	0.226403	1.254081
0.0066	-0.84	-0.0134	0.84	-0.804		-0.17435	0.203174	1.225286
0.0099	-2.03	-0.0101	2.03	-0.606		0.708036	0.179946	1.197153
0.0133	-0.89	-0.0067	0.89	-0.402		-0.11653	0.156013	1.168842
0.0166	-1.27	-0.0034	1.27	-0.204		0.239017	0.132785	1.142004
0.02	-1.17	0	1.17	0	*	0.157004	0.108852	1.114998
0.0233	-1.13	0.0033	1.13	0.198	*	0.122218	0.085624	1.089396
0.0266	-1.08	0.0066	1.08	0.396	*	0.076961	0.062395	1.064383
0.03	-1.04	0.01	1.04	0.6	*	0.039221	0.038463	1.039212
0.0333	-1.01	0.0133	1.01	0.798	*	0.00995	0.015234	1.015351
0.05	-0.88	0.03	0.88	1.8	*	-0.12783	-0.10232	0.902744
0.0666	-0.8	0.0466	0.8	2.796	*	-0.22314	-0.21916	0.803191
0.0833	-0.71	0.0633	0.71	3.798	*	-0.34249	-0.33671	0.714113
0.1	-0.6	0.08	0.6	4.8	*	-0.51083	-0.45426	0.634915
0.1166	-0.54	0.0966	0.54	5.796	*	-0.61619	-0.57111	0.564898
0.1333	-0.49	0.1133	0.49	6.798	*	-0.71335	-0.68866	0.502248
0.15	-0.44	0.13	0.44	7.8	*	-0.82098	-0.80621	0.446546
0.1666	-0.4	0.1466	0.4	8.796	*	-0.91629	-0.92306	0.397302
0.1833	-0.36	0.1633	0.36	9.798	*	-1.02165	-1.04061	0.353239
0.2	-0.32	0.18	0.32	10.8	*	-1.13943	-1.15816	0.314064
0.2166	-0.29	0.1966	0.29	11.796	*	-1.23787	-1.27501	0.279429
0.2333	-0.27	0.2133	0.27	12.798		-1.30933	-1.39256	0.248439
0.25	-0.25	0.23	0.25	13.8		-1.38629	-1.51011	0.220886
0.2666	-0.23	0.2466	0.23	14.796		-1.46968	-1.62695	0.196527
0.2833	-0.22	0.2633	0.22	15.798		-1.51413	-1.7445	0.174731
0.3	-0.2	0.28	0.2	16.8		-1.60944	-1.86206	0.155353
0.3166	-0.19	0.2966	0.19	17.796		-1.66073	-1.9789	0.138221
0.33[illegible]	-0.17	0.3133	0.17	18.798		-1.77196	-2.09645	0.122892
0.4167	-0.13	0.3967	0.13	23.802		-2.04022	-2.6835	0.068323
0.5	-0.1	0.48	0.1	28.8		-2.30259	-3.26985	0.038012
0.5833	-0.08	0.5633	0.08	33.798		-2.52573	-3.85619	0.021148
0.6667	-0.06	0.6467	0.06	38.802		-2.81341	-4.44324	0.011758
0.75	-0.06	0.73	0.06	43.8		-2.81341	-5.02959	0.006542
0.8333	-0.05	0.8133	0.05	48.798		-2.99573	-5.61593	0.003639
0.9167	-0.04	0.8967	0.04	53.802		-3.21888	-6.20298	0.002023
1	-0.03	0.98	0.03	58.8		-3.50656	-6.78933	0.001126
1.0833	-0.03	1.0633	0.03	63.798		-3.50656	-7.37567	0.000626
1.1667	-0.02	1.1467	0.02	68.802		-3.91202	-7.96272	0.000348
1.25	-0.02	1.23	0.02	73.8		-3.91202	-8.54906	0.000194
1.3333	-0.02	1.3133	0.02	78.798		-3.91202	-9.13541	0.000108
1.4166	-0.02	1.3966	0.02	83.796		-3.91202	-9.72175	6E-05
1.5	-0.02	1.48	0.02	88.8		-3.91202	-10.3088	3.33E-05
1.5833	-0.02	1.5633	0.02	93.798		-3.91202	-10.8951	1.85E-05
1.6667	-0.01	1.6467	0.01	98.802		-4.60517	-11.4822	1.03E-05
1.75	-0.01	1.73	0.01	103.8		-4.60517	-12.0685	5.74E-06
1.8333	-0.01	1.8133	0.01	108.798		-4.60517	-12.6549	3.19E-06
1.9167	-0.01	1.8967	0.01	113.802		-4.60517	-13.2419	1.77E-06
2	-0.01	1.98	0.01	118.8		-4.60517	-13.8283	9.87E-07

LENSE OIL

MW5S RISING HEAD SLUG TEST DATA (5-24-91)

THIS SPREADSHEET CALCULATES HYDRAULIC CONDUCTIVITY BASED ON THE BOUWER AND RICE (1976) METHOD.

THE FOLLOWING STEPS ARE REQUIRED TO CALCULATE HYDRAULIC CONDUCTIVITY:

1.) IMPORT HERMIT DATA INTO COLUMNS UNDER RAW DATA
2.) DECIDE WHICH DATA IS APPROPRIATE, CHOOSE THE INITIAL INDUCED HEAD, TRANSLATE TIME VALUES
3.) DO THE REGRESSION CALCULATION FOR LEAST SQUARES FIT
4.) CHOOSE APPROPRIATE SLUG TEST PARAMETERS
5.) CHOOSE A VALUE FOR TIME t AND ITS CORRESPONDING Yt

Note: Values of time are translated to the first meaningful data point. The initial theoretical induced head (Yo) is chosen on the regression line at the translated time t=0. (see Pandit and and Miner, 1986. Ground Water. V. 24, No. 6, p. 743-749).

LINEAR REGRESSION DATA

Regression Output:

Constant	0.108852
Std Err of Y Est	0.030228
R Squared	0.996313
No. of Observations	16
Degrees of Freedom	14
X Coefficient(s)	-0.11732
Std Err of Coef.	0.001907

Regression line equation:

Ln Y = -0.11732 t+0.108852

Ln Y intercept: 0.108852

SLUG TEST PARAMETERS

Length of slug (Ls)=	3	ft.
Slug diameter (Ds)=	0.14	ft.
Initial theoret. induced head (Yo)=	1.114998	ft.
Actual initial induced head (Ho)=	1.17	ft.
Radius of developed zone (rw)=	0.375	ft.
Radius of well casing (rc)=	0.0833	ft.
Effective length of inflow (L)=	10	ft.
Saturated thickness of aquifer (D)=	175	ft.
L/rw=	26.66667	
A=	2.384	
Constants based on L/rw: B=	0.3667	
C=	1.9177	
Distance between top of aquifer and screen bottom (H)=	10.2	ft.
D > H Ln (R/rw)=	1.980527	
D = H Ln (R/rw)=	2.469609	
Note: Ln((D-H)/rw)=	6	

If Ln((D-H)/rw)>6, set Ln((D-H)/rw)=6

where:

D > H Ln(R/rw)=[1.1/Ln(H/rw)+(A+BLn[(D-H)/rw])/L/rw]**-1

D = H Ln(R/rw)=[1.1/Ln(H/rw)+C/(L/rw)]**-1

K=rc**2*Ln(R/rw)*Ln(Yo/Yt))/2Lt

Initial theoret. induced head (Yo):
Induced head (Yt) at time t:
Ordered pair on regression line (t,Yt):

Note: Choose Yt and t

Yo = 1.114998 ft.
Yt = 0.902744 ft.
t = 1.8 sec.

RADIUS OF INFLUENCE

R= 2.717459 ft.

CALCULATION OF HYDRAULIC CONDUCTIVITY

K= 0.002457 cm/sec
K= 52.08931 gal/day-ft**2

31.2	0.047627	0.5200	0.096123	9.412484	28.3	-2.34213	-1.85597	0.156301
32.2	0.0477	0.5367	0.081816	9.426791	29.3	-2.50328	-1.96665	0.139924
33.2	0.047752	0.5533	0.071368	9.437239	30.3	-2.63991	-2.07734	0.125263
34.2	0.047819	0.5700	0.058188	9.450419	31.3	-2.84408	-2.18802	0.112138
35.2	0.047874	0.5867	0.047257	9.46135	32.3	-3.05216	-2.29871	0.100389
36.2	0.047922	0.6033	0.037935	9.470672	33.3	-3.27189	-2.40939	0.08987
37.2	0.047938	0.6200	0.034719	9.473887	34.3	-3.36046	-2.52007	0.080454
38.2	0.047973	0.6367	0.027808	9.480798	35.3	-3.58242	-2.63076	0.072024
39.2	0.048001	0.6533	0.022182	9.486425	36.3	-3.80848	-2.74144	0.064477
40.2	0.048027	0.6700	0.017038	9.491569	37.3	-4.07234	-2.85213	0.057721
41.2	0.048049	0.6867	0.0127	9.495907	38.3	-4.36618	-2.96281	0.051673
42.2	0.048042	0.7033	0.014146	9.49446	39.3	-4.25831	-3.07349	0.046259
43.2	0.048062	0.7200	0.010126	9.49848	40.3	-4.5926	-3.18418	0.041412
44.2	0.048062	0.7367	0.010126	9.49848	41.3	-4.5926	-3.29486	0.037073
45.2	0.04807	0.7533	0.00852	9.500087	42.3	-4.76537	-3.40555	0.033189
46.2	0.048094	0.7700	0.003858	9.504749	43.3	-5.55768	-3.51623	0.029711
47.2	0.048096	0.7867	0.003375	9.505231	44.3	-5.69121	-3.62691	0.026598
48.2	0.04809	0.8033	0.004662	9.503945	45.3	-5.3683	-3.7376	0.023811
49.2	0.04808	0.8200	0.006591	9.502016	46.3	-5.02206	-3.84828	0.021316
50.2	0.048097	0.8367	0.003215	9.505391	47.3	-5.7398	-3.95897	0.019083

11.2	0.0408	0.1867	1.445356	8.063251	8.3	*	0.368355	0.357709	1.430049
11.4	0.040906	0.1900	1.424458	8.084148	8.5	*	0.353792	0.335572	1.39874
11.6	0.041099	0.1933	1.386364	8.122243	8.7	*	0.326684	0.313435	1.368117
11.8	0.04125	0.1967	1.356466	8.15214	8.9	*	0.304883	0.291298	1.338164
12	0.041383	0.2000	1.330107	8.1785	9.1	*	0.285259	0.269162	1.308867
12.2	0.041591	0.2033	1.289119	8.219488	9.3	*	0.253959	0.247025	1.280211
12.4	0.041722	0.2067	1.263077	8.24553	9.5	*	0.233551	0.224888	1.252183
12.6	0.041866	0.2100	1.234789	8.273818	9.7	*	0.2109	0.202751	1.224768
12.8	0.041988	0.2133	1.210516	8.298091	9.9	*	0.191047	0.180614	1.197953
13	0.042124	0.2167	1.183674	8.324933	10.1	*	0.168623	0.158478	1.171726
13.2	0.042249	0.2200	1.159081	8.349526	10.3	*	0.147627	0.136341	1.146072
13.4	0.042432	0.2233	1.122915	8.385692	10.5	*	0.115928	0.114204	1.120981
13.6	0.042542	0.2267	1.101053	8.407553	10.7	*	0.096267	0.092067	1.096439
13.8	0.042652	0.2300	1.079356	8.429251	10.9	*	0.076364	0.06993	1.072434
14	0.042829	0.2333	1.044474	8.464132	11.1	*	0.043514	0.047794	1.048954
14.2	0.04291	0.2367	1.028401	8.480206	11.3	*	0.028005	0.025657	1.025989
14.4	0.043056	0.2400	0.999468	8.509138	11.5	*	-0.00053	0.00352	1.003526
14.6	0.043161	0.2433	0.978733	8.529874	11.7	*	-0.0215	-0.01862	0.981555
14.8	0.043281	0.2467	0.955105	8.553502	11.9	*	-0.04593	-0.04075	0.960066
15	0.043427	0.2500	0.926172	8.582435	12.1	*	-0.0767	-0.06289	0.939046
15.2	0.043516	0.2533	0.90865	8.599957	12.3	*	-0.0958	-0.08503	0.918487
15.4	0.043624	0.2567	0.887273	8.621334	12.5	*	-0.1196	-0.10716	0.898378
15.6	0.043744	0.2600	0.863644	8.644962	12.7	*	-0.14659	-0.1293	0.87871
15.8	0.043833	0.2633	0.845964	8.662642	12.9	*	-0.16728	-0.15144	0.859472
16	0.043969	0.2667	0.819121	8.689486	13.1	*	-0.19952	-0.17357	0.840655
16.2	0.044062	0.2700	0.800796	8.70781	13.3	*	-0.22215	-0.19571	0.82225
16.4	0.04414	0.2733	0.785206	8.723401	13.5	*	-0.24181	-0.21785	0.804248
16.6	0.044234	0.2767	0.766719	8.741887	13.7	*	-0.26563	-0.23998	0.78664
16.8	0.044296	0.2800	0.754504	8.754103	13.9	*	-0.28169	-0.26212	0.769418
17	0.044374	0.2833	0.739073	8.769534	14.1	*	-0.30236	-0.28426	0.752572
17.2	0.044458	0.2867	0.722356	8.786251	14.3	*	-0.32524	-0.3064	0.736096
17.4	0.044561	0.2900	0.702103	8.806504	14.5		-0.35368	-0.32853	0.71998
17.6	0.044624	0.2933	0.689725	8.818881	14.7		-0.37146	-0.35067	0.704217
17.8	0.044726	0.2967	0.669474	8.839132	14.9		-0.40126	-0.37281	0.688799
18	0.044808	0.3000	0.653239	8.855368	15.1		-0.42581	-0.39494	0.673719
18.2	0.04488	0.3033	0.639095	8.869512	15.3		-0.4477	-0.41708	0.658969
18.4	0.044977	0.3067	0.619806	8.8888	15.5		-0.47835	-0.43922	0.644542
18.6	0.045027	0.3100	0.61	8.898607	15.7		-0.4943	-0.46135	0.63043
18.8	0.045145	0.3133	0.586694	8.921913	15.9		-0.53325	-0.48349	0.616628
19	0.045206	0.3167	0.574638	8.933968	16.1		-0.55401	-0.50563	0.603128
19.2	0.04528	0.3200	0.560012	8.948595	16.3		-0.5798	-0.52776	0.589923
19.4	0.045353	0.3233	0.545545	8.963061	16.5		-0.60597	-0.5499	0.577008
19.6	0.045441	0.3267	0.528186	8.980421	16.7		-0.63831	-0.57204	0.564375
19.8	0.045463	0.3300	0.523846	8.984761	16.9		-0.64656	-0.59417	0.552019
20	0.045569	0.3333	0.502789	9.005818	17.1		-0.68759	-0.61631	0.539933
20.2	0.045658	0.3367	0.485269	9.023338	17.3		-0.72305	-0.63845	0.528112
21.2	0.045948	0.3533	0.428045	9.080561	18.3		-0.84853	-0.74913	0.472777
22.2	0.046229	0.3700	0.372431	9.136176	19.3		-0.9877	-0.85982	0.42324
23.2	0.04648	0.3867	0.322763	9.185844	20.3		-1.13084	-0.9705	0.378894
24.2	0.046675	0.4033	0.284346	9.224261	21.3		-1.25756	-1.08118	0.339194
25.2	0.046846	0.4200	0.250431	9.258176	22.3		-1.38457	-1.19187	0.303654
26.2	0.047057	0.4367	0.208798	9.299808	23.3		-1.56639	-1.30255	0.271837
27.2	0.047211	0.4533	0.178419	9.330188	24.3		-1.72362	-1.41323	0.243355
28.2	0.047314	0.4700	0.158006	9.350601	25.3		-1.84512	-1.52392	0.217856
29.2	0.047455	0.4867	0.130198	9.378409	26.3		-2.0387	-1.6346	0.19503
30.2	0.047542	0.5033	0.113	9.395607	27.3		-2.18037	-1.74529	0.174595

5	0.033881	0.0833	2.812751	6.695856	2.1	*	1.034163	1.04395	2.840413
5.1	0.033959	0.0850	2.79732	6.711287	2.2	*	1.028662	1.032881	2.809148
5.2	0.034127	0.0867	2.764209	6.744397	2.3	*	1.016755	1.021813	2.778226
5.3	0.034289	0.0883	2.732061	6.776545	2.4	*	1.005056	1.010744	2.747645
5.4	0.034443	0.0900	2.701682	6.806925	2.5	*	0.993874	0.999676	2.717401
5.5	0.034598	0.0917	2.67098	6.837626	2.6	*	0.982446	0.988608	2.68749
5.6	0.034744	0.0933	2.642208	6.866399	2.7	*	0.971615	0.977539	2.657907
5.7	0.034814	0.0950	2.628385	6.880221	2.8	*	0.96637	0.966471	2.628651
5.8	0.034988	0.0967	2.593988	6.914619	2.9	*	0.953197	0.955402	2.599716
5.9	0.035122	0.0983	2.567466	6.94114	3	*	0.94292	0.944334	2.5711
6	0.035288	0.1000	2.534676	6.973931	3.1	*	0.930066	0.933266	2.542799
6.1	0.035425	0.1017	2.50767	7.000937	3.2	*	0.919354	0.922197	2.51481
6.2	0.035513	0.1033	2.490312	7.018294	3.3	*	0.912408	0.911129	2.487128
6.3	0.035648	0.1050	2.463628	7.044978	3.4	*	0.901635	0.90006	2.459752
6.4	0.035787	0.1067	2.436142	7.072464	3.5	*	0.890416	0.888992	2.432676
6.5	0.035936	0.1083	2.406727	7.101879	3.6	*	0.878268	0.877924	2.405899
6.6	0.036086	0.1100	2.376992	7.131615	3.7	*	0.865836	0.866855	2.379416
6.7	0.036212	0.1117	2.352077	7.15653	3.8	*	0.855299	0.855787	2.353225
6.8	0.036296	0.1133	2.335522	7.173085	3.9	*	0.848235	0.844718	2.327322
6.9	0.036429	0.1150	2.30916	7.199447	4	*	0.836884	0.83365	2.301705
7	0.036553	0.1167	2.284727	7.223879	4.1	*	0.826247	0.822582	2.276369
7.1	0.036695	0.1183	2.256599	7.252008	4.2	*	0.813859	0.811513	2.251312
7.2	0.036822	0.1200	2.231524	7.277083	4.3	*	0.802685	0.800445	2.226531
7.3	0.036968	0.1217	2.202591	7.306016	4.4	*	0.789634	0.789376	2.202023
7.4	0.037042	0.1233	2.188125	7.320482	4.5	*	0.783045	0.778308	2.177784
7.5	0.037155	0.1250	2.165783	7.342824	4.6	*	0.772782	0.76724	2.153813
7.6	0.037286	0.1267	2.139743	7.368864	4.7	*	0.760686	0.756171	2.130105
7.7	0.037404	0.1283	2.116435	7.392172	4.8	*	0.749733	0.745103	2.106658
7.8	0.037534	0.1300	2.090877	7.417729	4.9	*	0.737584	0.734034	2.083469
7.9	0.037608	0.1317	2.076251	7.432356	5	*	0.730564	0.722966	2.060536
8	0.037706	0.1333	2.056802	7.451804	5.1	*	0.721153	0.711898	2.037855
8.1	0.03784	0.1350	2.030279	7.478328	5.2	*	0.708173	0.700829	2.015423
8.2	0.037969	0.1367	2.004883	7.503723	5.3	*	0.695586	0.689761	1.993239
8.3	0.038088	0.1383	1.981415	7.527192	5.4	*	0.683811	0.678692	1.971298
8.400001	0.038199	0.1400	1.959395	7.549211	5.500001	*	0.672636	0.667624	1.949599
8.5	0.038247	0.1417	1.949911	7.558696	5.6	*	0.667784	0.656556	1.92814
8.6	0.038378	0.1433	1.924032	7.584575	5.7	*	0.654423	0.645487	1.906916
8.7	0.038488	0.1450	1.902332	7.606275	5.8	*	0.643081	0.634419	1.885926
8.8	0.038598	0.1467	1.880472	7.628134	5.9	*	0.631523	0.62335	1.865167
8.900001	0.038721	0.1483	1.856202	7.652405	6.000001	*	0.618532	0.612282	1.844636
9	0.038772	0.1500	1.846073	7.662534	6.1	*	0.613061	0.601214	1.824331
9.1	0.038888	0.1517	1.823249	7.685358	6.2	*	0.60062	0.590145	1.80425
9.2	0.038986	0.1533	1.80396	7.704646	6.3	*	0.589985	0.579077	1.78439
9.3	0.039087	0.1550	1.78387	7.724737	6.4	*	0.578785	0.568008	1.764749
9.400001	0.039187	0.1567	1.764097	7.74451	6.500001	*	0.567639	0.55694	1.745323
9.5	0.039306	0.1583	1.74063	7.767976	6.6	*	0.554247	0.545872	1.726112
9.6	0.039329	0.1600	1.736128	7.772478	6.7	*	0.551658	0.534803	1.707112
9.7	0.039463	0.1617	1.709607	7.799	6.8	*	0.536263	0.523735	1.688321
9.8	0.039565	0.1633	1.689356	7.819251	6.9	*	0.524347	0.512666	1.669737
9.900001	0.039673	0.1650	1.668138	7.840468	7.000001	*	0.511708	0.501598	1.651358
10	0.039682	0.1667	1.66637	7.842237	7.1	*	0.510647	0.49053	1.633181
10.2	0.039865	0.1700	1.630204	7.878403	7.3	*	0.488705	0.468393	1.597425
10.4	0.040025	0.1733	1.598538	7.910069	7.5	*	0.469089	0.446256	1.562451
10.6	0.040261	0.1767	1.551925	7.956682	7.7	*	0.439496	0.424119	1.528244
10.8	0.040437	0.1800	1.517043	7.991563	7.9	*	0.416763	0.401982	1.494785
11	0.040585	0.1833	1.487789	8.020818	8.1	*	0.397291	0.379846	1.462059

RAW DATA Note: 1 ft. head = 0.00506 volts

Induced head = final head reading-transducer head at time t

Time (sec.)	Transducer Head (Volts)	Time (min.)	Induced head Value Y (ft)	Translated Time (sec.)	Data used in linear fit	Ln (Y)	Ln (Yt) (theor.)	Yt
0.1	0.028855	0.0017	3.805951	5.702656	-2.8	1.336566	1.586301	4.885644
0.2	0.028859	0.0033	3.805308	5.703298	-2.7	1.336397	1.575233	4.831866
0.3	0.028862	0.0050	3.804664	5.703943	-2.6	1.336228	1.564164	4.77868
0.4	0.028873	0.0067	3.802415	5.706192	-2.5	1.335636	1.553096	4.726079
0.5	0.028866	0.0083	3.803862	5.704745	-2.4	1.336017	1.542027	4.674057
0.6	0.028872	0.0100	3.802735	5.705872	-2.3	1.335721	1.530959	4.622608
0.7	0.028859	0.0117	3.805308	5.703298	-2.2	1.336397	1.519891	4.571725
0.8	0.028865	0.0133	3.804022	5.704585	-2.1	1.336059	1.508822	4.521403
0.9	0.028877	0.0150	3.801771	5.706836	-2	1.335467	1.497754	4.471634
1	0.028873	0.0167	3.802575	5.706032	-1.9	1.335678	1.486685	4.422413
1.1	0.028868	0.0183	3.803379	5.705227	-1.8	1.33589	1.475617	4.373734
1.2	0.028871	0.0200	3.802897	5.705709	-1.7	1.335763	1.464549	4.325591
1.3	0.028881	0.0217	3.800806	5.7078	-1.6	1.335213	1.45348	4.277977
1.4	0.028876	0.0233	3.801933	5.706674	-1.5	1.33551	1.442412	4.230888
1.5	0.028881	0.0250	3.800968	5.707638	-1.4	1.335256	1.431343	4.184317
1.6	0.028866	0.0267	3.803862	5.704745	-1.3	1.336017	1.420275	4.138259
1.7	0.02889	0.0283	3.7992	5.709407	-1.2	1.33479	1.409207	4.092707
1.8	0.028881	0.0300	3.800806	5.7078	-1.1	1.335213	1.398138	4.047657
1.9	0.028876	0.0317	3.801933	5.706674	-1	1.33551	1.38707	4.003103
2	0.028872	0.0333	3.802735	5.705872	-0.9	1.335721	1.376001	3.95904
2.1	0.028869	0.0350	3.803217	5.705389	-0.8	1.335847	1.364933	3.915461
2.2	0.028875	0.0367	3.802093	5.706514	-0.7	1.335552	1.353865	3.872362
2.3	0.02887	0.0383	3.803057	5.705549	-0.6	1.335805	1.342796	3.829738
2.4	0.028877	0.0400	3.801611	5.706996	-0.5	1.335425	1.331728	3.787582
2.5	0.029327	0.0417	3.712723	5.795883	-0.4	1.311766	1.320659	3.745891
2.6	0.033033	0.0433	2.980401	6.528206	-0.3	1.092058	1.309591	3.704659
2.7	0.030547	0.0450	3.471617	6.03699	-0.2	1.24462	1.298523	3.66388
2.8	0.030221	0.0467	3.536071	5.972536	-0.1	1.263016	1.287454	3.62355
2.9	0.030158	0.0483	3.548449	5.960158	0	*	1.26651	1.276386	3.583665
3	0.030294	0.0500	3.521605	5.987002	0.1	*	1.258917	1.265317	3.544218
3.1	0.030492	0.0517	3.482545	6.026061	0.2	*	1.247763	1.254249	3.505205
3.2	0.030702	0.0533	3.441075	6.067532	0.3	*	1.235784	1.243181	3.466622
3.3	0.030934	0.0550	3.395265	6.113342	0.4	*	1.222382	1.232112	3.428464
3.4	0.03116	0.0567	3.350419	6.158188	0.5	*	1.209085	1.221044	3.390725
3.5	0.03127	0.0583	3.328719	6.179887	0.6	*	1.202588	1.209976	3.353403
3.6	0.031476	0.0600	3.288053	6.220553	0.7	*	1.190296	1.198907	3.31649
3.7	0.031683	0.0617	3.247065	6.261542	0.8	*	1.177752	1.187839	3.279985
3.8	0.031899	0.0633	3.20447	6.304136	0.9	*	1.164547	1.17677	3.243881
3.9	0.032084	0.0650	3.16782	6.340787	1	*	1.153044	1.165702	3.208174
4	0.032182	0.0667	3.148534	6.360073	1.1	*	1.146937	1.154634	3.17286
4.1	0.032374	0.0683	3.110599	6.398008	1.2	*	1.134815	1.143565	3.137936
4.2	0.032563	0.0700	3.073308	6.435298	1.3	*	1.122755	1.132497	3.103395
4.3	0.032751	0.0717	3.036016	6.472591	1.4	*	1.110546	1.121428	3.069235
4.4	0.032924	0.0733	3.001939	6.506668	1.5	*	1.099258	1.11036	3.035451
4.5	0.033099	0.0750	2.967221	6.541385	1.6	*	1.087626	1.099292	3.002038
4.6	0.033195	0.0767	2.948253	6.560354	1.7	*	1.081213	1.088223	2.968994
4.7	0.033365	0.0783	2.91466	6.593947	1.8	*	1.069753	1.077155	2.936313
4.8	0.033548	0.0800	2.878494	6.630113	1.9	*	1.057267	1.066086	2.903992
4.9	0.033706	0.0817	2.84731	6.661296	2	*	1.046375	1.055018	2.872027

LENZ OIL
MW04D RISING HEAD PRESSURE TEST DATA (5-30-91)

THIS SPREADSHEET CALCULATES HYDRAULIC CONDUCTIVITY BASED ON THE BOUWER AND RICE (1976) METHOD. AIR PRESSURE WAS USED TO PUSH THE WATER DOWN IN THE WELL AND RECOVERY RATE WAS MEASURED.

THE FOLLOWING STEPS ARE REQUIRED TO CALCULATE HYDRAULIC CONDUCTIVITY:
1.) IMPORT HERMIT DATA INTO COLUMNS UNDER RAW DATA
2.) DECIDE WHICH DATA IS APPROPRIATE, CHOOSE THE INITIAL INDUCED HEAD, TRANSLATE TIME VALUES
3.) DO THE REGRESSION CALCULATION FOR LEAST SQUARES FIT
4.) CHOOSE APPROPRIATE SLUG TEST PARAMETERS
5.) CHOOSE A VALUE FOR TIME t AND ITS CORRESPONDING Yt

Note: Values of time are translated to the first meaningful data point. The initial theoretical induced head (Yo) is chosen on the regression line at the translated time t=0. (see Pandit and and Miner, 1986. Ground Water. V. 24, No. 6, p. 743-749).

LINEAR REGRESSION DATA

Regression Output:

Constant	1.276386
Std Err of Y Est	0.01102
R Squared	0.999392
No. of Observations	108
Degrees of Freedom	106
X Coefficient(s)	-0.11068
Std Err of Coef.	0.000265

Regression line equation:

Ln Y = -0.11068 t+1.276386

Ln Y intercept: 1.276386

SLUG TEST PARAMETERS

Length of slug (Ls)=		ft.
Slug diameter (Ds)=		ft.
Initial theoret. induced head (Yo)=	3.583665	ft.
Actual initial induced head (Ho)=	3.548449	ft.
Radius of developed zone (rw)=	0.25	ft.
Radius of well casing (rc)=	0.0833	ft.
Effective length of inflow (L)=	5	ft.
Saturated thickness of aquifer (D)=	175	ft.
L/rw=	20	
A=	2.1686	
Constants based on L/rw: B=	0.318	
C=	1.6788	
Distance between top of aquifer and screen bottom (H)=	33	ft.
D > H Ln (R/rw)=	2.330402	
D = H Ln (R/rw)=	3.233938	
Note: Ln((D-H)/rw)=	6	

If Ln((D-H)/rw)>6, set Ln((D-H)/rw)=6

where:

D > H Ln(R/rw)=[1.1/Ln(H/rw)+(A+BLn[(D-H)/rw])/L/rw]**-1

D = H Ln(R/rw)=[1.1/Ln(H/rw)+C/(L/rw)]**-1

K=rc**2*Ln(R/rw)*Ln(Yo/Yt))/2Lt

Initial theoret. induced head (Yo):
Induced head (Yt) at time t:
Ordered pair on regression line (t,Yt):

Note: Choose Yt and t

Yo = 3.583665 ft.
Yt = 3.279985 ft.
t = 0.8 sec.

RADIUS OF INFLUENCE

R= 2.570519 ft.

CALCULATION OF HYDRAULIC CONDUCTIVITY

K= 0.005455 cm/sec
K= 115.6529 gal/day-ft**2

RAW DATA

Time (min.)	Transducer Head (ft.)	Translated Time (min.)	Induced head Value Y (ft)	Translated Time (sec.)	Data used in linear fit	Ln (Y)	Ln (Yt) (theor.)	Yt
0	-2.13	-0.02	2.13	-1.2		0.756122	0.647217	1.910217
0.0033	-3.04	-0.0167	3.04	-1.002		1.111858	0.577261	1.781153
0.0066	-3.08	-0.0134	3.08	-0.804		1.12493	0.507305	1.660809
0.0099	-2.08	-0.0101	2.08	-0.606		0.732368	0.437349	1.548596
0.0133	-1.48	-0.0067	1.48	-0.402		0.392042	0.365273	1.440907
0.0166	-1.48	-0.0034	1.48	-0.204		0.392042	0.295316	1.343551
0.02	-1.26	0	1.26	0	*	0.231112	0.22324	1.250121
0.0233	-1.18	0.0033	1.18	0.198	*	0.165514	0.153284	1.165656
0.0266	-1.1	0.0066	1.1	0.396	*	0.09531	0.083328	1.086898
0.03	-1.01	0.01	1.01	0.6	*	0.00995	0.011252	1.011316
0.0333	-0.94	0.0133	0.94	0.798	*	-0.06188	-0.0587	0.942986
0.05	-0.64	0.03	0.64	1.8	*	-0.44629	-0.41272	0.661845
0.0666	-0.45	0.0466	0.45	2.796	*	-0.79851	-0.76462	0.465509
0.0833	-0.34	0.0633	0.34	3.798	*	-1.07881	-1.11865	0.326722
0.1	-0.29	0.08	0.29	4.8		-1.23787	-1.47267	0.229313
0.1166	-0.25	0.0966	0.25	5.796		-1.38629	-1.82457	0.161288
0.1333	-0.23	0.1133	0.23	6.798		-1.46968	-2.17859	0.113201
0.15	-0.22	0.13	0.22	7.8		-1.51413	-2.53261	0.079452
0.1666	-0.2	0.1466	0.2	8.796		-1.60944	-2.88451	0.055882
0.1833	-0.19	0.1633	0.19	9.798		-1.66073	-3.23853	0.039222
0.2	-0.18	0.18	0.18	10.8		-1.7148	-3.59255	0.027528
0.2166	-0.18	0.1966	0.18	11.796		-1.7148	-3.94445	0.019362
0.2333	-0.17	0.2133	0.17	12.798		-1.77196	-4.29847	0.013589
0.25	-0.16	0.23	0.16	13.8		-1.83258	-4.65249	0.009538
0.2666	-0.16	0.2466	0.16	14.796		-1.83258	-5.00439	0.006708
0.2833	-0.16	0.2633	0.16	15.798		-1.83258	-5.35841	0.004708
0.3	-0.15	0.28	0.15	16.8		-1.89712	-5.71243	0.003305
0.3166	-0.15	0.2966	0.15	17.796		-1.89712	-6.06433	0.002324
0.3333	-0.14	0.3133	0.14	18.798		-1.96611	-6.41835	0.001631
0.4167	-0.12	0.3967	0.12	23.802		-2.12026	-8.18633	0.000278

LENZ OIL

MW4S RISING HEAD SLUG TEST DATA (5-23-91))

THIS SPREADSHEET CALCULATES HYDRAULIC CONDUCTIVITY BASED ON THE BOUWER AND RICE (1976) METHOD.

THE FOLLOWING STEPS ARE REQUIRED TO CALCULATE HYDRAULIC CONDUCTIVITY:
1.) IMPORT HERMIT DATA INTO COLUMNS UNDER RAW DATA
2.) DECIDE WHICH DATA IS APPROPRIATE, CHOOSE THE INITIAL INDUCED HEAD, TRANSLATE TIME VALUES
3.) DO THE REGRESSION CALCULATION FOR LEAST SQUARES FIT
4.) CHOOSE APPROPRIATE SLUG TEST PARAMETERS
5.) CHOOSE A VALUE FOR TIME t AND ITS CORRESPONDING Yt

Note: Values of time are translated to the first meaningful data point. The initial theoretical induced head (Yo) is chosen on the regression line at the translated time t=0. (see Pandit and and Miner, 1986. Ground Water. V. 24, No. 6, p. 743-749).

LINEAR REGRESSION DATA

Regression Output:

Constant	0.22324
Std Err of Y Est	0.026546
R Squared	0.997439
No. of Observations	8
Degrees of Freedom	6
X Coefficient(s)	-0.35331
Std Err of Coef.	0.007309

Regression line equation:

Ln Y = -0.35331 t+ 0.22324

Ln Y intercept: 0.22324

SLUG TEST PARAMETERS

Length of slug (Ls)=	3	ft.
Slug diameter (Ds)=	0.14	ft.
Initia. theoret. induced head (Yo)=	1.250121	ft.
Actual initial induced head (Ho)=	1.26	ft.
Radius of developed zone (rw)=	0.25	ft.
Radius of well casing (rc)=	0.0833	ft.
Effective length of inflow (L)=	2.4	ft.
Saturated thickness of aquifer (D)=	175	ft.
L/rw=	9.6	
A=	1.8441	
Constants based on L/rw: B=	0.2596	
C=	1.1813	
Distance between top of aquifer and screen bottom (H)=	7.5	ft.
D > H Ln (R/rw)=	1.47545	
D = H Ln (R/rw)=	2.239804	
Note: Ln((D-H)/rw)=	6	

If Ln((D-H)/rw)>6, set Ln((D-H)/rw)=6

where:

D > H Ln(R/rw)=[1.1/Ln(H/rw)+(A+BLn[(D-H)/rw])/L/rw]**-1

D = H Ln(R/rw)=[1.1/Ln(H/rw)+C/(L/rw)]**-1

K=rc**2*Ln(R/rw)*Ln(Yo/Yt))/2Lt

Initial theoret. induced head (Yo):
Induced head (Yt) at time t:
Ordered pair on regression line (t,Yt):

Note: Choose Yt and t

Yo = 1.250121 ft.
Yt = 0.661845 ft.
t = 1.8 sec.

RADIUS OF INFLUENCE

R= 1.093251 ft.

CALCULATION OF HYDRAULIC CONDUCTIVITY

K= 0.022969 cm/sec
K= 486.9503 gal/day-ft**2

31.2	0.047627	0.5200	0.096123
32.2	0.0477	0.5367	0.081816
33.2	0.047752	0.5533	0.071368
34.2	0.047819	0.5700	0.058188
35.2	0.047874	0.5867	0.047257
36.2	0.047922	0.6033	0.037935
37.2	0.047938	0.6200	0.034719
38.2	0.047973	0.6367	0.027808
39.2	0.048001	0.6533	0.022182
40.2	0.048027	0.6700	0.017038
41.2	0.048049	0.6867	0.0127
42.2	0.048042	0.7033	0.014146
43.2	0.048062	0.7200	0.010126
44.2	0.048062	0.7367	0.010126
45.2	0.04807	0.7533	0.00852
46.2	0.048094	0.7700	0.003858
47.2	0.048096	0.7867	0.003375
48.2	0.04809	0.8033	0.004662
49.2	0.04808	0.8200	0.006591
50.2	0.048097	0.8367	0.003215

28.3	-2.34213	-1.85883	0.155855
29.3	-2.50328	-1.96963	0.139508
30.3	-2.63991	-2.08043	0.124876
31.3	-2.84408	-2.19124	0.111778
32.3	-3.05216	-2.30204	0.100055
33.3	-3.27189	-2.41284	0.089561
34.3	-3.36046	-2.52364	0.080167
35.3	-3.58242	-2.63444	0.071759
36.3	-3.80848	-2.74525	0.064232
37.3	-4.07234	-2.85605	0.057495
38.3	-4.36618	-2.96685	0.051465
39.3	-4.25831	-3.07765	0.046067
40.3	-4.5926	-3.18846	0.041236
41.3	-4.5926	-3.29926	0.036911
42.3	-4.76537	-3.41006	0.033039
43.3	-5.55768	-3.52086	0.029574
44.3	-5.69121	-3.63166	0.026472
45.3	-5.3683	-3.74247	0.023696
46.3	-5.02206	-3.85327	0.02121
47.3	-5.7398	-3.96407	0.018986

11.2	0.0408	0.1867	1.445356	8.3	*	0.368355	0.357212	1.429339
11.4	0.040906	0.1900	1.424458	8.5	*	0.353792	0.335051	1.398012
11.6	0.041099	0.1933	1.386364	8.7	*	0.326684	0.312891	1.367372
11.8	0.04125	0.1967	1.356466	8.9	*	0.304883	0.290731	1.337404
12	0.041383	0.2000	1.330107	9.1	*	0.285259	0.26857	1.308093
12.2	0.041591	0.2033	1.289119	9.3	*	0.253959	0.24641	1.279424
12.4	0.041722	0.2067	1.263077	9.5	*	0.233551	0.224249	1.251383
12.6	0.041866	0.2100	1.234789	9.7	*	0.2109	0.202089	1.223957
12.8	0.041988	0.2133	1.210516	9.9	*	0.191047	0.179928	1.197132
13	0.042124	0.2167	1.183674	10.1	*	0.168623	0.157768	1.170895
13.2	0.042249	0.2200	1.159081	10.3	*	0.147627	0.135608	1.145232
13.4	0.042432	0.2233	1.122915	10.5	*	0.115928	0.113447	1.120133
13.6	0.042542	0.2267	1.101053	10.7	*	0.096267	0.091287	1.095583
13.8	0.042652	0.2300	1.079356	10.9	*	0.076364	0.069126	1.071572
14	0.042829	0.2333	1.044474	11.1	*	0.043514	0.046966	1.048086
14.2	0.04291	0.2367	1.028401	11.3	*	0.028005	0.024806	1.025116
14.4	0.043056	0.2400	0.999468	11.5	*	-0.00053	0.002645	1.002649
14.6	0.043161	0.2433	0.978733	11.7	*	-0.0215	-0.01952	0.980674
14.8	0.043281	0.2467	0.955105	11.9	*	-0.04593	-0.04168	0.959181
15	0.043427	0.2500	0.926172	12.1	*	-0.0767	-0.06384	0.938159
15.2	0.043516	0.2533	0.90865	12.3	*	-0.0958	-0.086	0.917597
15.4	0.043624	0.2567	0.887273	12.5	*	-0.1196	-0.10816	0.897487
15.6	0.043744	0.2600	0.863644	12.7	*	-0.14659	-0.13032	0.877817
15.8	0.043833	0.2633	0.845964	12.9	*	-0.16728	-0.15248	0.858578
16	0.043969	0.2667	0.819121	13.1	*	-0.19952	-0.17464	0.839761
16.2	0.044062	0.2700	0.800796	13.3	*	-0.22215	-0.1968	0.821356
16.4	0.04414	0.2733	0.785206	13.5	*	-0.24181	-0.21896	0.803355
16.6	0.044234	0.2767	0.766719	13.7	*	-0.26563	-0.24112	0.785748
16.8	0.044296	0.2800	0.754504	13.9	*	-0.28169	-0.26328	0.768527
17	0.044374	0.2833	0.739073	14.1	*	-0.30236	-0.28544	0.751683
17.2	0.044458	0.2867	0.722356	14.3	*	-0.32524	-0.3076	0.735209
17.4	0.044561	0.2900	0.702103	14.5	*	-0.35368	-0.32976	0.719095
17.6	0.044624	0.2933	0.689725	14.7		-0.37146	-0.35192	0.703335
17.8	0.044726	0.2967	0.669474	14.9		-0.40126	-0.37408	0.687921
18	0.044808	0.3000	0.653239	15.1		-0.42581	-0.39624	0.672844
18.2	0.04488	0.3033	0.639095	15.3		-0.4477	-0.4184	0.658097
18.4	0.044977	0.3067	0.619806	15.5		-0.47835	-0.44056	0.643674
18.6	0.045027	0.3100	0.61	15.7		-0.4943	-0.46272	0.629567
18.8	0.045145	0.3133	0.586694	15.9		-0.53325	-0.48488	0.615769
19	0.045206	0.3167	0.574638	16.1		-0.55401	-0.50704	0.602273
19.2	0.04528	0.3200	0.560012	16.3		-0.5798	-0.5292	0.589073
19.4	0.045353	0.3233	0.545545	16.5		-0.60597	-0.55137	0.576163
19.6	0.045441	0.3267	0.528186	16.7		-0.63831	-0.57353	0.563535
19.8	0.045463	0.3300	0.523846	16.9		-0.64656	-0.59569	0.551184
20	0.045569	0.3333	0.502789	17.1		-0.68759	-0.61785	0.539104
20.2	0.045658	0.3367	0.485269	17.3		-0.72305	-0.64001	0.527289
21.2	0.045948	0.3533	0.428045	18.3		-0.84853	-0.75081	0.471985
22.2	0.046229	0.3700	0.372431	19.3		-0.9877	-0.86161	0.422481
23.2	0.04648	0.3867	0.322763	20.3		-1.13084	-0.97241	0.378169
24.2	0.046675	0.4033	0.284346	21.3		-1.25756	-1.08322	0.338505
25.2	0.046846	0.4200	0.250431	22.3		-1.38457	-1.19402	0.303002
26.2	0.047057	0.4367	0.208798	23.3		-1.56639	-1.30482	0.271221
27.2	0.047211	0.4533	0.178419	24.3		-1.72362	-1.41562	0.242775
28.2	0.047314	0.4700	0.158006	25.3		-1.84512	-1.52642	0.217311
29.2	0.047455	0.4867	0.130198	26.3		-2.0387	-1.63723	0.194519
30.2	0.047542	0.5033	0.113	27.3		-2.18037	-1.74803	0.174117

5	0.033881	0.0833	2.812751	2.1	*	1.034163	1.044185	2.841081
5.1	0.033959	0.0850	2.79732	2.2	*	1.028662	1.033105	2.809775
5.2	0.034127	0.0867	2.764209	2.3	*	1.016755	1.022024	2.778814
5.3	0.034289	0.0883	2.732061	2.4	*	1.005056	1.010944	2.748194
5.4	0.034443	0.0900	2.701682	2.5	*	0.993874	0.999864	2.717912
5.5	0.034598	0.0917	2.67098	2.6	*	0.982446	0.988784	2.687963
5.6	0.034744	0.0933	2.642208	2.7	*	0.971615	0.977704	2.658344
5.7	0.034814	0.0950	2.628385	2.8	*	0.96637	0.966623	2.629052
5.8	0.034988	0.0967	2.593988	2.9	*	0.953197	0.955543	2.600082
5.9	0.035122	0.0983	2.567466	3	*	0.94292	0.944463	2.571432
6	0.035288	0.1000	2.534676	3.1	*	0.930066	0.933383	2.543097
6.1	0.035425	0.1017	2.50767	3.2	*	0.919354	0.922302	2.515075
6.2	0.035513	0.1033	2.490312	3.3	*	0.912408	0.911222	2.487361
6.3	0.035648	0.1050	2.463628	3.4	*	0.901635	0.900142	2.459953
6.4	0.035787	0.1067	2.436142	3.5	*	0.890416	0.889062	2.432846
6.5	0.035936	0.1083	2.406727	3.6	*	0.878268	0.877982	2.406039
6.6	0.036086	0.1100	2.376992	3.7	*	0.865836	0.866901	2.379526
6.7	0.036212	0.1117	2.352077	3.8	*	0.855299	0.855821	2.353306
6.8	0.036296	0.1133	2.335522	3.9	*	0.848235	0.844741	2.327375
6.9	0.036429	0.1150	2.30916	4	*	0.836884	0.833661	2.301729
7	0.036553	0.1167	2.284727	4.1	*	0.826247	0.822581	2.276367
7.1	0.036695	0.1183	2.256599	4.2	*	0.813859	0.8115	2.251283
7.2	0.036822	0.1200	2.231524	4.3	*	0.802685	0.80042	2.226476
7.3	0.036968	0.1217	2.202591	4.4	*	0.789634	0.78934	2.201943
7.4	0.037042	0.1233	2.188125	4.5	*	0.783045	0.77826	2.177679
7.5	0.037155	0.1250	2.165783	4.6	*	0.772782	0.76718	2.153683
7.6	0.037286	0.1267	2.139743	4.7	*	0.760686	0.756099	2.129952
7.7	0.037404	0.1283	2.116435	4.8	*	0.749733	0.745019	2.106482
7.8	0.037534	0.1300	2.090877	4.9	*	0.737584	0.733939	2.08327
7.9	0.037608	0.1317	2.076251	5	*	0.730564	0.722859	2.060315
8	0.037706	0.1333	2.056802	5.1	*	0.721153	0.711778	2.037612
8.1	0.03784	0.1350	2.030279	5.2	*	0.708173	0.700698	2.015159
8.2	0.037969	0.1367	2.004883	5.3	*	0.695586	0.689618	1.992954
8.3	0.038088	0.1383	1.981415	5.4	*	0.683811	0.678538	1.970994
8.400001	0.038199	0.1400	1.959395	5.500001	*	0.672636	0.667458	1.949275
8.[illegible]	0.038247	0.1417	1.949911	5.6	*	0.667784	0.656377	1.927796
8.6	0.038378	0.1433	1.924032	5.7	*	0.654423	0.645297	1.906554
8.7	0.038488	0.1450	1.902332	5.8	*	0.643081	0.634217	1.885545
8.8	0.038598	0.1467	1.880472	5.9	*	0.631523	0.623137	1.864768
8.900001	0.038721	0.1483	1.856202	6.000001	*	0.618532	0.612057	1.84422
9	0.038772	0.1500	1.846073	6.1	*	0.613061	0.600976	1.823899
9.1	0.038888	0.1517	1.823249	6.2	*	0.60062	0.589896	1.803801
9.2	0.038986	0.1533	1.80396	6.3	*	0.589985	0.578816	1.783925
9.3	0.039087	0.1550	1.78387	6.4	*	0.578785	0.567736	1.764268
9.400001	0.039187	0.1567	1.764097	6.500001	*	0.567639	0.556655	1.744827
9.5	0.039306	0.1583	1.74063	6.6	*	0.554247	0.545575	1.725601
9.6	0.039329	0.1600	1.736128	6.7	*	0.551658	0.534495	1.706586
9.7	0.039463	0.1617	1.709607	6.8	*	0.536263	0.523415	1.687781
9.8	0.039565	0.1633	1.689356	6.9	*	0.524347	0.512335	1.669184
9.900001	0.039673	0.1650	1.668138	7.000001	*	0.511708	0.501254	1.650791
10	0.039682	0.1667	1.66637	7.1	*	0.510647	0.490174	1.632601
10.2	0.039865	0.1700	1.630204	7.3	*	0.488705	0.468014	1.59682
10.4	0.040025	0.1733	1.598538	7.5	*	0.469089	0.445853	1.561823
10.6	0.040261	0.1767	1.551925	7.7	*	0.439496	0.423693	1.527593
10.8	0.040437	0.1800	1.517043	7.9	*	0.416763	0.401533	1.494113
11	0.040585	0.1833	1.487789	8.1	*	0.397291	0.379372	1.461367

RAW DATA Note: 1 ft. head = 0.00506 volts
Induced head = final head reading-transducer head at time t

Time (sec.)	Transducer Head (Volts)	Time (min.)	Induced head Value Y (ft)	Translated Time (sec.)	Data used in linear fit	Ln (Y)	Ln (Yt) (theor.)	Yt
0.1	0.028855	0.0017	3.805951	-2.8		1.336566	1.587115	4.889622
0.2	0.028859	0.0033	3.805308	-2.7		1.336397	1.576035	4.835743
0.3	0.028862	0.0050	3.804664	-2.6		1.336228	1.564955	4.782458
0.4	0.028873	0.0067	3.802415	-2.5		1.335636	1.553874	4.72976
0.5	0.028866	0.0083	3.803862	-2.4		1.336017	1.542794	4.677642
0.6	0.028872	0.0100	3.802735	-2.3		1.335721	1.531714	4.626099
0.7	0.028859	0.0117	3.805308	-2.2		1.336397	1.520634	4.575124
0.8	0.028865	0.0133	3.804022	-2.1		1.336059	1.509554	4.52471
0.9	0.028877	0.0150	3.801771	-2		1.335467	1.498473	4.474852
1	0.028873	0.0167	3.802575	-1.9		1.335678	1.487393	4.425544
1.1	0.028868	0.0183	3.803379	-1.8		1.33589	1.476313	4.376778
1.2	0.028871	0.0200	3.802897	-1.7		1.335763	1.465233	4.32855
1.3	0.028881	0.0217	3.800806	-1.6		1.335213	1.454152	4.280854
1.4	0.028876	0.0233	3.801933	-1.5		1.33551	1.443072	4.233683
1.5	0.028881	0.0250	3.800968	-1.4		1.335256	1.431992	4.187032
1.6	0.028866	0.0267	3.803862	-1.3		1.336017	1.420912	4.140895
1.7	0.02889	0.0283	3.7992	-1.2		1.33479	1.409832	4.095266
1.8	0.028881	0.0300	3.800806	-1.1		1.335213	1.398751	4.05014
1.9	0.028876	0.0317	3.801933	-1		1.33551	1.387671	4.005511
2	0.028872	0.0333	3.802735	-0.9		1.335721	1.376591	3.961374
2.1	0.028869	0.0350	3.803217	-0.8		1.335847	1.365511	3.917724
2.2	0.028875	0.0367	3.802093	-0.7		1.335552	1.354431	3.874554
2.3	0.02887	0.0383	3.803057	-0.6		1.335805	1.34335	3.83186
2.4	0.028877	0.0400	3.801611	-0.5		1.335425	1.33227	3.789637
2.5	0.029327	0.0417	3.712723	-0.4		1.311766	1.32119	3.747879
2.6	0.033033	0.0433	2.980401	-0.3		1.092058	1.31011	3.706581
2.7	0.030547	0.0450	3.471617	-0.2		1.24462	1.29903	3.665738
2.8	0.030221	0.0467	3.536071	-0.1		1.263016	1.287949	3.625345
2.9	0.030158	0.0483	3.548449	0	*	1.26651	1.276869	3.585397
3	0.030294	0.0500	3.521605	0.1	*	1.258917	1.265789	3.545889
3.1	0.030492	0.0517	3.482545	0.2	*	1.247763	1.254709	3.506817
3.2	0.030702	0.0533	3.441075	0.3	*	1.235784	1.243629	3.468175
3.3	0.030934	0.0550	3.395265	0.4	*	1.222382	1.232548	3.429959
3.4	0.03116	0.0567	3.350419	0.5	*	1.209085	1.221468	3.392164
3.5	0.03127	0.0583	3.328719	0.6	*	1.202588	1.210388	3.354786
3.6	0.031476	0.0600	3.288053	0.7	*	1.190296	1.199308	3.317819
3.7	0.031683	0.0617	3.247065	0.8	*	1.177752	1.188227	3.28126
3.8	0.031899	0.0633	3.20447	0.9	*	1.164547	1.177147	3.245104
3.9	0.032084	0.0650	3.16782	1	*	1.153044	1.166067	3.209346
4	0.032182	0.0667	3.148534	1.1	*	1.146937	1.154987	3.173982
4.1	0.032374	0.0683	3.110599	1.2	*	1.134815	1.143907	3.139007
4.2	0.032563	0.0700	3.073308	1.3	*	1.122755	1.132826	3.104419
4.3	0.032751	0.0717	3.036016	1.4	*	1.110546	1.121746	3.070211
4.4	0.032924	0.0733	3.001939	1.5	*	1.099258	1.110666	3.03638
4.5	0.033099	0.0750	2.967221	1.6	*	1.087626	1.099586	3.002922
4.6	0.033195	0.0767	2.948253	1.7	*	1.081213	1.088506	2.969833
4.7	0.033365	0.0783	2.91466	1.8	*	1.069753	1.077425	2.937108
4.8	0.033548	0.0800	2.878494	1.9	*	1.057267	1.066345	2.904744
4.9	0.033706	0.0817	2.84731	2	*	1.046375	1.055265	2.872736

LENZ OIL
MW3D RISING HEAD PRESSURE TEST DATA (5-30-91)

THIS SPREADSHEET CALCULATES HYDRAULIC CONDUCTIVITY BASED ON THE BOUWER AND RICE (1976) METHOD. AIR PRESSURE WAS USED TO PUSH THE WATER DOWN IN THE WELL AND RECOVERY RATE WAS MEASURED.

THE FOLLOWING STEPS ARE REQUIRED TO CALCULATE HYDRAULIC CONDUCTIVITY:
1.) IMPORT HERMIT DATA INTO COLUMNS UNDER RAW DATA
2.) DECIDE WHICH DATA IS APPROPRIATE, CHOOSE THE INITIAL INDUCED HEAD, TRANSLATE TIME VALUES
3.) DO THE REGRESSION CALCULATION FOR LEAST SQUARES FIT
4.) CHOOSE APPROPRIATE SLUG TEST PARAMETERS
5.) CHOOSE A VALUE FOR TIME t AND ITS CORRESPONDING Yt

Note: Values of time are translated to the first meaningful data point. The initial theoretical induced head (Yo) is chosen on the regression line at the translated time t=0. (see Pandit and and Miner, 1986. Ground Water. V. 24, No. 6, p. 743-749).

LINEAR REGRESSION DATA

Regression Output:

Constant	1.276869
Std Err of Y Est	0.011221
R Squared	0.999391
No. of Observations	109
Degrees of Freedom	107
X Coefficient(s)	-0.1108
Std Err of Coef.	0.000264

Regression line equation:

Ln Y = -0.1108 t+1.276869

Ln Y intercept: 1.276869

SLUG TEST PARAMETERS

Length of slug (Ls)=		ft.
Slug diameter (Ds)=		ft.
Initial theoret. induced head (Yo)=	3.585397	ft.
Actual initial induced head (Ho)=	3.548449	ft.
Radius of developed zone (rw)=	0.25	ft.
Radius of well casing (rc)=	0.0833	ft.
Effective length of inflow (L)=	5	ft.
Saturated thickness of aquifer (D)=	175	ft.
L/rw=	20	
A=	2.1686	
Constants based on L/rw: B=	0.318	
C=	1.6788	
Distance between top of aquifer and screen bottom (H)=	36.4	ft.
D > H Ln (R/rw)=	2.35474	
D = H Ln (R/rw)=	3.280999	
Note: Ln((D-H)/rw)=	6	

If Ln((D-H)/rw)>6, set Ln((D-H)/rw)=6

where:

D > H Ln(R/rw)=[1.1/Ln(H/rw)+(A+BLn[(D-H)/rw])/L/rw]**-1

D = H Ln(R/rw)=[1.1/Ln(H/rw)+C/(L/rw)]**-1

K=rc**2*Ln(R/rw)*Ln(Yo/Yt))/2Lt

Initial theoret. induced head (Yo):
Induced head (Yt) at time t:
Ordered pair on regression line (t,Yt):

Note: Choose Yt and t

Yo = 3.585397 ft.
Yt = 3.28126 ft.
t = 0.8 sec.

RADIUS OF INFLUENCE

R= 2.633848 ft.

CALCULATION OF HYDRAULIC CONDUCTIVITY

K= 0.005518 cm/sec
K= 116.9854 gal/day-ft**2

RAW DATA

Time (min.)	Transducer Head (ft.)	Translated Time (min.)	Induced head Value Y (ft)	Translated Time (sec.)	Data used in linear fit	Ln (Y)	Ln (Yt) (theor.)	Yt
0	-3.89	-0.02	3.89	-1.2		1.358409	0.614962	1.849587
0.0033	-6.08	-0.0167	6.08	-1.002		1.805005	0.586245	1.797227
0.0066	-1.95	-0.0134	1.95	-0.804		0.667829	0.557527	1.746348
0.0099	-1.67	-0.0101	1.67	-0.606		0.512824	0.528809	1.69691
0.0133	-1.69	-0.0067	1.69	-0.402		0.524729	0.499221	1.647438
0.0166	-1.66	-0.0034	1.66	-0.204		0.506818	0.470503	1.6008
0.02	-1.58	0	1.58	0	*	0.457425	0.440915	1.554129
0.0233	-1.53	0.0033	1.53	0.198	*	0.425268	0.412198	1.510133
0.0266	-1.46	0.0066	1.46	0.396	*	0.378436	0.38348	1.467382
0.03	-1.43	0.01	1.43	0.6	*	0.357674	0.353892	1.424601
0.0333	-1.38	0.0133	1.38	0.798	*	0.322083	0.325174	1.384272
0.05	-1.18	0.03	1.18	1.8	*	0.165514	0.179845	1.197032
0.0666	-1.02	0.0466	1.02	2.796	*	0.019803	0.035386	1.036019
0.0833	-0.88	0.0633	0.88	3.798	*	-0.12783	-0.10994	0.895885
0.1	-0.77	0.08	0.77	4.8	*	-0.26136	-0.25527	0.774705
0.1166	-0.69	0.0966	0.69	5.796	*	-0.37106	-0.39973	0.6705
0.1333	-0.63	0.1133	0.63	6.798		-0.46204	-0.54506	0.579806
0.15	-0.58	0.13	0.58	7.8		-0.54473	-0.69039	0.50138
0.1666	-0.54	0.1466	0.54	8.796		-0.61619	-0.83485	0.43394
0.1833	-0.51	0.1633	0.51	9.798		-0.67334	-0.98018	0.375244
0.2	-0.49	0.18	0.49	10.8		-0.71335	-1.12551	0.324488
0.2166	-0.47	0.1966	0.47	11.796		-0.75502	-1.26997	0.280841
0.2333	-0.45	0.2133	0.45	12.798		-0.79851	-1.4153	0.242854
0.25	-0.43	0.23	0.43	13.8		-0.84397	-1.56063	0.210005
0.2666	-0.41	0.2466	0.41	14.796		-0.8916	-1.70508	0.181757
0.2833	-0.4	0.2633	0.4	15.798		-0.91629	-1.85041	0.157172
0.3	-0.38	0.28	0.38	16.8		-0.96758	-1.99574	0.135913
0.3166	-0.37	0.2966	0.37	17.796		-0.99425	-2.1402	0.117631
0.3333	-0.35	0.3133	0.35	18.798		-1.04982	-2.28553	0.10172
0.4167	-0.3	0.3967	0.3	23.802		-1.20397	-3.01131	0.049227
0.5	-0.26	0.48	0.26	28.8		-1.34707	-3.73621	0.023844
0.5833	-0.22	0.5633	0.22	33.798		-1.51413	-4.46112	0.011549
0.6667	-0.19	0.6467	0.19	38.802		-1.66073	-5.1869	0.005589
0.75	-0.16	0.73	0.16	43.8		-1.83258	-5.9118	0.002707
0.8333	-0.15	0.8133	0.15	48.798		-1.89712	-6.63671	0.001311
0.9167	-0.13	0.8967	0.13	53.802		-2.04022	-7.36248	0.000635
1	-0.11	0.98	0.11	58.8		-2.20727	-8.08739	0.000307
1.0833	-0.1	1.0633	0.1	63.798		-2.30259	-8.8123	0.000149

LENZ OIL

MW3S DUPLICATE FALLING HEAD SLUG TEST DATA (5-23-91)

THIS SPREADSHEET CALCULATES HYDRAULIC CONDUCTIVITY BASED ON THE BOUWER AND RICE (1976) METHOD.

THE FOLLOWING STEPS ARE REQUIRED TO CALCULATE HYDRAULIC CONDUCTIVITY:

1.) IMPORT HERMIT DATA INTO COLUMNS UNDER RAW DATA
2.) DECIDE WHICH DATA IS APPROPRIATE, CHOOSE THE INITIAL INDUCED HEAD, TRANSLATE TIME VALUES
3.) DO THE REGRESSION CALCULATION FOR LEAST SQUARES FIT
4.) CHOOSE APPROPRIATE SLUG TEST PARAMETERS
5.) CHOOSE A VALUE FOR TIME t AND ITS CORRESPONDING Yt

Note: Values of time are translated to the first meaningful data point. The initial theoretical induced head (Yo) is chosen on the regression line at the translated time t=0. (see Pandit and and Miner, 1986. Ground Water. V. 24, No. 6, p. 743-749).

LINEAR REGRESSION DATA

Regression Output:

Constant	0.440915
Std Err of Y Est	0.016278
R Squared	0.997441
No. of Observations	10
Degrees of Freedom	8
X Coefficient(s)	-0.14504
Std Err of Coef.	0.002597

Regression line equation:

Ln Y = -0.14504 t+0.440915

Ln Y intercept: 0.440915

SLUG TEST PARAMETERS

Length of slug (Ls)=	3	ft.
Slug diameter (Ds)=	0.14	ft.
Initial theoret. induced head (Yo)=	1.554129	ft.
Actual initial induced head (Ho)=	1.58	ft.
Radius of developed zone (rw)=	0.25	ft.
Radius of well casing (rc)=	0.0833	ft.
Effective length of inflow (L)=	5	ft.
Saturated thickness of aquifer (D)=	175	ft.
L/rw=	20	
A=	2.1686	
Constants based on L/rw: B=	0.318	
C=	1.6788	
Distance between top of aquifer and screen bottom (H)=	8.8	ft.
D > H Ln (R/rw)=	1.950352	
D = H Ln (R/rw)=	2.545579	
Note: Ln((D-H)/rw)=	6	

If Ln((D-H)/rw)>6, set Ln((D-H)/rw)=6

where:

D > H Ln(R/rw)=[1.1/Ln(H/rw)+(A+BLn[(D-H)/rw])/L/rw]**-1

D = H Ln(R/rw)=[1.1/Ln(H/rw)+C/(L/rw)]**-1

K=rc**2*Ln(R/rw)*Ln(Yo/Yt))/2Lt

Initial theoret. induced head (Yo):
Induced head (Yt) at time t:
Ordered pair on regression line (t,Yt):

Note: Choose Yt and t

Yo = 1.554129 ft.
Yt = 1.197032 ft.
t = 1.8 sec.

RADIUS OF INFLUENCE

R= 1.75779 ft.

CALCULATION OF HYDRAULIC CONDUCTIVITY

K= 0.005983 cm/sec
K= 126.835 gal/day-ft**2

RAW DATA

Time (min.)	Transducer Head (ft.)	Translated Time (min.)	Induced head Value Y (ft)	Translated Time (sec.)	Data used in linear fit	Ln (Y)	Ln (Yt) (theor.)	Yt
	-4.83	-0.0133	4.83	-0.798		1.574846	0.616343	1.852142
0.0033	-5.24	-0.01	5.24	-0.6		1.656321	0.585605	1.796077
0.0066	-1.74	-0.0067	1.74	-0.402		0.553885	0.554867	1.741708
0.0099	-1.73	-0.0034	1.73	-0.204		0.548121	0.524128	1.688986
0.0133	-1.67	0	1.67	0	*	0.512824	0.492459	1.636335
0.0166	-1.59	0.0033	1.59	0.198	*	0.463734	0.461721	1.586802
0.02	-1.54	0.0067	1.54	0.402	*	0.431782	0.430051	1.537336
0.0233	-1.5	0.01	1.5	0.6	*	0.405465	0.399313	1.490801
0.0266	-1.42	0.0133	1.42	0.798	*	0.350657	0.368575	1.445673
0.03	-1.4	0.0167	1.4	1.002	*	0.336472	0.336906	1.400607
0.0333	-1.35	0.02	1.35	1.2	*	0.300105	0.306168	1.35821
0.05	-1.15	0.0367	1.15	2.202	*	0.139762	0.150615	1.162548
0.0666	-0.99	0.0533	0.99	3.198	*	-0.01005	-0.00401	0.996001
0.0833	-0.85	0.07	0.85	4.2	*	-0.16252	-0.15956	0.852518
0.1	-0.74	0.0867	0.74	5.202	*	-0.30111	-0.31511	0.729706
0.1166	-0.66	0.1033	0.66	6.198		-0.41552	-0.46974	0.625168
0.1333	-0.6	0.12	0.6	7.2		-0.51083	-0.62529	0.535107
0.15	-0.56	0.1367	0.56	8.202		-0.57982	-0.78084	0.45802
0.1666	-0.54	0.1533	0.54	9.198		-0.61619	-0.93546	0.392404
0.1833	-0.49	0.17	0.49	10.2		-0.71335	-1.09102	0.335875
0.2	-0.47	0.1867	0.47	11.202		-0.75502	-1.24657	0.287489
0.2166	-0.45	0.2033	0.45	12.198		-0.79851	-1.40119	0.246303
0.2333	-0.43	0.22	0.43	13.2		-0.84397	-1.55674	0.210821
0.25	-0.42	0.2367	0.42	14.202		-0.8675	-1.7123	0.180451
0.2666	-0.4	0.2533	0.4	15.198		-0.91629	-1.86692	0.154599
0.2833	-0.38	0.27	0.38	16.2		-0.96758	-2.02247	0.132328
0.3	-0.37	0.2867	0.37	17.202		-0.99425	-2.17803	0.113265
0.3166	-0.35	0.3033	0.35	18.198		-1.04982	-2.33265	0.097038
0.3333	-0.34	0.32	0.34	19.2		-1.07881	-2.4882	0.083059
0.4167	-0.29	0.4034	0.29	24.204		-1.23787	-3.26504	0.038196
0.5	-0.25	0.4867	0.25	29.202		-1.38629	-4.04094	0.017581
0.5833	-0.21	0.57	0.21	34.2		-1.56065	-4.81684	0.008092
0.6667	-0.18	0.6534	0.18	39.204		-1.7148	-5.59368	0.003721
0.75	-0.16	0.7367	0.16	44.202		-1.83258	-6.36958	0.001713
0.8333	-0.13	0.82	0.13	49.2		-2.04022	-7.14548	0.000788
0.9167	-0.12	0.9034	0.12	54.204		-2.12026	-7.92232	0.000363
1	-0.1	0.9867	0.1	59.202		-2.30259	-8.69822	0.000167

LENZ OIL

MW3S RISING HEAD SLUG TEST DATA (5-23-91)

THIS SPREADSHEET CALCULATES HYDRAULIC CONDUCTIVITY BASED ON THE BOUWER AND RICE (1976) METHOD.

THE FOLLOWING STEPS ARE REQUIRED TO CALCULATE HYDRAULIC CONDUCTIVITY:

1.) IMPORT HERMIT DATA INTO COLUMNS UNDER RAW DATA
2.) DECIDE WHICH DATA IS APPROPRIATE, CHOOSE THE INITIAL INDUCED HEAD, TRANSLATE TIME VALUES
3.) DO THE REGRESSION CALCULATION FOR LEAST SQUARES FIT
4.) CHOOSE APPROPRIATE SLUG TEST PARAMETERS
5.) CHOOSE A VALUE FOR TIME t AND ITS CORRESPONDING Yt

Note: Values of time are translated to the first meaningful data point. The initial theoretical induced head (Yo) is chosen on the regression line at the translated time t=0. (see Pandit and and Miner, 1986. Ground Water. V. 24, No. 6, p. 743-749).

LINEAR REGRESSION DATA

Regression Output:

Constant	0.492459
Std Err of Y Est	0.011435
R Squared	0.998406
No. of Observations	11
Degrees of Freedom	9
X Coefficient(s)	-0.15524
Std Err of Coef.	0.002067

Regression line equation:

Ln Y = -0.15524 t+0.492459

Ln Y intercept: 0.492459

SLUG TEST PARAMETERS

Length of slug (Ls)=	3	ft.
Slug diameter (Ds)=	0.14	ft.
Initial theoret. induced head (Yo)=	1.67	ft.
Actual initial induced head (Ho)=	1.636335	ft.
Radius of developed zone (rw)=	0.25	ft.
Radius of well casing (rc)=	0.0833	ft.
Effective length of inflow (L)=	5	ft.
Saturated thickness of aquifer (D)=	175	ft.
L/rw=	20	
A=	2.1686	
Constants based on L/rw: B=	0.318	
C=	1.6788	
Distance between top of aquifer and screen bottom (H)=	8.8	ft.
D > H Ln (R/rw)=	1.950352	
D = H Ln (R/rw)=	2.545579	
Note: Ln((D-H)/rw)=	6	

If Ln((D-H)/rw)>6, set Ln((D-H)/rw)=6

Initial theoret. induced head (Yo):
Induced head (Yt) at time t:
Ordered pair on regression line (t,Yt):

Note: Choose Yt and t

Yo = 1.636335 ft.
Yt = 1.445673 ft.
t = 0.798 sec.

RADIUS OF INFLUENCE

R= 1.75779 ft.

CALCULATION OF HYDRAULIC CONDUCTIVITY

K= 0.006404 cm/sec
K= 135.7579 gal/day-ft**2

where:

D > H Ln(R/rw)=[1.1/Ln(H/rw)+(A+BLn[(D-H)/rw])/L/rw]**-1

D = H Ln(R/rw)=[1.1/Ln(H/rw)+C/(L/rw)]**-1

K=rc**2*Ln(R/rw)*Ln(Yo/Yt))/2Lt

31.2	0.047627	0.5200	0.096123	28.3	-2.34213	-1.85883	0.155855
32.2	0.0477	0.5367	0.081816	29.3	-2.50328	-1.96963	0.139508
33.2	0.047752	0.5533	0.071368	30.3	-2.63991	-2.08043	0.124876
34.2	0.047819	0.5700	0.058188	31.3	-2.84408	-2.19124	0.111778
35.2	0.047874	0.5867	0.047257	32.3	-3.05216	-2.30204	0.100055
36.2	0.047922	0.6033	0.037935	33.3	-3.27189	-2.41284	0.089561
37.2	0.047938	0.6200	0.034719	34.3	-3.36046	-2.52364	0.080167
38.2	0.047973	0.6367	0.027808	35.3	-3.58242	-2.63444	0.071759
39.2	0.048001	0.6533	0.022182	36.3	-3.80848	-2.74525	0.064232
40.2	0.048027	0.6700	0.017038	37.3	-4.07234	-2.85605	0.057495
41.2	0.048049	0.6867	0.0127	38.3	-4.36618	-2.96685	0.051465
42.2	0.048042	0.7033	0.014146	39.3	-4.25831	-3.07765	0.046067
43.2	0.048062	0.7200	0.010126	40.3	-4.5926	-3.18846	0.041236
44.2	0.048062	0.7367	0.010126	41.3	-4.5926	-3.29926	0.036911
45.2	0.04807	0.7533	0.00852	42.3	-4.76537	-3.41006	0.033039
46.2	0.048094	0.7700	0.003858	43.3	-5.55768	-3.52086	0.029574
47.2	0.048096	0.7867	0.003375	44.3	-5.69121	-3.63166	0.026472
48.2	0.04809	0.8033	0.004662	45.3	-5.3683	-3.74247	0.023696
49.2	0.04808	0.8200	0.006591	46.3	-5.02206	-3.85327	0.02121
50.2	0.048097	0.8367	0.003215	47.3	-5.7398	-3.96407	0.018986

11.2	0.0408	0.1867	1.445356	8.3	*	0.368355	0.357212	1.429339
11.4	0.040906	0.1900	1.424458	8.5	*	0.353792	0.335051	1.398012
11.6	0.041099	0.1933	1.386364	8.7	*	0.326684	0.312891	1.367372
11.8	0.04125	0.1967	1.356466	8.9	*	0.304883	0.290731	1.337404
12	0.041383	0.2000	1.330107	9.1	*	0.285259	0.26857	1.308093
12.2	0.041591	0.2033	1.289119	9.3	*	0.253959	0.24641	1.279424
12.4	0.041722	0.2067	1.263077	9.5	*	0.233551	0.224249	1.251383
12.6	0.041866	0.2100	1.234789	9.7	*	0.2109	0.202089	1.223957
12.8	0.041988	0.2133	1.210516	9.9	*	0.191047	0.179928	1.197132
13	0.042124	0.2167	1.183674	10.1	*	0.168623	0.157768	1.170895
13.2	0.042249	0.2200	1.159081	10.3	*	0.147627	0.135608	1.145232
13.4	0.042432	0.2233	1.122915	10.5	*	0.115928	0.113447	1.120133
13.6	0.042542	0.2267	1.101053	10.7	*	0.096267	0.091287	1.095583
13.8	0.042652	0.2300	1.079356	10.9	*	0.076364	0.069126	1.071572
14	0.042829	0.2333	1.044474	11.1	*	0.043514	0.046966	1.048086
14.2	0.04291	0.2367	1.028401	11.3	*	0.028005	0.024806	1.025116
14.4	0.043056	0.2400	0.999468	11.5	*	-0.00053	0.002645	1.002649
14.6	0.043161	0.2433	0.978733	11.7	*	-0.0215	-0.01952	0.980674
14.8	0.043281	0.2467	0.955105	11.9	*	-0.04593	-0.04168	0.959181
15	0.043427	0.2500	0.926172	12.1	*	-0.0767	-0.06384	0.938159
15.2	0.043516	0.2533	0.90865	12.3	*	-0.0958	-0.086	0.917597
15.4	0.043624	0.2567	0.887273	12.5	*	-0.1196	-0.10816	0.897487
15.6	0.043744	0.2600	0.863644	12.7	*	-0.14659	-0.13032	0.877817
15.8	0.043833	0.2633	0.845964	12.9	*	-0.16728	-0.15248	0.858578
16	0.043969	0.2667	0.819121	13.1	*	-0.19952	-0.17464	0.839761
16.2	0.044062	0.2700	0.800796	13.3	*	-0.22215	-0.1968	0.821356
16.4	0.04414	0.2733	0.785206	13.5	*	-0.24181	-0.21896	0.803355
16.6	0.044234	0.2767	0.766719	13.7	*	-0.26563	-0.24112	0.785748
16.8	0.044296	0.2800	0.754504	13.9	*	-0.28169	-0.26328	0.768527
17	0.044374	0.2833	0.739073	14.1	*	-0.30236	-0.28544	0.751683
17.2	0.044458	0.2867	0.722356	14.3	*	-0.32524	-0.3076	0.735209
17.4	0.044561	0.2900	0.702103	14.5	*	-0.35368	-0.32976	0.719095
17.6	0.044624	0.2933	0.689725	14.7		-0.37146	-0.35192	0.703335
17.8	0.044726	0.2967	0.669474	14.9		-0.40126	-0.37408	0.687921
18	0.044808	0.3000	0.653239	15.1		-0.42581	-0.39624	0.672844
18.2	0.04488	0.3033	0.639095	15.3		-0.4477	-0.4184	0.658097
18.4	0.044977	0.3067	0.619806	15.5		-0.47835	-0.44056	0.643674
18.6	0.045027	0.3100	0.61	15.7		-0.4943	-0.46272	0.629567
18.8	0.045145	0.3133	0.586694	15.9		-0.53325	-0.48488	0.615769
19	0.045206	0.3167	0.574638	16.1		-0.55401	-0.50704	0.602273
19.2	0.04528	0.3200	0.560012	16.3		-0.5798	-0.5292	0.589073
19.4	0.045353	0.3233	0.545545	16.5		-0.60597	-0.55137	0.576163
19.6	0.045441	0.3267	0.528186	16.7		-0.63831	-0.57353	0.563535
19.8	0.045463	0.3300	0.523846	16.9		-0.64656	-0.59569	0.551184
20	0.045569	0.3333	0.502789	17.1		-0.68759	-0.61785	0.539104
20.2	0.045658	0.3367	0.485269	17.3		-0.72305	-0.64001	0.527289
21.2	0.045948	0.3533	0.428045	18.3		-0.84853	-0.75081	0.471985
22.2	0.046229	0.3700	0.372431	19.3		-0.9877	-0.86161	0.422481
23.2	0.04648	0.3867	0.322763	20.3		-1.13084	-0.97241	0.378169
24.2	0.046675	0.4033	0.284346	21.3		-1.25756	-1.08322	0.338505
25.2	0.046846	0.4200	0.250431	22.3		-1.38457	-1.19402	0.303002
26.2	0.047057	0.4367	0.208798	23.3		-1.56639	-1.30482	0.271221
27.2	0.047211	0.4533	0.178419	24.3		-1.72362	-1.41562	0.242775
28.2	0.047314	0.4700	0.158006	25.3		-1.84512	-1.52642	0.217311
29.2	0.047455	0.4867	0.130198	26.3		-2.0387	-1.63723	0.194519
30.2	0.047542	0.5033	0.113	27.3		-2.18037	-1.74803	0.174117

5	0.033881	0.0833	2.812751	2.1	*	1.034163	1.044185	2.841081
5.1	0.033959	0.0850	2.79732	2.2	*	1.028662	1.033105	2.809775
5.2	0.034127	0.0867	2.764209	2.3	*	1.016755	1.022024	2.778814
5.3	0.034289	0.0883	2.732061	2.4	*	1.005056	1.010944	2.748194
5.4	0.034443	0.0900	2.701682	2.5	*	0.993874	0.999864	2.717912
5.5	0.034598	0.0917	2.67098	2.6	*	0.982446	0.988784	2.687963
5.6	0.034744	0.0933	2.642208	2.7	*	0.971615	0.977704	2.658344
5.7	0.034814	0.0950	2.628385	2.8	*	0.96637	0.966623	2.629052
5.8	0.034988	0.0967	2.593988	2.9	*	0.953197	0.955543	2.600082
5.9	0.035122	0.0983	2.567466	3	*	0.94292	0.944463	2.571432
6	0.035288	0.1000	2.534676	3.1	*	0.930066	0.933383	2.543097
6.1	0.035425	0.1017	2.50767	3.2	*	0.919354	0.922302	2.515075
6.2	0.035513	0.1033	2.490312	3.3	*	0.912408	0.911222	2.487361
6.3	0.035648	0.1050	2.463628	3.4	*	0.901635	0.900142	2.459953
6.4	0.035787	0.1067	2.436142	3.5	*	0.890416	0.889062	2.432846
6.5	0.035936	0.1083	2.406727	3.6	*	0.878268	0.877982	2.406039
6.6	0.036086	0.1100	2.376992	3.7	*	0.865836	0.866901	2.379526
6.7	0.036212	0.1117	2.352077	3.8	*	0.855299	0.855821	2.353306
6.8	0.036296	0.1133	2.335522	3.9	*	0.848235	0.844741	2.327375
6.9	0.036429	0.1150	2.30916	4	*	0.836884	0.833661	2.301729
7	0.036553	0.1167	2.284727	4.1	*	0.826247	0.822581	2.276367
7.1	0.036695	0.1183	2.256599	4.2	*	0.813859	0.8115	2.251283
7.2	0.036822	0.1200	2.231524	4.3	*	0.802685	0.80042	2.226476
7.3	0.036968	0.1217	2.202591	4.4	*	0.789634	0.78934	2.201943
7.4	0.037042	0.1233	2.188125	4.5	*	0.783045	0.77826	2.177679
7.5	0.037155	0.1250	2.165783	4.6	*	0.772782	0.76718	2.153683
7.6	0.037286	0.1267	2.139743	4.7	*	0.760686	0.756099	2.129952
7.7	0.037404	0.1283	2.116435	4.8	*	0.749733	0.745019	2.106482
7.8	0.037534	0.1300	2.090877	4.9	*	0.737584	0.733939	2.08327
7.9	0.037608	0.1317	2.076251	5	*	0.730564	0.722859	2.060315
8	0.037706	0.1333	2.056802	5.1	*	0.721153	0.711778	2.037612
8.1	0.03784	0.1350	2.030279	5.2	*	0.708173	0.700698	2.015159
8.2	0.037969	0.1367	2.004883	5.3	*	0.695586	0.689618	1.992954
8.3	0.038088	0.1383	1.981415	5.4	*	0.683811	0.678538	1.970994
8.400001	0.038199	0.1400	1.959395	5.500001	*	0.672636	0.667458	1.949275
8.5	0.038247	0.1417	1.949911	5.6	*	0.667784	0.656377	1.927796
8.6	0.038378	0.1433	1.924032	5.7	*	0.654423	0.645297	1.906554
8.7	0.038488	0.1450	1.902332	5.8	*	0.643081	0.634217	1.885545
8.8	0.038598	0.1467	1.880472	5.9	*	0.631523	0.623137	1.864768
8.900001	0.038721	0.1483	1.856202	6.000001	*	0.618532	0.612057	1.84422
9	0.038772	0.1500	1.846073	6.1	*	0.613061	0.600976	1.823899
9.1	0.038888	0.1517	1.823249	6.2	*	0.60062	0.589896	1.803801
9.2	0.038986	0.1533	1.80396	6.3	*	0.589985	0.578816	1.783925
9.3	0.039087	0.1550	1.78387	6.4	*	0.578785	0.567736	1.764268
9.400001	0.039187	0.1567	1.764097	6.500001	*	0.567639	0.556655	1.744827
9.5	0.039306	0.1583	1.74063	6.6	*	0.554247	0.545575	1.725601
9.6	0.039329	0.1600	1.736128	6.7	*	0.551658	0.534495	1.706586
9.7	0.039463	0.1617	1.709607	6.8	*	0.536263	0.523415	1.687781
9.8	0.039565	0.1633	1.689356	6.9	*	0.524347	0.512335	1.669184
9.900001	0.039673	0.1650	1.668138	7.000001	*	0.511708	0.501254	1.650791
10	0.039682	0.1667	1.66637	7.1	*	0.510647	0.490174	1.632601
10.2	0.039865	0.1700	1.630204	7.3	*	0.488705	0.468014	1.59682
10.4	0.040025	0.1733	1.598538	7.5	*	0.469089	0.445853	1.561823
10.6	0.040261	0.1767	1.551925	7.7	*	0.439496	0.423693	1.527593
10.8	0.040437	0.1800	1.517043	7.9	*	0.416763	0.401533	1.494113
11	0.040585	0.1833	1.487789	8.1	*	0.397291	0.379372	1.461367

RAW DATA Note: 1 ft. head = 0.00506 volts

Induced head = final head reading-transducer head at time t

Time (sec.)	Transducer Head (Volts)	Time (min.)	Induced head Value Y (ft)	Translated Time (sec.)	Data used in linear fit	Ln (Y)	Ln (Yt) (theor.)	Yt
0.1	0.028855	0.0017	3.805951	-2.8		1.336566	1.587115	4.889622
0.2	0.028859	0.0033	3.805308	-2.7		1.336397	1.576035	4.835743
0.3	0.028862	0.0050	3.804664	-2.6		1.336228	1.564955	4.782458
0.4	0.028873	0.0067	3.802415	-2.5		1.335636	1.553874	4.72976
0.5	0.028866	0.0083	3.803862	-2.4		1.336017	1.542794	4.677642
0.6	0.028872	0.0100	3.802735	-2.3		1.335721	1.531714	4.626099
0.7	0.028859	0.0117	3.805308	-2.2		1.336397	1.520634	4.575124
0.8	0.028865	0.0133	3.804022	-2.1		1.336059	1.509554	4.52471
0.9	0.028877	0.0150	3.801771	-2		1.335467	1.498473	4.474852
1	0.028873	0.0167	3.802575	-1.9		1.335678	1.487393	4.425544
1.1	0.028868	0.0183	3.803379	-1.8		1.33589	1.476313	4.376778
1.2	0.028871	0.0200	3.802897	-1.7		1.335763	1.465233	4.32855
1.3	0.028881	0.0217	3.800806	-1.6		1.335213	1.454152	4.280854
1.4	0.028876	0.0233	3.801933	-1.5		1.33551	1.443072	4.233683
1.5	0.028881	0.0250	3.800968	-1.4		1.335256	1.431992	4.187032
1.6	0.028866	0.0267	3.803862	-1.3		1.336017	1.420912	4.140895
1.7	0.02889	0.0283	3.7992	-1.2		1.33479	1.409832	4.095266
1.8	0.028881	0.0300	3.800806	-1.1		1.335213	1.398751	4.05014
1.9	0.028876	0.0317	3.801933	-1		1.33551	1.387671	4.005511
2	0.028872	0.0333	3.802735	-0.9		1.335721	1.376591	3.961374
2.1	0.028869	0.0350	3.803217	-0.8		1.335847	1.365511	3.917724
2.2	0.028875	0.0367	3.802093	-0.7		1.335552	1.354431	3.874554
2.3	0.02887	0.0383	3.803057	-0.6		1.335805	1.34335	3.83186
2.4	0.028877	0.0400	3.801611	-0.5		1.335425	1.33227	3.789637
2.5	0.029327	0.0417	3.712723	-0.4		1.311766	1.32119	3.747879
2.6	0.033033	0.0433	2.980401	-0.3		1.092058	1.31011	3.706581
2.7	0.030547	0.0450	3.471617	-0.2		1.24462	1.29903	3.665738
2.8	0.030221	0.0467	3.536071	-0.1		1.263016	1.287949	3.625345
2.9	0.030158	0.0483	3.548449	0	*	1.26651	1.276869	3.585397
3	0.030294	0.0500	3.521605	0.1	*	1.258917	1.265789	3.545889
3.1	0.030492	0.0517	3.482545	0.2	*	1.247763	1.254709	3.506817
3.2	0.030702	0.0533	3.441075	0.3	*	1.235784	1.243629	3.468175
3.3	0.030934	0.0550	3.395265	0.4	*	1.222382	1.232548	3.429959
3.4	0.03116	0.0567	3.350419	0.5	*	1.209085	1.221468	3.392164
3.5	0.03127	0.0583	3.328719	0.6	*	1.202588	1.210388	3.354786
3.6	0.031476	0.0600	3.288053	0.7	*	1.190296	1.199308	3.317819
3.7	0.031683	0.0617	3.247065	0.8	*	1.177752	1.188227	3.28126
3.8	0.031899	0.0633	3.20447	0.9	*	1.164547	1.177147	3.245104
3.9	0.032084	0.0650	3.16782	1	*	1.153044	1.166067	3.209346
4	0.032182	0.0667	3.148534	1.1	*	1.146937	1.154987	3.173982
4.1	0.032374	0.0683	3.110599	1.2	*	1.134815	1.143907	3.139007
4.2	0.032563	0.0700	3.073308	1.3	*	1.122755	1.132826	3.104419
4.3	0.032751	0.0717	3.036016	1.4	*	1.110546	1.121746	3.070211
4.4	0.032924	0.0733	3.001939	1.5	*	1.099258	1.110666	3.03638
4.5	0.033099	0.0750	2.967221	1.6	*	1.087626	1.099586	3.002922
4.6	0.033195	0.0767	2.948253	1.7	*	1.081213	1.088506	2.969833
4.7	0.033365	0.0783	2.91466	1.8	*	1.069753	1.077425	2.937108
4.8	0.033548	0.0800	2.878494	1.9	*	1.057267	1.066345	2.904744
4.9	0.033706	0.0817	2.84731	2	*	1.046375	1.055265	2.872736

LENZ OIL
MW2D RISING HEAD PRESSURE TEST DATA (5-30-91)

THIS SPREADSHEET CALCULATES HYDRAULIC CONDUCTIVITY BASED ON THE BOUWER AND RICE (1976) METHOD. AIR PRESSURE WAS USED TO PUSH THE WATER DOWN IN THE WELL AND RECOVERY RATE WAS MEASURED.

THE FOLLOWING STEPS ARE REQUIRED TO CALCULATE HYDRAULIC CONDUCTIVITY:
1.) IMPORT HERMIT DATA INTO COLUMNS UNDER RAW DATA
2.) DECIDE WHICH DATA IS APPROPRIATE, CHOOSE THE INITIAL INDUCED HEAD, TRANSLATE TIME VALUES
3.) DO THE REGRESSION CALCULATION FOR LEAST SQUARES FIT
4.) CHOOSE APPROPRIATE SLUG TEST PARAMETERS
5.) CHOOSE A VALUE FOR TIME t AND ITS CORRESPONDING Yt

Note: Values of time are translated to the first meaningful data point. The initial theoretical induced head (Yo) is chosen on the regression line at the translated time t=0. (see Pandit and and Miner, 1986. Ground Water. V. 24, No. 6, p. 743-749).

LINEAR REGRESSION DATA

Regression Output:

Constant	1.276869
Std Err of Y Est	0.011221
R Squared	0.999391
No. of Observations	109
Degrees of Freedom	107
X Coefficient(s)	-0.1108
Std Err of Coef.	0.000264

Regression line equation:

Ln Y = -0.1108 t+1.276869

Ln Y intercept: 1.276869

SLUG TEST PARAMETERS

Length of slug (Ls)=		ft.
Slug diameter (Ds)=		ft.
Initial theoret. induced head (Yo)=	3.585397	ft.
Actual initial induced head (Ho)=	3.548449	ft.
Radius of developed zone (rw)=	0.25	ft.
Radius of well casing (rc)=	0.0833	ft.
Effective length of inflow (L)=	5	ft.
Saturated thickness of aquifer (D)=	175	ft.
L/rw=	20	
A=	2.1686	
Constants based on L/rw: B=	0.318	
C=	1.6788	
Distance between top of aquifer and screen bottom (H)=	24.1	ft.
D > H Ln (R/rw)=	2.249168	
D = H Ln (R/rw)=	3.079586	
Note: Ln((D-H)/rw)=	6	

If Ln((D-H)/rw)>6, set Ln((D-H)/rw)=6

where:

D > H Ln(R/rw)=[1.1/Ln(H/rw)+(A+BLn[(D-H)/rw])/L/rw]**-1

D = H Ln(R/rw)=[1.1/Ln(H/rw)+C/(L/rw)]**-1

K=rc**2*Ln(R/rw)*Ln(Yo/Yt))/2Lt

Initial theoret. induced head (Yo):
Induced head (Yt) at time t:
Ordered pair on regression line (t,Yt):

Note: Choose Yt and t

Yo = 3.585397 ft.
Yt = 3.28126 ft.
t = 0.8 sec.

RADIUS OF INFLUENCE

R= 2.36996 ft.

CALCULATION OF HYDRAULIC CONDUCTIVITY

K= 0.005271 cm/sec
K= 111.7405 gal/day-ft**2

RAW DATA

Time (min.)	Transducer Head (ft.)	Translated Time (min.)	Induced head Value Y (ft)	Translated Time (sec.)	Data used in linear fit	Ln (Y)	Ln (Yt) (theor.)	Yt
0	-1.34	-0.0066	1.34	-0.396		0.29267	0.306466	1.358615
0.0033	-1.14	-0.0033	1.14	-0.198		0.131028	0.155695	1.16847
0.0066	-1.07	0	1.07	0	*	0.067659	0.004925	1.004937
0.0099	-0.85	0.0033	0.85	0.198	*	-0.16252	-0.14584	0.864292
0.0133	-0.73	0.0067	0.73	0.402	*	-0.31471	-0.30118	0.739942
0.0166	-0.62	0.01	0.62	0.6	*	-0.47804	-0.45195	0.636384
0.02	-0.52	0.0134	0.52	0.804	*	-0.65393	-0.60729	0.544824
0.0233	-0.47	0.0167	0.47	1.002	*	-0.75502	-0.75806	0.468573
0.0266	-0.39	0.02	0.39	1.2	*	-0.94161	-0.90883	0.402994
0.03	-0.37	0.0234	0.37	1.404	*	-0.99425	-1.06417	0.345014
0.0333	-0.41	0.0267	0.41	1.602		-0.8916	-1.21494	0.296727
0.05	-0.13	0.0434	0.13	2.604		-2.04022	-1.97793	0.138355
0.0666	-0.08	0.06	0.08	3.6		-2.52573	-2.73635	0.064807
0.0833	-0.05	0.0767	0.05	14 4.602		-2.99573	-3.49934	0.030217
0.1	-0.03	0.0934	0.03	5.604		-3.50656	-4.26233	0.01409
0.1166	-0.02	0.11	0.02	6.6		-3.91202	-5.02074	0.0066
0.1333	-0.01	0.1267	0.01	7.602		-4.60517	-5.78373	0.003077
0.15	0	0.1434	0	8.604		ERR	-6.54672	0.001435

LENZ OIL

MW-02S RISING HEAD SLUG TEST DATA (5-23-91)

THIS SPREADSHEET CALCULATES HYDRAULIC CONDUCTIVITY BASED ON THE BOUWER AND RICE (1976) METHOD.

THE FOLLOWING STEPS ARE REQUIRED TO CALCULATE HYDRAULIC CONDUCTIVITY:
1.) IMPORT HERMIT DATA INTO COLUMNS UNDER RAW DATA
2.) DECIDE WHICH DATA IS APPROPRIATE, CHOOSE THE INITIAL INDUCED HEAD, TRANSLATE TIME VALUES
3.) DO THE REGRESSION CALCULATION FOR LEAST SQUARES FIT
4.) CHOOSE APPROPRIATE SLUG TEST PARAMETERS
5.) CHOOSE A VALUE FOR TIME t AND ITS CORRESPONDING Yt

Note: Values of time are translated to the first meaningful data point. The initial theoretical induced head (Yo) is chosen on the regression line at the translated time t=0. (see Pandit and and Miner, 1986. Ground Water. V. 24, No. 6, p. 743-749).

LINEAR REGRESSION DATA

Regression Output:

Constant	0.004925
Std Err of Y Est	0.046946
R Squared	0.986673
No. of Observations	8
Degrees of Freedom	6
X Coefficient(s)	-0.76147
Std Err of Coef.	0.036129

Regression line equation:

Ln Y = -0.76147 t+0.004925

Ln Y intercept: 0.004925

SLUG TEST PARAMETERS

Length of slug (Ls)=	3	ft.
Slug diameter (Ds)=	0.14	ft.
Initial theoret. induced head (Yo)=	1.07	ft.
Actual initial induced head (Ho)=	1.004937	ft.
Radius of developed zone (rw)=	0.25	ft.
Radius of well casing (rc)=	0.0833	ft.
Effective length of inflow (L)=	7.2	ft.
Saturated thickness of aquifer (D)=	175	ft.
L/rw=	28.8	
A=	2.4544	
Constants based on L/rw: B=	0.383	
C=	1.9868	
Distance between top of aquifer and screen bottom (H)=	7.2	ft.
D > H Ln (R/rw)=	2.031041	
D = H Ln (R/rw)=	2.523147	
Note: Ln((D-H)/rw)=	6	

If Ln((D-H)/rw)>6, set Ln((D-H)/rw)=6

where:

D > H Ln(R/rw)=[1.1/Ln(H/rw)+(A+BLn[(D-H)/rw])/L/rw]**-1

D = H Ln(R/rw)=[1.1/Ln(H/rw)+C/(L/rw)]**-1

K=rc**2*Ln(R/rw)*Ln(Yo/Yt))/2Lt

Initial theoret. induced head (Yo):
Induced head (Yt) at time t:
Ordered pair on regression line (t,Yt):

Note: Choose Yt and t

Yo = 1.004937 ft.
Yt = 0.402994 ft.
t = 1.2 sec.

RADIUS OF INFLUENCE

R= 1.905505 ft.

CALCULATION OF HYDRAULIC CONDUCTIVITY

K= 0.022715 cm/sec
K= 481.5563 gal/day-ft**2

31.2	0.037776	0.5200	0.967642	28.6	*	-0.03289	-0.02902	0.971394
32.2	0.038025	0.5367	0.918457	29.6	*	-0.08506	-0.07383	0.92883
33.2	0.038257	0.5533	0.872646	30.6	*	-0.13623	-0.11864	0.888131
34.2	0.038441	0.5700	0.836158	31.6	*	-0.17894	-0.16344	0.849215
35.2	0.038631	0.5867	0.798708	32.6	*	-0.22476	-0.20825	0.812004
36.2	0.038829	0.6033	0.759648	33.6	*	-0.2749	-0.25306	0.776424
37.2	0.038977	0.6200	0.730393	34.6	*	-0.31417	-0.29786	0.742403
38.2	0.039104	0.6367	0.705158	35.6	*	-0.34933	-0.34267	0.709873
39.2	0.039278	0.6533	0.670759	36.6		-0.39935	-0.38748	0.678768
40.2	0.039442	0.6700	0.638451	37.6		-0.44871	-0.43228	0.649026
41.2	0.039576	0.6867	0.611929	38.6		-0.49114	-0.47709	0.620587
42.2	0.039657	0.7033	0.596016	39.6		-0.51749	-0.5219	0.593394
43.2	0.039835	0.7200	0.560654	40.6		-0.57865	-0.5667	0.567393
44.2	0.039996	0.7367	0.528828	41.6		-0.63709	-0.61151	0.542531
45.2	0.040097	0.7533	0.509057	42.6		-0.67519	-0.65632	0.518759
46.2	0.040252	0.7700	0.478356	43.6		-0.7374	-0.70112	0.496028
47.2	0.040349	0.7867	0.459069	44.6		-0.77855	-0.74593	0.474293
48.2	0.040443	0.8033	0.440583	45.6		-0.81966	-0.79074	0.453511
49.2	0.040551	0.8200	0.419206	46.6		-0.86939	-0.83554	0.433639
50.2	0.040658	0.8367	0.398148	47.6		-0.92093	-0.88035	0.414638
51.2	0.040761	0.8533	0.377735	48.6		-0.97356	-0.92516	0.39647
61.2	0.041527	1.0200	0.22632	58.6		-1.4858	-1.37322	0.253289
71.2	0.042031	1.1867	0.126662	68.6		-2.06623	-1.82129	0.161817
81.2	0.042336	1.3533	0.066385	78.6		-2.71228	-2.26936	0.103379
91.2	0.042508	1.5200	0.03247	88.6		-3.42743	-2.71742	0.066045
101.2	0.042624	1.6867	0.009484	98.6		-4.65813	-3.16549	0.042193

11.2	0.030559	0.1867	2.39403	8.6	*	0.872978	0.867111	2.380024
11.4	0.030655	0.1900	2.374901	8.8	*	0.864956	0.858149	2.358791
11.6	0.030795	0.1933	2.347255	9	*	0.853247	0.849188	2.337748
11.8	0.030879	0.1967	2.3307	9.2	*	0.846168	0.840227	2.316892
12	0.030979	0.2000	2.310929	9.4	*	0.83765	0.831265	2.296222
12.2	0.031115	0.2033	2.284085	9.6	*	0.825965	0.822304	2.275737
12.4	0.031181	0.2067	2.271065	9.8	*	0.820249	0.813343	2.255434
12.6	0.031318	0.2100	2.243901	10	*	0.808216	0.804381	2.235313
12.8	0.031406	0.2133	2.226542	10.2	*	0.800449	0.79542	2.215371
13	0.031478	0.2167	2.212395	10.4	*	0.794076	0.786459	2.195607
13.2	0.031625	0.2200	2.183302	10.6	*	0.780839	0.777497	2.176019
13.4	0.031677	0.2233	2.173016	10.8	*	0.776116	0.768536	2.156606
13.6	0.031804	0.2267	2.147939	11	*	0.764509	0.759575	2.137367
13.8	0.031886	0.2300	2.131706	11.2	*	0.756922	0.750613	2.118299
14	0.031997	0.2333	2.109684	11.4	*	0.746538	0.741652	2.099401
14.2	0.032075	0.2367	2.094415	11.6	*	0.739274	0.732691	2.080671
14.4	0.03218	0.2400	2.07368	11.8	*	0.729325	0.723729	2.062109
14.6	0.032274	0.2433	2.055034	12	*	0.720292	0.714768	2.043712
14.8	0.032346	0.2467	2.040727	12.2	*	0.713306	0.705807	2.02548
15	0.032472	0.2500	2.015974	12.4	*	0.701103	0.696845	2.00741
15.2	0.032552	0.2533	2.000061	12.6	*	0.693178	0.687884	1.989501
15.4	0.032624	0.2567	1.985915	12.8	*	0.68608	0.678923	1.971752
15.6	0.032746	0.2600	1.961806	13	*	0.673866	0.669961	1.954162
15.8	0.032791	0.2633	1.952804	13.2	*	0.669266	0.661	1.936728
16	0.032905	0.2667	1.9303	13.4	*	0.657676	0.652039	1.91945
16.2	0.032956	0.2700	1.920176	13.6	*	0.652417	0.643077	1.902326
16.4	0.033059	0.2733	1.899921	13.8	*	0.641812	0.634116	1.885355
16.6	0.033173	0.2767	1.877257	14	*	0.629812	0.625155	1.868535
16.8	0.033239	0.2800	1.864237	14.2	*	0.622852	0.616193	1.851865
17	0.033326	0.2833	1.8472	14.4	*	0.613671	0.607232	1.835344
17.2	0.0334	0.2867	1.832573	14.6	*	0.605721	0.598271	1.81897
17.4	0.033478	0.2900	1.817142	14.8	*	0.597265	0.589309	1.802743
17.6	0.033557	0.2933	1.801549	15	*	0.588647	0.580348	1.78666
17.8	0.033656	0.2967	1.781941	15.2	*	0.577703	0.571387	1.770721
18	0.033736	0.3000	1.766028	15.4	*	0.568733	0.562425	1.754923
18.2	0.033792	0.3033	1.755097	15.6	*	0.562524	0.553464	1.739267
18.4	0.0339	0.3067	1.733717	15.8	*	0.550268	0.544503	1.723751
18.6	0.033927	0.3100	1.728415	16	*	0.547205	0.535541	1.708373
18.8	0.034042	0.3133	1.705589	16.2	*	0.53391	0.52658	1.693132
19	0.034137	0.3167	1.686783	16.4	*	0.522823	0.517619	1.678027
19.2	0.034194	0.3200	1.675532	16.6	*	0.516131	0.508657	1.663057
19.4	0.034284	0.3233	1.65785	16.8	*	0.505521	0.499696	1.64822
19.6	0.034362	0.3267	1.642419	17	*	0.49617	0.490735	1.633516
19.8	0.034421	0.3300	1.630686	17.2	*	0.489001	0.481773	1.618943
20	0.03451	0.3333	1.613166	17.4	*	0.478199	0.472812	1.604499
20.2	0.034564	0.3367	1.602395	17.6	*	0.4715	0.463851	1.590185
21.2	0.034907	0.3533	1.534565	18.6	*	0.428247	0.419044	1.520507
22.2	0.035308	0.3700	1.455482	19.6	*	0.375337	0.374237	1.453882
23.2	0.03563	0.3867	1.39183	20.6	*	0.330619	0.329431	1.390176
24.2	0.035931	0.4033	1.332196	21.6	*	0.286828	0.284624	1.329262
25.2	0.036234	0.4200	1.272401	22.6	*	0.240906	0.239817	1.271017
26.2	0.036536	0.4367	1.212767	23.6	*	0.192904	0.195011	1.215324
27.2	0.03682	0.4533	1.15651	24.6	*	0.145407	0.150204	1.162071
28.2	0.037075	0.4700	1.106198	25.6	*	0.100929	0.105397	1.111152
29.2	0.037325	0.4867	1.056692	26.6	*	0.055143	0.060591	1.062464
30.2	0.037556	0.5033	1.011042	27.6	*	0.010981	0.015784	1.015909

5	0.026866	0.0833	3.123779	2.4	*	1.139043	1.144912	3.142164
5.1	0.026896	0.0850	3.117832	2.5	*	1.137138	1.140431	3.128117
5.2	0.026969	0.0867	3.103526	2.6	*	1.132539	1.135951	3.114132
5.3	0.02706	0.0883	3.085364	2.7	*	1.12667	1.13147	3.10021
5.4	0.027072	0.0900	3.083113	2.8	*	1.12594	1.126989	3.08635
5.5	0.027204	0.0917	3.057073	2.9	*	1.117458	1.122509	3.072552
5.6	0.027226	0.0933	3.052733	3	*	1.116037	1.118028	3.058816
5.7	0.027311	0.0950	3.035856	3.1	*	1.110493	1.113547	3.045141
5.8	0.027381	0.0967	3.022032	3.2	*	1.105929	1.109067	3.031527
5.9	0.02743	0.0983	3.012387	3.3	*	1.102733	1.104586	3.017974
6	0.027533	0.1000	2.991974	3.4	*	1.095933	1.100105	3.004482
6.1	0.027552	0.1017	2.988117	3.5	*	1.094643	1.095625	2.99105
6.2	0.027617	0.1033	2.975417	3.6	*	1.090384	1.091144	2.977678
6.3	0.027698	0.1050	2.959344	3.7	*	1.084968	1.086663	2.964366
6.4	0.027769	0.1067	2.94536	3.8	*	1.080231	1.082183	2.951113
6.5	0.027857	0.1083	2.92784	3.9	*	1.074265	1.077702	2.93792
6.6	0.027878	0.1100	2.923822	4	*	1.072892	1.073221	2.924786
6.7	0.027943	0.1117	2.910962	4.1	*	1.068484	1.068741	2.91171
6.8	0.028032	0.1133	2.893281	4.2	*	1.062391	1.06426	2.898693
6.9	0.028094	0.1150	2.881065	4.3	*	1.05816	1.059779	2.885734
7	0.028168	0.1167	2.866439	4.4	*	1.05307	1.055299	2.872833
7.1	0.028231	0.1183	2.854061	4.5	*	1.048743	1.050818	2.859989
7.2	0.028293	0.1200	2.841684	4.6	*	1.044397	1.046337	2.847203
7.3	0.02833	0.1217	2.834451	4.7	*	1.041848	1.041857	2.834474
7.4	0.0284	0.1233	2.820628	4.8	*	1.03696	1.037376	2.821803
7.5	0.028453	0.1250	2.81018	4.9	*	1.033248	1.032895	2.809187
7.6	0.028537	0.1267	2.793462	5	*	1.027282	1.028415	2.796628
7.7	0.028595	0.1283	2.782051	5.1	*	1.023189	1.023934	2.784126
7.8	0.02863	0.1300	2.775138	5.2	*	1.020701	1.019453	2.771679
7.9	0.028704	0.1317	2.760512	5.3	*	1.015416	1.014973	2.759288
8	0.028764	0.1333	2.748617	5.4	*	1.011098	1.010492	2.746952
8.1	0.028813	0.1350	2.738972	5.5	*	1.007583	1.006011	2.734671
8.2	0.028906	0.1367	2.720648	5.6	*	1.00087	1.001531	2.722445
8.3	0.028929	0.1383	2.716148	5.7	*	0.999215	0.99705	2.710274
8.400001	0.029021	0.1400	2.697984	5.800001	*	0.992505	0.992569	2.698158
8.5	0.029075	0.1417	2.687215	5.9	*	0.988505	0.988089	2.686095
8.6	0.029151	0.1433	2.672267	6	*	0.982927	0.983608	2.674087
8.7	0.029217	0.1450	2.659247	6.1	*	0.978043	0.979127	2.662132
8.8	0.029274	0.1467	2.647834	6.2	*	0.973742	0.974647	2.65023
8.900001	0.029336	0.1483	2.635619	6.300001	*	0.969118	0.970166	2.638382
9	0.02934	0.1500	2.634814	6.4	*	0.968813	0.965685	2.626587
9.1	0.029427	0.1517	2.617617	6.5	*	0.962264	0.961205	2.614844
9.2	0.029487	0.1533	2.605881	6.6	*	0.957771	0.956724	2.603154
9.3	0.029552	0.1550	2.593024	6.7	*	0.952825	0.952243	2.591516
9.400001	0.02961	0.1567	2.581451	6.800001	*	0.948351	0.947762	2.579931
9.5	0.029644	0.1583	2.5747	6.9	*	0.945733	0.943282	2.568397
9.6	0.029722	0.1600	2.559429	7	*	0.939784	0.938801	2.556914
9.7	0.029785	0.1617	2.546891	7.1	*	0.934874	0.934321	2.545483
9.8	0.029855	0.1633	2.533067	7.2	*	0.929431	0.92984	2.534103
9.900001	0.0299	0.1650	2.524227	7.300001	*	0.925935	0.925359	2.522774
10	0.029917	0.1667	2.520852	7.4	*	0.924597	0.920879	2.511496
10.2	0.03003	0.1700	2.49851	7.6	*	0.915695	0.911917	2.48909
10.4	0.030122	0.1733	2.480346	7.8	*	0.908398	0.902956	2.466884
10.6	0.030271	0.1767	2.450771	8	*	0.896403	0.893995	2.444876
10.8	0.030357	0.1800	2.433893	8.2	*	0.889492	0.885033	2.423065
11	0.030461	0.1833	2.413318	8.4	*	0.881003	0.876072	2.401448

RAW DATA Note: 1 ft. head = 0.00506 volts

Induced head = final head reading-transducer head at time t

Time (sec.)	Transducer Head (Volts)	Time (min.)	Induced head Value Y (ft)	Translated Time (sec.)	Data used in linear fit	Ln (Y)	Ln (Yt) (theor.)	Yt
0.1	0.024303	0.0017	3.630265	-2.5		1.289306	1.364465	3.913627
0.2	0.024302	0.0033	3.630425	-2.4		1.28935	1.359984	3.896131
0.3	0.024304	0.0050	3.630103	-2.3		1.289261	1.355503	3.878712
0.4	0.024276	0.0067	3.635569	-2.2		1.290766	1.351023	3.861372
0.5	0.024268	0.0083	3.637176	-2.1		1.291208	1.346542	3.844109
0.6	0.024306	0.0100	3.629783	-2		1.289173	1.342061	3.826923
0.7	0.024316	0.0117	3.627692	-1.9		1.288597	1.337581	3.809815
0.8	0.024305	0.0133	3.629943	-1.8		1.289217	1.3331	3.792782
0.9	0.024319	0.0150	3.627209	-1.7		1.288464	1.328619	3.775826
1	0.024301	0.0167	3.630747	-1.6		1.289438	1.324139	3.758946
1.1	0.024311	0.0183	3.628656	-1.5		1.288862	1.319658	3.742141
1.2	0.024317	0.0200	3.627532	-1.4		1.288552	1.315177	3.725411
1.3	0.024314	0.0217	3.628174	-1.3		1.288729	1.310697	3.708756
1.4	0.024322	0.0233	3.626567	-1.2		1.288287	1.306216	3.692176
1.5	0.024328	0.0250	3.625281	-1.1		1.287932	1.301735	3.675669
1.6	0.02432	0.0267	3.626889	-1		1.288375	1.297255	3.659237
1.7	0.02433	0.0283	3.62496	-0.9		1.287843	1.292774	3.642877
1.8	0.02457	0.0300	3.577542	-0.8		1.274676	1.288293	3.626591
1.9	0.024533	0.0317	3.584937	-0.7		1.276741	1.283813	3.610378
2	0.024586	0.0333	3.574328	-0.6		1.273777	1.279332	3.594238
2.1	0.025317	0.0350	3.429824	-0.5		1.232509	1.274851	3.578169
2.2	0.026097	0.0367	3.275676	-0.4		1.186524	1.270371	3.562172
2.3	0.025845	0.0383	3.325506	-0.3		1.201622	1.26589	3.546247
2.4	0.025413	0.0400	3.411018	-0.2		1.227011	1.261409	3.530393
2.5	0.02516	0.0417	3.460846	-0.1		1.241513	1.256929	3.51461
2.6	0.025134	0.0433	3.46615	0	*	1.243045	1.252448	3.498897
2.7	0.025212	0.0450	3.450719	0.1	*	1.238583	1.247967	3.483255
2.8	0.025221	0.0467	3.448953	0.2	*	1.238071	1.243487	3.467683
2.9	0.025286	0.0483	3.436093	0.3	*	1.234335	1.239006	3.45218
3	0.025421	0.0500	3.409411	0.4	*	1.22654	1.234525	3.436746
3.1	0.02551	0.0517	3.391729	0.5	*	1.22134	1.230045	3.421382
3.2	0.025576	0.0533	3.378709	0.6	*	1.217494	1.225564	3.406086
3.3	0.025612	0.0550	3.371636	0.7	*	1.215398	1.221083	3.390859
3.4	0.025708	0.0567	3.35267	0.8	*	1.209757	1.216603	3.375699
3.5	0.025777	0.0583	3.339008	0.9	*	1.205674	1.212122	3.360608
3.6	0.025848	0.0600	3.325024	1	*	1.201477	1.207641	3.345584
3.7	0.025936	0.0617	3.307502	1.1	*	1.196193	1.203161	3.330627
3.8	0.026002	0.0633	3.294482	1.2	*	1.192249	1.19868	3.315737
3.9	0.02609	0.0650	3.277123	1.3	*	1.186966	1.194199	3.300913
4	0.026142	0.0667	3.266836	1.4	*	1.183822	1.189719	3.286156
4.1	0.026204	0.0683	3.254621	1.5	*	1.180076	1.185238	3.271465
4.2	0.026292	0.0700	3.237261	1.6	*	1.174728	1.180757	3.256839
4.3	0.026375	0.0717	3.220866	1.7	*	1.16965	1.176277	3.242279
4.4	0.026444	0.0733	3.207202	1.8	*	1.165399	1.171796	3.227784
4.5	0.026482	0.0750	3.199646	1.9	*	1.16304	1.167315	3.213354
4.6	0.026573	0.0767	3.181644	2	*	1.157398	1.162835	3.198988
4.7	0.026631	0.0783	3.170233	2.1	*	1.153805	1.158354	3.184687
4.8	0.026708	0.0800	3.154962	2.2	*	1.148977	1.153873	3.170449
4.9	0.02679	0.0817	3.138889	2.3	*	1.143869	1.149393	3.156275

LENZ OIL
MW01D RISING HEAD PRESSURE TEST DATA (5-30-91)

THIS SPREADSHEET CALCULATES HYDRAULIC CONDUCTIVITY BASED ON THE BOUWER AND RICE (1976) METHOD. AIR PRESSURE WAS USED TO PUSH THE WATER DOWN IN THE WELL AND RECOVERY RATE WAS MEASURED.

THE FOLLOWING STEPS ARE REQUIRED TO CALCULATE HYDRAULIC CONDUCTIVITY:
1.) IMPORT HERMIT DATA INTO COLUMNS UNDER RAW DATA
2.) DECIDE WHICH DATA IS APPROPRIATE, CHOOSE THE INITIAL INDUCED HEAD, TRANSLATE TIME VALUES
3.) DO THE REGRESSION CALCULATION FOR LEAST SQUARES FIT
4.) CHOOSE APPROPRIATE SLUG TEST PARAMETERS
5.) CHOOSE A VALUE FOR TIME t AND ITS CORRESPONDING Yt

Note: Values of time are translated to the first meaningful data point. The initial theoretical induced head (Yo) is chosen on the regression line at the translated time t=0. (see Pandit and and Miner, 1986. Ground Water. V. 24, No. 6, p. 743-749).

LINEAR REGRESSION DATA

Regression Output:

Constant	1.252448
Std Err of Y Est	0.006105
R Squared	0.999733
No. of Observations	144
Degrees of Freedom	142
X Coefficient(s)	-0.04481
Std Err of Coef.	6.15E-05

Regression line equation:

Ln Y = -0.04481 t+1.252448

Ln Y intercept: 1.252448

SLUG TEST PARAMETERS

Length of slug (Ls)=		ft.
Slug diameter (Ds)=		ft.
Initial theoret. induced head (Yo)=	3.498897	ft.
Actual initial induced head (Ho)=	3.46615	ft.
Radius of developed zone (rw)=	0.2	ft.
Radius of well casing (rc)=	0.0833	ft.
Effective length of inflow (L)=	5	ft.
Saturated thickness of aquifer (D)=	175	ft.
L/rw=	25	
A=	2.311	
Constants based on L/rw: B=	0.3504	
C=	1.8585	
Distance between top of aquifer and screen bottom (H)=	33.9	ft.
D > H Ln (R/rw)=	2.55858	
D = H Ln (R/rw)=	3.464454	
Note: Ln((D-H)/rw)=	6	

If Ln((D-H)/rw)>6, set Ln((D-H)/rw)=6

where:

D > H Ln(R/rw)=[1.1/Ln(H/rw)+(A+BLn[(D-H)/rw])/L/rw]**-1

D = H Ln(R/rw)=[1.1/Ln(H/rw)+C/(L/rw)]**-1

K=rc**2*Ln(R/rw)*Ln(Yo/Yt))/2Lt

Initial theoret. induced head (Yo):
Induced head (Yt) at time t:
Ordered pair on regression line (t,Yt):

Note: Choose Yt and t

Yo = 3.498897 ft.
Yt = 3.330627 ft.
t = 1.1 sec.

RADIUS OF INFLUENCE

R= 2.583493 ft.

CALCULATION OF HYDRAULIC CONDUCTIVITY

K= 0.002425 cm/sec
K= 51.40229 gal/day-ft**2

RAW DATA

Time (min.)	Transducer Head (ft.)	Translated Time (min.)	Induced head Value Y (ft)	Translated Time (sec.)	Data used in linear fit	Ln (Y)	Ln (Yt) (theor.)	Yt
0	-2.14	-0.02	2.14	-1.2		0.760806	0.567597	1.764024
0.0033	-4.06	-0.0167	4.06	-1.002		1.401183	0.48498	1.624143
0.0066	-4.33	-0.0134	4.33	-0.804		1.465568	0.402363	1.495355
0.0099	-1.4	-0.0101	1.4	-0.606		0.336472	0.319746	1.376778
0.0133	-1.14	-0.0067	1.14	-0.402		0.131028	0.234626	1.264435
0.0166	-1.22	-0.0034	1.22	-0.204		0.198851	0.152009	1.16417
0.02	-1.07	0	1.07	0	*	0.067659	0.066888	1.069176
0.0233	-1.01	0.0033	1.01	0.198	*	0.00995	-0.01573	0.984394
0.0266	-0.9	0.0066	0.9	0.396	*	-0.10536	-0.09835	0.906335
0.03	-0.83	0.01	0.83	0.6	*	-0.18633	-0.18347	0.83238
0.0333	-0.76	0.0133	0.76	0.798	*	-0.27444	-0.26608	0.766375
0.05	-0.49	0.03	0.49	1.8	*	-0.71335	-0.68418	0.504506
0.0666	-0.34	0.0466	0.34	2.796	*	-1.07881	-1.09976	0.332949
0.0833	-0.26	0.0633	0.26	3.798		-1.34707	-1.51786	0.219181
0.1	-0.22	0.08	0.22	4.8		-1.51413	-1.93595	0.144287
0.1166	-0.19	0.0966	0.19	5.796		-1.66073	-2.35154	0.095223
0.1333	-0.17	0.1133	0.17	6.798		-1.77196	-2.76963	0.062685
0.15	-0.16	0.13	0.16	7.8		-1.83258	-3.18772	0.041266
0.1666	-0.15	0.1466	0.15	8.796		-1.89712	-3.60331	0.027233
0.1833	-0.14	0.1633	0.14	9.798		-1.96611	-4.0214	0.017928
0.2	-0.14	0.18	0.14	10.8		-1.96611	-4.4395	0.011802
0.2166	-0.13	0.1966	0.13	11.796		-2.04022	-4.85508	0.007789
0.2333	-0.13	0.2133	0.13	12.798		-2.04022	-5.27318	0.005127
0.25	-0.12	0.23	0.12	13.8		-2.12026	-5.69127	0.003375
0.2666	-0.12	0.2466	0.12	14.796		-2.12026	-6.10686	0.002228
0.2833	-0.11	0.2633	0.11	15.798		-2.20727	-6.52495	0.001466
0.3	-0.11	0.28	0.11	16.8		-2.20727	-6.94304	0.000965
0.3166	-0.11	0.2966	0.11	17.796		-2.20727	-7.35863	0.000637
0.3333	-0.1	0.3133	0.1	18.798		-2.30259	-7.77672	0.000419
0.4167	-0.09	0.3967	0.09	23.802		-2.40795	-9.86468	5.2E-05
0.5	-0.08	0.48	0.08	28.8		-2.52573	-11.9501	6.46E-06
0.5833	-0.07	0.5633	0.07	33.798		-2.65926	-14.0356	8.02E-07
0.6667	-0.07	0.6467	0.07	38.802		-2.65926	-16.1235	9.95E-08
0.75	-0.06	0.73	0.06	43.8		-2.81341	-18.209	1.24E-08
0.8333	-0.05	0.8133	0.05	48.798		-2.99573	-20.2945	1.54E-09
0.9167	-0.05	0.8967	0.05	53.802		-2.99573	-22.3824	1.9E-10
1	-0.04	0.98	0.04	58.8		-3.21888	-24.4679	2.36E-11
1.0833	-0.04	1.0633	0.04	63.798		-3.21888	-26.5533	2.94E-12
1.1667	-0.04	1.1467	0.04	68.802		-3.21888	-28.6413	3.64E-13
1.25	-0.03	1.23	0.03	73.8		-3.50656	-30.7267	4.52E-14
1.3333	-0.03	1.3133	0.03	78.798		-3.50656	-32.8122	5.62E-15
1.4166	-0.03	1.3966	0.03	83.796		-3.50656	-34.8976	6.98E-16
1.5	-0.03	1.48	0.03	88.8		-3.50656	-36.9856	8.66E-17
1.5833	-0.02	1.5633	0.02	93.798		-3.91202	-39.0711	1.08E-17
1.6667	-0.02	1.6467	0.02	98.802		-3.91202	-41.159	1.33E-18
1.75	-0.02	1.73	0.02	103.8		-3.91202	-43.2445	1.66E-19
1.8333	-0.02	1.8133	0.02	108.798		-3.91202	-45.3299	2.06E-20
1.9167	-0.02	1.8967	0.02	113.802		-3.91202	-47.4179	2.55E-21
2	-0.02	1.98	0.02	118.8		-3.91202	-49.5033	3.17E-22

LENZ OIL

MW-01S RISING HEAD SLUG TEST DATA (5-23-91)

THIS SPREADSHEET CALCULATES HYDRAULIC CONDUCTIVITY BASED ON THE BOUWER AND RICE (1976) METHOD.

THE FOLLOWING STEPS ARE REQUIRED TO CALCULATE HYDRAULIC CONDUCTIVITY:

1.) IMPORT HERMIT DATA INTO COLUMNS UNDER RAW DATA
2.) DECIDE WHICH DATA IS APPROPRIATE, CHOOSE THE INITIAL INDUCED HEAD, TRANSLATE TIME VALUES
3.) DO THE REGRESSION CALCULATION FOR LEAST SQUARES FIT
4.) CHOOSE APPROPRIATE SLUG TEST PARAMETERS
5.) CHOOSE A VALUE FOR TIME t AND ITS CORRESPONDING Yt

Note: Values of time are translated to the first meaningful data point. The initial theoretical induced head (Yo) is chosen on the regression line at the translated time t=0. (see Pandit and and Miner, 1986. Ground Water. V. 24, No. 6, p. 743-749).

LINEAR REGRESSION DATA

Regression Output:

Constant	0.066888
Std Err of Y Est	0.020383
R Squared	0.998032
No. of Observations	7
Degrees of Freedom	5
X Coefficient(s)	-0.41726
Std Err of Coef.	0.008287

Regression line equation:

Ln Y = -0.41726 t+0.066888

Ln Y intercept: 0.066888

SLUG TEST PARAMETERS

Length of slug (Ls)=	3	ft.
Slug diameter (Ds)=	0.14	ft.
Initia. theoret. induced head (Yo)=	1.069176	ft.
Actual initial induced head (Ho)=	1.07	ft.
Radius of developed zone (rw)=	0.33	ft.
Radius of well casing (rc)=	0.0833	ft.
Effective length of inflow (L)=	1.5	ft.
Saturated thickness of aquifer (D)=	6	ft.
L/rw=	4.545455	
A=	1.6972	
Constants based on L/rw: B=	0.2369	
C=	0.8225	
Distance between top of aquifer and screen bottom (H)=	8.5	ft.
D > H Ln (R/rw)=	ERR	
D = H Ln (R/rw)=	1.924765	

Initial theoret. induced head (Yo):
Induced head (Yt) at time t:
Ordered pair on regression line (t,Yt):

Note: Choose Yt and t

Yo = 1.069176 ft.
Yt = 0.504506 ft.
t = 1.8 sec.

RADIUS OF INFLUENCE

R= 2.261667 ft.

CALCULATION OF HYDRAULIC CONDUCTIVITY

K= 0.056619 cm/sec
K= 1200.333 gal/day-ft**2

where:

D > H Ln(R/rw)=[1.1/Ln(H/rw)+(A+BLn[(D-H)/rw])/L/rw]**-1
D = H Ln(R/rw)=[1.1/Ln(H/rw)+C/(L/rw)]**-1

K=rc**2*Ln(R/rw)*Ln(Yo/Yt))/2Lt

31.2	0.043943	0.5200	0.565152	28.6	-0.57066	-0.3709	0.690115
32.2	0.044221	0.5367	0.51018	29.6	-0.67299	-0.42307	0.655031
33.2	0.044448	0.5533	0.465336	30.6	-0.765	-0.47525	0.62173
34.2	0.044612	0.5700	0.432866	31.6	-0.83733	-0.52743	0.590122
35.2	0.044813	0.5867	0.393164	32.6	-0.93353	-0.5796	0.560121
36.2	0.045021	0.6033	0.352016	33.6	-1.04408	-0.63178	0.531646
37.2	0.045203	0.6200	0.31601	34.6	-1.15198	-0.68395	0.504618
38.2	0.045408	0.6367	0.275664	35.6	-1.28857	-0.73613	0.478964
39.2	0.045604	0.6533	0.236927	36.6	-1.44	-0.78831	0.454614
40.2	0.045766	0.6700	0.204779	37.6	-1.58583	-0.84048	0.431503
41.2	0.04595	0.6867	0.168453	38.6	-1.7811	-0.89266	0.409566
42.2	0.046099	0.7033	0.139038	39.6	-1.97301	-0.94483	0.388744
43.2	0.046246	0.7200	0.109945	40.6	-2.20778	-0.99701	0.368981
44.2	0.046397	0.7367	0.080208	41.6	-2.52314	-1.04919	0.350223
45.2	0.04654	0.7533	0.051917	42.6	-2.95811	-1.10136	0.332418
46.2	0.046691	0.7700	0.02202	43.6	-3.81581	-1.15354	0.315518

RAW DATA Note: 1 ft. head = 0.00506 volts

Induced head = final head reading-transducer head at time t

Time (sec.)	Transducer Head (Volts)	Time (min.)	Induced head Value Y (ft)	Translated Time (sec.)	Data used in linear fit	Ln (Y)	Ln (Yt) (theor.)	Yt
0.1	0.026459	0.0017	3.652927	-2.3		1.295529	1.607406	4.989851
0.2	0.026481	0.0033	3.648587	-2.2		1.29434	1.592915	4.918062
0.3	0.026459	0.0050	3.653087	-2.1		1.295573	1.578423	4.847307
0.4	0.026468	0.0067	3.651158	-2		1.295044	1.563932	4.777569
0.5	0.026457	0.0083	3.653409	-1.9		1.295661	1.54944	4.708834
0.6	0.026472	0.0100	3.650356	-1.8		1.294825	1.534949	4.641089
0.7	0.026471	0.0117	3.650676	-1.7		1.294912	1.520458	4.574318
0.8	0.026467	0.0133	3.65132	-1.6		1.295089	1.505966	4.508508
0.9	0.026468	0.0150	3.651158	-1.5		1.295044	1.491475	4.443645
1	0.026475	0.0167	3.649874	-1.4		1.294693	1.476983	4.379714
1.1	0.026484	0.0183	3.648105	-1.3		1.294208	1.462492	4.316704
1.2	0.026479	0.0200	3.649069	-1.2		1.294472	1.448001	4.2546
1.3	0.026491	0.0217	3.646658	-1.1		1.293811	1.433509	4.193389
1.4	0.026451	0.0233	3.654534	-1		1.295968	1.419018	4.13306
1.5	0.026484	0.0250	3.648105	-0.9		1.294208	1.404527	4.073598
1.6	0.026498	0.0267	3.645211	-0.8		1.293414	1.390035	4.014991
1.7	0.0265	0.0283	3.644889	-0.7		1.293326	1.375544	3.957228
1.8	0.026496	0.0300	3.645694	-0.6		1.293547	1.361052	3.900296
1.9	0.026484	0.0317	3.648105	-0.5		1.294208	1.346561	3.844183
2	0.026492	0.0333	3.646498	-0.4		1.293767	1.33207	3.788877
2.1	0.026553	0.0350	3.634443	-0.3		1.290456	1.317578	3.734367
2.2	0.030336	0.0367	2.88685	-0.2		1.060166	1.303087	3.680641
2.3	0.02825	0.0383	3.298982	-0.1		1.193614	1.288595	3.627688
2.4	0.027397	0.0400	3.467595	0	*	1.243461	1.274104	3.575497
2.5	0.027612	0.0417	3.425162	0.1	*	1.231149	1.259613	3.524056
2.6	0.027815	0.0433	3.384976	0.2	*	1.219347	1.245121	3.473356
2.7	0.027981	0.0450	3.352186	0.3	*	1.209613	1.23063	3.423385
2.8	0.028053	0.0467	3.337881	0.4	*	1.205336	1.216139	3.374133
2.9	0.028284	0.0483	3.292391	0.5	*	1.191614	1.201647	3.32559
3	0.028543	0.0500	3.241117	0.6	*	1.175918	1.187156	3.277745
3.1	0.028837	0.0517	3.183091	0.7	*	1.157853	1.172664	3.230589
3.2	0.029079	0.0533	3.13519	0.8	*	1.14269	1.158173	3.18411
3.3	0.029222	0.0550	3.106901	0.9	*	1.133626	1.143682	3.138301
3.4	0.029462	0.0567	3.059482	1	*	1.118246	1.12919	3.093151
3.5	0.02968	0.0583	3.016405	1.1	*	1.104066	1.114699	3.04865
3.6	0.029892	0.0600	2.974613	1.2	*	1.090114	1.100207	3.004789
3.7	0.030113	0.0617	2.930893	1.3	*	1.075307	1.085716	2.96156
3.8	0.030335	0.0633	2.887012	1.4	*	1.060222	1.071225	2.918952
3.9	0.030549	0.0650	2.844737	1.5	*	1.045471	1.056733	2.876957
4	0.030672	0.0667	2.820304	1.6	*	1.036845	1.042242	2.835567
4.1	0.03086	0.0683	2.783174	1.7	*	1.023592	1.02775	2.794772
4.2	0.031088	0.0700	2.738168	1.8	*	1.007289	1.013259	2.754564
4.3	0.03129	0.0717	2.698304	1.9	*	0.992624	0.998768	2.714934
4.4	0.031491	0.0733	2.658603	2	*	0.977801	0.984276	2.675875
4.5	0.031595	0.0750	2.638028	2.1	*	0.970032	0.969785	2.637377
4.6	0.031779	0.0767	2.601702	2.2	*	0.956166	0.955294	2.599434
4.7	0.031978	0.0783	2.562322	2.3	*	0.940914	0.940802	2.562036
4.8	0.032166	0.0800	2.52519	2.4	*	0.926316	0.926311	2.525176
4.9	0.032362	0.0817	2.486453	2.5	*	0.910857	0.911819	2.488847

5	0.03255	0.0833	2.449162	2.6	*	0.895746	0.897328	2.45304
5.1	0.032649	0.0850	2.429711	2.7	*	0.887773	0.882837	2.417748
5.2	0.032814	0.0867	2.397081	2.8	*	0.874252	0.868345	2.382964
5.3	0.033006	0.0883	2.359148	2.9	*	0.858301	0.853854	2.348681
5.4	0.033183	0.0900	2.324107	3	*	0.843336	0.839362	2.314891
5.5	0.03336	0.0917	2.289067	3.1	*	0.828144	0.824871	2.281587
5.6	0.033442	0.0933	2.272992	3.2	*	0.821097	0.81038	2.248762
5.7	0.033609	0.0950	2.239879	3.3	*	0.806422	0.795888	2.216409
5.8	0.03379	0.0967	2.204196	3.4	*	0.790363	0.781397	2.184522
5.9	0.033952	0.0983	2.172209	3.5	*	0.775745	0.766906	2.153093
6	0.034129	0.1000	2.13717	3.6	*	0.759483	0.752414	2.122117
6.1	0.034206	0.1017	2.121899	3.7	*	0.752312	0.737923	2.091586
6.2	0.034363	0.1033	2.090877	3.8	*	0.737584	0.723431	2.061495
6.3	0.034519	0.1050	2.060016	3.9	*	0.722714	0.70894	2.031836
6.4	0.034694	0.1067	2.025617	4	*	0.705874	0.694449	2.002604
6.5	0.034862	0.1083	1.992344	4.1	*	0.689312	0.679957	1.973793
6.6	0.035006	0.1100	1.963893	4.2	*	0.674929	0.665466	1.945396
6.7	0.035168	0.1117	1.931907	4.3	*	0.658508	0.650974	1.917408
6.8	0.035233	0.1133	1.919047	4.4	*	0.651829	0.636483	1.889823
6.9	0.035396	0.1150	1.886739	4.5	*	0.63485	0.621992	1.862634
7	0.035483	0.1167	1.869542	4.6	*	0.625693	0.6075	1.835837
7.1	0.03567	0.1183	1.832731	4.7	*	0.605807	0.593009	1.809425
7.2	0.035836	0.1200	1.799781	4.8	*	0.587665	0.578517	1.783393
7.3	0.035904	0.1217	1.786439	4.9	*	0.580224	0.564026	1.757735
7.4	0.036047	0.1233	1.75815	5	*	0.564262	0.549535	1.732447
7.5	0.036197	0.1250	1.728573	5.1	*	0.547296	0.535043	1.707522
7.6	0.036322	0.1267	1.70382	5.2	*	0.532873	0.520552	1.682956
7.7	0.036464	0.1283	1.675692	5.3	*	0.516226	0.506061	1.658744
7.8	0.036528	0.1300	1.663152	5.4	*	0.508715	0.491569	1.63488
7.9	0.036667	0.1317	1.635668	5.5	*	0.492051	0.477078	1.611359
8	0.036794	0.1333	1.610593	5.6	*	0.476602	0.462586	1.588176
8.1	0.036931	0.1350	1.583427	5.7	*	0.459591	0.448095	1.565327
8.2	0.037055	0.1367	1.558834	5.8	*	0.443938	0.433604	1.542807
8.3	0.037113	0.1383	1.547423	5.9	*	0.436591	0.419112	1.520611
8.400001	0.037238	0.1400	1.52283	6.000001	*	0.42057	0.404621	1.498734
8.5	0.037365	0.1417	1.497593	6.1	*	0.403859	0.390129	1.477172
8.6	0.037485	0.1433	1.473964	6.2	*	0.387956	0.375638	1.45592
8.7	0.037594	0.1450	1.452427	6.3	*	0.373236	0.361147	1.434974
8.8	0.037721	0.1467	1.427352	6.4	*	0.355821	0.346655	1.414329
8.900001	0.037852	0.1483	1.401472	6.500001	*	0.337523	0.332164	1.393981
9	0.037896	0.1500	1.392792	6.6	*	0.331311	0.317673	1.373926
9.1	0.038033	0.1517	1.365628	6.7	*	0.311615	0.303181	1.35416
9.2	0.03814	0.1533	1.344571	6.8	*	0.296075	0.28869	1.334678
9.3	0.038262	0.1550	1.3203	6.9	*	0.277859	0.274198	1.315476
9.400001	0.038374	0.1567	1.298279	7.000001	*	0.261039	0.259707	1.29655
9.5	0.038478	0.1583	1.277704	7.1	*	0.245064	0.245216	1.277897
9.6	0.03853	0.1600	1.267417	7.2	*	0.236981	0.230724	1.259512
9.7	0.038638	0.1617	1.24604	7.3	*	0.21997	0.216233	1.241391
9.8	0.038728	0.1633	1.228358	7.4	*	0.205678	0.201741	1.223532
9.900001	0.038847	0.1650	1.204729	7.500001	*	0.186255	0.18725	1.205929
10	0.03887	0.1667	1.200229	7.6	*	0.182513	0.172759	1.188579
10.2	0.039047	0.1700	1.165348	7.8	*	0.15302	0.143776	1.154625
10.4	0.039203	0.1733	1.134326	8	*	0.126039	0.114793	1.121641
10.6	0.03944	0.1767	1.087551	8.2	*	0.083929	0.08581	1.0896
10.8	0.039592	0.1800	1.057494	8.4	*	0.055902	0.056828	1.058473
11	0.039737	0.1833	1.028881	8.6	*	0.028472	0.027845	1.028236

11.2	0.039899	0.1867	0.996895
11.4	0.040057	0.1900	0.965713
11.6	0.040234	0.1933	0.930672
11.8	0.040388	0.1967	0.900292
12	0.040523	0.2000	0.873609
12.2	0.040701	0.2033	0.838407
12.4	0.040767	0.2067	0.825387
12.6	0.040933	0.2100	0.792597
12.8	0.041023	0.2133	0.774755
13	0.041188	0.2167	0.742126
13.2	0.041351	0.2200	0.709978
13.4	0.041448	0.2233	0.69069
13.6	0.041567	0.2267	0.667221
13.8	0.041672	0.2300	0.646486
14	0.041805	0.2333	0.620126
14.2	0.041916	0.2367	0.598265
14.4	0.042009	0.2400	0.579781
14.6	0.042144	0.2433	0.553259
14.8	0.042175	0.2467	0.54699
15	0.042306	0.2500	0.521111
15.2	0.042369	0.2533	0.508735
15.4	0.042469	0.2567	0.488964
15.6	0.042588	0.2600	0.465496
15.8	0.042632	0.2633	0.456656
16	0.042741	0.2667	0.435277
16.2	0.042788	0.2700	0.425955
16.4	0.042888	0.2733	0.406184
16.6	0.042953	0.2767	0.393324
16.8	0.043038	0.2800	0.376609
17	0.043109	0.2833	0.362462
17.2	0.043173	0.2867	0.349765
17.4	0.043239	0.2900	0.336745
17.6	0.043299	0.2933	0.325012
17.8	0.043374	0.2967	0.310063
18	0.043403	0.3000	0.304437
18.2	0.043489	0.3033	0.287399
18.4	0.043535	0.3067	0.278237
18.6	0.043561	0.3100	0.273093
18.8	0.043635	0.3133	0.258626
19	0.043673	0.3167	0.251071
19.2	0.043728	0.3200	0.240142
19.4	0.043772	0.3233	0.231462
19.6	0.04383	0.3267	0.220049
19.8	0.04387	0.3300	0.212174
20	0.043914	0.3333	0.203332
20.2	0.043935	0.3367	0.199314
21.2	0.044162	0.3533	0.154308
22.2	0.044297	0.3700	0.127787
23.2	0.044392	0.3867	0.108978
24.2	0.044498	0.4033	0.087923
25.2	0.044571	0.4200	0.073617
26.2	0.044645	0.4367	0.05883
27.2	0.044694	0.4533	0.049186
28.2	0.044741	0.4700	0.039862
29.2	0.044776	0.4867	0.033111
30.2	0.044803	0.5033	0.027646

8.8	*	-0.00311	-0.00114	0.998863
9	*	-0.03489	-0.03012	0.970328
9.2	*	-0.07185	-0.0591	0.942609
9.4	*	-0.10504	-0.08809	0.915682
9.6	*	-0.13512	-0.11707	0.889524
9.8	*	-0.17625	-0.14605	0.864113
10	*	-0.1919	-0.17503	0.839428
10.2	*	-0.23244	-0.20402	0.815448
10.4	*	-0.25521	-0.233	0.792153
10.6	*	-0.29824	-0.26198	0.769524
10.8	*	-0.34252	-0.29097	0.747541
11		-0.37006	-0.31995	0.726186
11.2		-0.40463	-0.34893	0.705442
11.4		-0.4362	-0.37791	0.685289
11.6		-0.47783	-0.4069	0.665713
11.8		-0.51372	-0.43588	0.646696
12		-0.54511	-0.46486	0.628222
12.2		-0.59193	-0.49385	0.610275
12.4		-0.60332	-0.52283	0.592842
12.6		-0.65179	-0.55181	0.575906
12.8		-0.67583	-0.58079	0.559454
13		-0.71547	-0.60978	0.543472
13.2		-0.76465	-0.63876	0.527947
13.4		-0.78382	-0.66774	0.512865
13.6		-0.83177	-0.69672	0.498214
13.8		-0.85342	-0.72571	0.483982
14		-0.90095	-0.75469	0.470156
14.2		-0.93312	-0.78367	0.456725
14.4		-0.97655	-0.81266	0.443678
14.6		-1.01483	-0.84164	0.431004
14.8		-1.05049	-0.87062	0.418691
15		-1.08843	-0.8996	0.406731
15.2		-1.12389	-0.92859	0.395112
15.4		-1.17098	-0.95757	0.383825
15.6		-1.18929	-0.98655	0.37286
15.8		-1.24688	-1.01554	0.362209
16		-1.27928	-1.04452	0.351861
16.2		-1.29794	-1.0735	0.34181
16.4		-1.35237	-1.10248	0.332045
16.6		-1.38202	-1.13147	0.32256
16.8		-1.42652	-1.16045	0.313345
17		-1.46334	-1.18943	0.304394
17.2		-1.5139	-1.21841	0.295699
17.4		-1.55035	-1.2474	0.287251
17.6		-1.59292	-1.27638	0.279046
17.8		-1.61287	-1.30536	0.271074
18.8		-1.8688	-1.45028	0.234505
19.8		-2.05739	-1.59519	0.20287
20.8		-2.21661	-1.7401	0.175502
21.8		-2.43129	-1.88502	0.151826
22.8		-2.60888	-2.02993	0.131344
23.8		-2.8331	-2.17485	0.113626
24.8		-3.01215	-2.31976	0.098297
25.8		-3.22234	-2.46467	0.085037
26.8		-3.4079	-2.60959	0.073565
27.8		-3.58827	-2.7545	0.063641

31.2	0.044833	0.5200	0.0217	28.8	-3.83046	-2.89942	0.055055
32.2	0.044852	0.5367	0.018002	29.8	-4.01727	-3.04433	0.047628
33.2	0.044854	0.5533	0.01768	30.8	-4.03533	-3.18924	0.041203
34.2	0.044872	0.5700	0.014144	31.8	-4.25845	-3.33416	0.035645
35.2	0.044882	0.5867	0.012055	32.8	-4.41825	-3.47907	0.030836
36.2	0.044887	0.6033	0.011091	33.8	-4.50163	-3.62398	0.026676
37.2	0.044898	0.6200	0.00884	34.8	-4.72848	-3.7689	0.023077
38.2	0.044923	0.6367	0.004018	35.8	-5.51702	-3.91381	0.019964
39.2	0.044931	0.6533	0.002409	36.8	-6.02851	-4.05873	0.017271
40.2	0.044934	0.6700	0.001767	37.8	-6.33859	-4.20364	0.014941
41.2	0.044942	0.6867	0.00016	38.8	-8.73984	-4.34855	0.012925
42.2	0.04492	0.7033	0.00466	39.8	-5.36872	-4.49347	0.011182
43.2	0.044926	0.7200	0.003375	40.8	-5.69121	-4.63838	0.009673
44.2	0.044934	0.7367	0.001767	41.8	-6.33859	-4.7833	0.008368

LENZ OIL
MW05D DUPLICATE RISING HEAD PRESSURE TEST DATA (5-30-91)

THIS SPREADSHEET CALCULATES HYDRAULIC CONDUCTIVITY BASED ON THE BOUWER AND RICE (1976) METHOD. AIR PRESSURE WAS USED TO PUSH THE WATER DOWN IN THE WELL AND RECOVERY RATE WAS MEASURED.

THE FOLLOWING STEPS ARE REQUIRED TO CALCULATE HYDRAULIC CONDUCTIVITY:
1.) IMPORT HERMIT DATA INTO COLUMNS UNDER RAW DATA
2.) DECIDE WHICH DATA IS APPROPRIATE, CHOOSE THE INITIAL INDUCED HEAD, TRANSLATE TIME VALUES
3.) DO THE REGRESSION CALCULATION FOR LEAST SQUARES FIT
4.) CHOOSE APPROPRIATE SLUG TEST PARAMETERS
5.) CHOOSE A VALUE FOR TIME t AND ITS CORRESPONDING Yt

Note: Values of time are translated to the first meaningful data point. The initial theoretical induced head (Yo) is chosen on the regression line at the translated time t=0. (see Pandit and and Miner, 1986. Ground Water. V. 24, No. 6, p. 743-749).

LINEAR REGRESSION DATA

Regression Output:

Constant	1.289776
Std Err of Y Est	0.016004
R Squared	0.998667
No. of Observations	97
Degrees of Freedom	95
X Coefficient(s)	-0.14773
Std Err of Coef.	0.000554

Regression line equation:

Ln Y = -0.14773 t+1.289776

Ln Y intercept: 1.289776

SLUG TEST PARAMETERS

Length of slug (Ls)=		ft.
Slug diameter (Ds)=		ft.
Initial theoret. induced head (Yo)=	3.631972	ft.
Actual initial induced head (Ho)=	3.534464	ft.
Radius of developed zone (rw)=	0.25	ft.
Radius of well casing (rc)=	0.0833	ft.
Effective length of inflow (L)=	5	ft.
Saturated thickness of aquifer (D)=	175	ft.
L/rw=	20	
A=	2.1686	
Constants based on L/rw: B=	0.318	
C=	1.6788	
Distance between top of aquifer and screen bottom (H)=	33	ft.
D > H Ln (R/rw)=	2.330402	
D = H Ln (R/rw)=	3.233938	
Note: Ln((D-H)/rw)=	6	

If Ln((D-H)/rw)>6, set Ln((D-H)/rw)=6

where:

D > H Ln(R/rw)=[1.1/Ln(H/rw)+(A+BLn[(D-H)/rw])/L/rw]**-1

D = H Ln(R/rw)=[1.1/Ln(H/rw)+C/(L/rw)]**-1

K=rc**2*Ln(R/rw)*Ln(Yo/Yt))/2Lt

Initial theoret. induced head (Yo):
Induced head (Yt) at time t:
Ordered pair on regression line (t,Yt):

Note: Choose Yt and t

Yo = 3.631972 ft.
Yt = 2.663237 ft.
t = 2.1 sec.

RADIUS OF INFLUENCE

R= 2.570519 ft.

CALCULATION OF HYDRAULIC CONDUCTIVITY

K= 0.007281 cm/sec
K= 154.3623 gal/day-ft**2

RAW DATA Note: 1 ft. head = 0.00506 volts

Induced head = final head reading-transducer head at time t

Time (sec.)	Transducer Head (Volts)	Time (min.)	Induced head Value Y (ft)	Translated Time (sec.)	Data used in linear fit	Ln (Y)	Ln (Yt) (theor.)	Yt
0.1	0.025788	0.0017	3.763836	-1.5		1.325439	1.511371	4.532942
0.2	0.025774	0.0033	3.766569	-1.4		1.326165	1.496598	4.466469
0.3	0.025786	0.0050	3.764158	-1.3		1.325524	1.481825	4.400971
0.4	0.025796	0.0067	3.762229	-1.2		1.325012	1.467052	4.336433
0.5	0.025791	0.0083	3.763194	-1.1		1.325268	1.452279	4.272842
0.6	0.025812	0.0100	3.759014	-1		1.324157	1.437506	4.210183
0.7	0.025694	0.0117	3.782322	-0.9		1.330338	1.422733	4.148443
0.8	0.025813	0.0133	3.758854	-0.8		1.324114	1.40796	4.087608
0.9	0.025811	0.0150	3.759176	-0.7		1.3242	1.393187	4.027666
1	0.025815	0.0167	3.758372	-0.6		1.323986	1.378414	3.968602
1.1	0.02582	0.0183	3.757407	-0.5		1.323729	1.363641	3.910405
1.2	0.025965	0.0200	3.728796	-0.4		1.316086	1.348868	3.853061
1.3	0.029746	0.0217	2.981526	-0.3		1.092435	1.334095	3.796558
1.4	0.027488	0.0233	3.427733	-0.2		1.231899	1.319322	3.740884
1.5	0.027073	0.0250	3.509872	-0.1		1.255579	1.304549	3.686026
1.6	0.026948	0.0267	3.534464	0	*	1.262562	1.289776	3.631972
1.7	0.027152	0.0283	3.494119	0.1	*	1.251081	1.275003	3.578711
1.8	0.027328	0.0300	3.459399	0.2	*	1.241095	1.26023	3.526232
1.9	0.02767	0.0317	3.391729	0.3	*	1.22134	1.245457	3.474521
2	0.027944	0.0333	3.337721	0.4	*	1.205288	1.230684	3.423569
2.1	0.028162	0.0350	3.294482	0.5	*	1.192249	1.215911	3.373365
2.2	0.028381	0.0367	3.251243	0.6	*	1.179037	1.201138	3.323896
2.3	0.028489	0.0383	3.230026	0.7	*	1.17249	1.186365	3.275153
2.4	0.028746	0.0400	3.179233	0.8	*	1.15664	1.171592	3.227125
2.5	0.029002	0.0417	3.128601	0.9	*	1.140586	1.156819	3.179801
2.6	0.029239	0.0433	3.081666	1	*	1.12547	1.142046	3.133171
2.7	0.029474	0.0450	3.035374	1.1	*	1.110334	1.127273	3.087225
2.8	0.029577	0.0467	3.014958	1.2	*	1.103586	1.112499	3.041952
2.9	0.029793	0.0483	2.972204	1.3	*	1.089304	1.097726	2.997344
3	0.030024	0.0500	2.926553	1.4	*	1.073825	1.082953	2.953389
3.1	0.030254	0.0517	2.881065	1.5	*	1.05816	1.06818	2.910079
3.2	0.030447	0.0533	2.84297	1.6	*	1.044849	1.053407	2.867405
3.3	0.030678	0.0550	2.79732	1.7	*	1.028662	1.038634	2.825356
3.4	0.030891	0.0567	2.755208	1.8	*	1.013493	1.023861	2.783924
3.5	0.030987	0.0583	2.736239	1.9	*	1.006584	1.009088	2.743099
3.6	0.031203	0.0600	2.693644	2	*	0.990895	0.994315	2.702873
3.7	0.031402	0.0617	2.654263	2.1	*	0.976167	0.979542	2.663237
3.8	0.031599	0.0633	2.615366	2.2	*	0.961404	0.964769	2.624182
3.9	0.0318	0.0650	2.575662	2.3	*	0.946107	0.949996	2.5857
4	0.031909	0.0667	2.554125	2.4	*	0.93771	0.935223	2.547782
4.1	0.032086	0.0683	2.519083	2.5	*	0.923895	0.92045	2.51042
4.2	0.032279	0.0700	2.480988	2.6	*	0.908657	0.905677	2.473606
4.3	0.032466	0.0717	2.444018	2.7	*	0.893643	0.890904	2.437332
4.4	0.032628	0.0733	2.411872	2.8	*	0.880403	0.876131	2.40159
4.5	0.032846	0.0750	2.368955	2.9	*	0.862449	0.861358	2.366372
4.6	0.032937	0.0767	2.350951	3	*	0.85482	0.846585	2.33167
4.7	0.033121	0.0783	2.314464	3.1	*	0.839178	0.831812	2.297478
4.8	0.033273	0.0800	2.284405	3.2	*	0.826106	0.817039	2.263787
4.9	0.033453	0.0817	2.248883	3.3	*	0.810434	0.802266	2.230589

5	0.033639	0.0833	2.212075	3.4	*	0.793931	0.787493	2.197879
5.1	0.033726	0.0850	2.194875	3.5	*	0.786125	0.77272	2.165648
5.2	0.033888	0.0867	2.162887	3.6	*	0.771444	0.757947	2.13389
5.3	0.034064	0.0883	2.128168	3.7	*	0.755262	0.743174	2.102598
5.4	0.034232	0.0900	2.094895	3.8	*	0.739504	0.728401	2.071765
5.5	0.034393	0.0917	2.063231	3.9	*	0.724273	0.713628	2.041383
5.6	0.034489	0.0933	2.044263	4	*	0.715037	0.698855	2.011448
5.7	0.034641	0.0950	2.014206	4.1	*	0.700225	0.684082	1.981951
5.8	0.03479	0.0967	1.98463	4.2	*	0.685433	0.669309	1.952887
5.9	0.034971	0.0983	1.948947	4.3	*	0.667289	0.654536	1.924249
6	0.035125	0.1000	1.918567	4.4	*	0.651579	0.639763	1.896031
6.1	0.035274	0.1017	1.88899	4.5	*	0.636042	0.62499	1.868226
6.2	0.035423	0.1033	1.859575	4.6	*	0.620348	0.610216	1.84083
6.3	0.0355	0.1050	1.844466	4.7	*	0.61219	0.595443	1.813835
6.4	0.035633	0.1067	1.818105	4.8	*	0.597795	0.58067	1.787236
6.5	0.035786	0.1083	1.787887	4.9	*	0.581035	0.565897	1.761027
6.6	0.035799	0.1100	1.785314	5	*	0.579594	0.551124	1.735203
6.7	0.036074	0.1117	1.730986	5.1	*	0.548691	0.536351	1.709757
6.8	0.036139	0.1133	1.718126	5.2	*	0.541234	0.521578	1.684685
6.9	0.03628	0.1150	1.690318	5.3	*	0.524917	0.506805	1.65998
7	0.036413	0.1167	1.663957	5.4	*	0.509198	0.492032	1.635637
7.1	0.036545	0.1183	1.637919	5.5	*	0.493427	0.477259	1.611651
7.2	0.036681	0.1200	1.610913	5.6	*	0.476801	0.462486	1.588017
7.3	0.036744	0.1217	1.598538	5.7	*	0.469089	0.447713	1.56473
7.4	0.036881	0.1233	1.571534	5.8	*	0.452052	0.43294	1.541784
7.5	0.03702	0.1250	1.543887	5.9	*	0.434303	0.418167	1.519175
7.6	0.037136	0.1267	1.521061	6	*	0.419408	0.403394	1.496897
7.7	0.037278	0.1283	1.493093	6.1	*	0.40085	0.388621	1.474946
7.8	0.037321	0.1300	1.484413	6.2	*	0.395019	0.373848	1.453316
7.9	0.037467	0.1317	1.455642	6.3	*	0.375447	0.359075	1.432004
8	0.037587	0.1333	1.431852	6.4	*	0.358969	0.344302	1.411005
8.1	0.037706	0.1350	1.408385	6.5	*	0.342444	0.329529	1.390313
8.2	0.037787	0.1367	1.392472	6.6	*	0.331081	0.314756	1.369925
8.3	0.037922	0.1383	1.365628	6.7	*	0.311615	0.299983	1.349836
8.400001	0.038067	0.1400	1.337018	6.800001	*	0.290442	0.28521	1.330041
8.5	0.038118	0.1417	1.326891	6.9	*	0.282839	0.270437	1.310537
8.6	0.038231	0.1433	1.304708	7	*	0.265979	0.255664	1.291319
8.7	0.03835	0.1450	1.281081	7.1	*	0.247704	0.240891	1.272382
8.8	0.038453	0.1467	1.260828	7.2	*	0.231769	0.226118	1.253723
8.900001	0.038547	0.1483	1.242182	7.300001	*	0.216869	0.211345	1.235338
9	0.038679	0.1500	1.216142	7.4	*	0.195684	0.196572	1.217223
9.1	0.038737	0.1517	1.204569	7.5	*	0.186122	0.181799	1.199373
9.2	0.038843	0.1533	1.183674	7.6	*	0.168623	0.167026	1.181785
9.3	0.038943	0.1550	1.163903	7.7	*	0.151779	0.152253	1.164454
9.400001	0.039048	0.1567	1.143166	7.800001	*	0.133802	0.137479	1.147378
9.5	0.039144	0.1583	1.1242	7.9	*	0.117071	0.122707	1.130553
9.6	0.039186	0.1600	1.115842	8	*	0.109609	0.107934	1.113974
9.7	0.039285	0.1617	1.096393	8.1	*	0.092026	0.09316	1.097638
9.8	0.039388	0.1633	1.075978	8.2	*	0.07323	0.078387	1.081542
9.900001	0.039482	0.1650	1.057494	8.300001	*	0.055902	0.063614	1.065681
10	0.039513	0.1667	1.051385	8.4	*	0.050109	0.048841	1.050054
10.2	0.039666	0.1700	1.021006	8.6	*	0.020788	0.019295	1.019483
10.4	0.039819	0.1733	0.990789	8.8	*	-0.00925	-0.01025	0.989802
10.6	0.04002	0.1767	0.951085	9	*	-0.05015	-0.0398	0.960985
10.8	0.040167	0.1800	0.921992	9.2	*	-0.08122	-0.06934	0.933007
11	0.040296	0.1833	0.896595	9.4	*	-0.10915	-0.09889	0.905843

11.2	0.040495	0.1867	0.857215	9.6	*	-0.15407	-0.12843	0.879471
11.4	0.040581	0.1900	0.840176	9.8	*	-0.17414	-0.15798	0.853866
11.6	0.040781	0.1933	0.800796	10	*	-0.22215	-0.18753	0.829007
11.8	0.040902	0.1967	0.776846	10.2	*	-0.25251	-0.21707	0.804871
12	0.041025	0.2000	0.752573	10.4	*	-0.28426	-0.24662	0.781438
12.2	0.041193	0.2033	0.719302	10.6	*	-0.32947	-0.27617	0.758688
12.4	0.041236	0.2067	0.710783	10.8	*	-0.34139	-0.30571	0.736599
12.6	0.041424	0.2100	0.673652	11		-0.39504	-0.33526	0.715154
12.8	0.041523	0.2133	0.654042	11.2		-0.42458	-0.3648	0.694333
13	0.041672	0.2167	0.624626	11.4		-0.4706	-0.39435	0.674118
13.2	0.04175	0.2200	0.609196	11.6		-0.49562	-0.4239	0.654492
13.4	0.041835	0.2233	0.592478	11.8		-0.52344	-0.45344	0.635437
13.6	0.041884	0.2267	0.582676	12		-0.54012	-0.48299	0.616937
13.8	0.041984	0.2300	0.562903	12.2		-0.57465	-0.51253	0.598976
14	0.04213	0.2333	0.534132	12.4		-0.62711	-0.54208	0.581538
14.2	0.042201	0.2367	0.519986	12.6		-0.65395	-0.57163	0.564607
14.4	0.04228	0.2400	0.504555	12.8		-0.68408	-0.60117	0.548169
14.6	0.042409	0.2433	0.478998	13		-0.73606	-0.63072	0.53221
14.8	0.042463	0.2467	0.468389	13.2		-0.75846	-0.66026	0.516715
15	0.04256	0.2500	0.449101	13.4		-0.80051	-0.68981	0.501671
15.2	0.042614	0.2533	0.438492	13.6		-0.82441	-0.71936	0.487066
15.4	0.042703	0.2567	0.420812	13.8		-0.86557	-0.7489	0.472885
15.6	0.042798	0.2600	0.402166	14		-0.91089	-0.77845	0.459118
15.8	0.04285	0.2633	0.391719	14.2		-0.93721	-0.80799	0.445751
16	0.042935	0.2667	0.375002	14.4		-0.98082	-0.83754	0.432774
16.2	0.042993	0.2700	0.363589	14.6		-1.01173	-0.86709	0.420174
16.4	0.043074	0.2733	0.347516	14.8		-1.05695	-0.89663	0.407941
16.6	0.043134	0.2767	0.335621	15		-1.09177	-0.92618	0.396064
16.8	0.043215	0.2800	0.319708	15.2		-1.14035	-0.95572	0.384533
17	0.043268	0.2833	0.309259	15.4		-1.17358	-0.98527	0.373338
17.2	0.043324	0.2867	0.298168	15.6		-1.2101	-1.01482	0.362469
17.4	0.043364	0.2900	0.290132	15.8		-1.23742	-1.04436	0.351916
17.6	0.043426	0.2933	0.277915	16		-1.28044	-1.07391	0.34167
17.8	0.043499	0.2967	0.263611	16.2		-1.33328	-1.10345	0.331723
18	0.043542	0.3000	0.255091	16.4		-1.36614	-1.133	0.322065
18.[illegible]	0.043585	0.3033	0.246571	16.6		-1.4001	-1.16255	0.312689
18.4	0.043643	0.3067	0.23516	16.8		-1.44749	-1.19209	0.303585
18.6	0.043672	0.3100	0.229372	17		-1.47241	-1.22164	0.294747
18.8	0.043726	0.3133	0.218765	17.2		-1.51976	-1.25119	0.286165
19	0.043782	0.3167	0.207672	17.4		-1.5718	-1.28073	0.277834
19.2	0.043805	0.3200	0.203012	17.6		-1.59449	-1.31028	0.269745
19.4	0.043845	0.3233	0.195136	17.8		-1.63406	-1.33982	0.261892
19.6	0.04391	0.3267	0.182277	18		-1.70223	-1.36937	0.254267
19.8	0.043931	0.3300	0.178257	18.2		-1.72453	-1.39892	0.246865
20	0.043966	0.3333	0.171186	18.4		-1.76501	-1.42846	0.239677
20.2	0.04399	0.3367	0.166524	18.6		-1.79262	-1.45801	0.232699
21.2	0.044163	0.3533	0.132287	19.6		-2.02278	-1.60574	0.200741
22.2	0.044283	0.3700	0.108658	20.6		-2.21955	-1.75347	0.173172
23.2	0.044376	0.3867	0.090174	21.6		-2.40602	-1.9012	0.149389
24.2	0.044467	0.4033	0.072172	22.6		-2.6287	-2.04893	0.128873
25.2	0.044536	0.4200	0.05867	23.6		-2.83583	-2.19666	0.111174
26.2	0.044592	0.4367	0.047579	24.6		-3.04536	-2.34439	0.095906
27.2	0.044634	0.4533	0.039219	25.6		-3.23858	-2.49212	0.082734
28.2	0.044672	0.4700	0.031826	26.6		-3.44747	-2.63985	0.071372
29.2	0.044689	0.4867	0.028451	27.6		-3.55959	-2.78758	0.06157
30.2	0.04472	0.5033	0.022182	28.6		-3.80848	-2.93531	0.053114

31.2	0.044735	0.5200	0.019289
32.2	0.044748	0.5367	0.016717
33.2	0.044748	0.5533	0.016717
34.2	0.044767	0.5700	0.01286
35.2	0.044779	0.5867	0.010609
36.2	0.044794	0.6033	0.007715

29.6	-3.94824	-3.08304	0.04582
30.6	-4.09131	-3.23077	0.039527
31.6	-4.09131	-3.3785	0.034099
32.6	-4.35366	-3.52623	0.029416
33.6	-4.54608	-3.67396	0.025376
34.6	-4.86454	-3.82169	0.021891

LENSE OIL

MW6S RISING HEAD SLUG TEST DATA (5-24-91)

THIS SPREADSHEET CALCULATES HYDRAULIC CONDUCTIVITY BASED ON THE BOUWER AND RICE (1976) METHOD.

THE FOLLOWING STEPS ARE REQUIRED TO CALCULATE HYDRAULIC CONDUCTIVITY:

1.) IMPORT HERMIT DATA INTO COLUMNS UNDER RAW DATA
2.) DECIDE WHICH DATA IS APPROPRIATE, CHOOSE THE INITIAL INDUCED HEAD, TRANSLATE TIME VALUES
3.) DO THE REGRESSION CALCULATION FOR LEAST SQUARES FIT
4.) CHOOSE APPROPRIATE SLUG TEST PARAMETERS
5.) CHOOSE A VALUE FOR TIME t AND ITS CORRESPONDING Yt

Note: Values of time are translated to the first meaningful data point. The initial theoretical induced head (Yo) is chosen on the regression line at the translated time t=0. (see Pandit and and Miner, 1986. Ground Water. V. 24, No. 6, p. 743-749).

LINEAR REGRESSION DATA

Regression Output:

Constant	0.370796
Std Err of Y Est	0.052497
R Squared	0.995466
No. of Observations	6
Degrees of Freedom	4
X Coefficient(s)	-0.41534
Std Err of Coef.	0.014015

Regression line equation:

Ln Y = -0.41534 t+0.370796

Ln Y intercept: 0.370796

SLUG TEST PARAMETERS

Length of slug (Ls)=	3	ft.
Slug diameter (Ds)=	0.14	ft.
Initial theoret. induced head (Yo)=	1.448887	ft.
Actual initial induced head (Ho)=	1.44	ft.
Radius of developed zone (rw)=	0.25	ft.
Radius of well casing (rc)=	0.0833	ft.
Effective length of inflow (L)=	8.4	ft.
Saturated thickness of aquifer (D)=	175	ft.
L/rw=	33.6	
A=	2.5694	
Constants based on L/rw: B=	0.4087	
C=	2.1666	
Distance between top of aquifer and screen bottom (H)=	8.4	ft.
D > H Ln (R/rw)=	2.162447	
D = H Ln (R/rw)=	2.649225	
Note: Ln((D-H)/rw)=	6	

If Ln((D-H)/rw)>6, set Ln((D-H)/rw)=6

where:

D > H Ln(R/rw)=[1.1/Ln(H/rw)+(A+BLn[(D-H)/rw])/L/rw]**-1

D = H Ln(R/rw)=[1.1/Ln(H/rw)+C/(L/rw)]**-1

K=rc**2*Ln(R/rw)*Ln(Yo/Yt))/2Lt

Initial theoret. induced head (Yo):
Induced head (Yt) at time t:
Ordere . pair on regression line (t,Yt):

Note: Choose Yt and t

Yo = 1.448887 ft.
Yt = 0.880198 ft.
t = 1.2 sec.

RADIUS OF INFLUENCE

R= 2.173095 ft.

CALCULATION OF HYDRAULIC CONDUCTIVITY

K= 0.011307 cm/sec
K= 239.7053 gal/day-ft**2

RAW DATA

Time (min.)	Transducer Head (ft.)	Translated Time (min.)	Induced head Value Y (ft)	Translated Time (sec.)	Data used in linear fit	Ln (Y)	Ln (Yt) (theor.)	Yt
0	-8.03	-0.03	8.03	-1.8		2.083185	1.118402	3.059961
0.0033	-7.81	-0.0267	7.81	-1.602		2.055405	1.036165	2.818389
0.0066	-5.97	-0.0234	5.97	-1.404		1.786747	0.953929	2.595888
0.0099	-5.83	-0.0201	5.83	-1.206		1.763017	0.871692	2.390953
0.0133	-4.51	-0.0167	4.51	-1.002		1.506297	0.786963	2.196715
0.0166	-2.56	-0.0134	2.56	-0.804		0.940007	0.704726	2.023293
0.02	-6.34	-0.01	6.34	-0.6		1.846879	0.619998	1.858924
0.0233	-5.77	-0.0067	5.77	-0.402		1.752672	0.537761	1.712169
0.0266	-2.66	-0.0034	2.66	-0.204		0.978326	0.455524	1.577
0.03	-1.44	0	1.44	0	*	0.364643	0.370796	1.448887
0.0333	-1.38	0.0033	1.38	0.198	*	0.322083	0.288559	1.334503
0.05	-0.89	0.02	0.89	1.2	*	-0.11653	-0.12761	0.880198
0.0666	-0.56	0.0366	0.56	2.196	*	-0.57982	-0.54128	0.582
0.0833	-0.36	0.0533	0.36	3.198	*	-1.02165	-0.95745	0.38387
0.1	-0.27	0.07	0.27	4.2	*	-1.30933	-1.37362	0.253189
0.1166	-0.23	0.0866	0.23	5.196		-1.46968	-1.7873	0.167412
0.1333	-0.19	0.1033	0.19	6.198		-1.66073	-2.20346	0.11042
0.15	-0.16	0.12	0.16	7.2		-1.83258	-2.61963	0.07283
0.1666	-0.14	0.1366	0.14	8.196		-1.96611	-3.03331	0.048156
0.1833	-0.13	0.1533	0.13	9.198		-2.04022	-3.44947	0.031762
0.2	-0.11	0.17	0.11	10.2		-2.20727	-3.86564	0.020949
0.2166	-0.1	0.1866	0.1	11.196		-2.30259	-4.27932	0.013852
0.2333	-0.09	0.2033	0.09	12.198		-2.40795	-4.69548	0.009136
0.25	-0.08	0.22	0.08	13.2		-2.52573	-5.11165	0.006026
0.2666	-0.07	0.2366	0.07	14.196		-2.65926	-5.52533	0.003985
0.2833	-0.06	0.2533	0.06	15.198		-2.81341	-5.9415	0.002628
0.3	-0.06	0.27	0.06	16.2		-2.81341	-6.35766	0.001733

LENZ OIL
MW06D RISING HEAD PRESSURE TEST DATA (5-30-91)

THIS SPREADSHEET CALCULATES HYDRAULIC CONDUCTIVITY BASED ON THE BOUWER AND RICE (1976) METHOD. AIR PRESSURE WAS USED TO PUSH THE WATER DOWN IN THE WELL AND RECOVERY RATE WAS MEASURED.

THE FOLLOWING STEPS ARE REQUIRED TO CALCULATE HYDRAULIC CONDUCTIVITY:
1.) IMPORT HERMIT DATA INTO COLUMNS UNDER RAW DATA
2.) DECIDE WHICH DATA IS APPROPRIATE, CHOOSE THE INITIAL INDUCED HEAD, TRANSLATE TIME VALUES
3.) DO THE REGRESSION CALCULATION FOR LEAST SQUARES FIT
4.) CHOOSE APPROPRIATE SLUG TEST PARAMETERS
5.) CHOOSE A VALUE FOR TIME t AND ITS CORRESPONDING Yt

Note: Values of time are translated to the first meaningful data point. The initial theoretical induced head (Yo) is chosen on the regression line at the translated time t=0. (see Pandit and and Miner, 1986. Ground Water. V. 24, No. 6, p. 743-749).

LINEAR REGRESSION DATA

Regression Output:		Regression line equation:
Constant	1.353449	
Std Err of Y Est	0.017368	Ln Y = -0.15508 t+1.353449
R Squared	0.998464	
No. of Observations	93	Ln Y intercept: 1.353449
Degrees of Freedom	91	
X Coefficient(s)	-0.15508	
Std Err of Coef.	0.000638	

SLUG TEST PARAMETERS

Length of slug (Ls)=		ft	Initial theoret. induced head (Yo):
Slug diameter (Ds)=		ft.	Induced head (Yt) at time t:
Initi.. theoret. induced head (Yo)=	3.870752	ft.	Ordered pair on regression
Actual initial induced head (Ho)=	3.719955	ft.	line (t,Yt):
Radius of developed zone (rw)=	0.25	ft.	
Radius of well casing (rc)=	0.0833	ft.	Note: Choose Yt and t
Effective length of inflow (L)=	5	ft.	
Saturated thickness of aquifer (D)=	175	ft.	Yo = 3.870752 ft.
L/rw=	20		Yt = 2.973739 ft.
A=	2.1686		t = 1.7 sec.
Constants based on L/rw: B=	0.318		
C=	1.6788		
Distance between top of aquifer and screen bottom (H)=	37.4	ft.	RADIUS OF INFLUENCE
D > H Ln (R/rw)=	2.361386		R= 2.65141 ft.
D = H Ln (R/rw)=	3.293915		
Note: Ln((D-H)/rw)=	6		CALCULATION OF HYDRAULIC CONDUCTIVITY

If Ln((D-H)/rw)>6, set Ln((D-H)/rw)=6

where:
D > H Ln(R/rw)=[1.1/Ln(H/rw)+(A+BLn[(D-H)/rw])/L/rw]**-1
D = H Ln(R/rw)=[1.1/Ln(H/rw)+C/(L/rw)]**-1

K= 0.007745 cm/sec
K= 164.1918 gal/day-ft**2

K=rc**2*Ln(R/rw)*Ln(Yo/Yt))/2Lt

RAW DATA Note: 1 ft. head = 0.00506 volts
Induced head = final head reading-transducer head at time t

Time (sec.)	Transducer Head (Volts)	Time (min.)	Induced head Value Y (ft)	Translated Time (sec.)	Data used in linear fit	Ln (Y)	Ln (Yt) (theor.)	Yt
0.1	0.025728	0.0017	3.96717	-1.9		1.378053	1.648092	5.197057
0.2	0.025733	0.0033	3.966206	-1.8		1.37781	1.632585	5.117085
0.3	0.025743	0.0050	3.964277	-1.7		1.377323	1.617077	5.038343
0.4	0.025759	0.0067	3.961061	-1.6		1.376512	1.60157	4.960814
0.5	0.025736	0.0083	3.965561	-1.5		1.377647	1.586062	4.884477
0.6	0.025717	0.0100	3.969419	-1.4		1.37862	1.570555	4.809315
0.7	0.025764	0.0117	3.960097	-1.3		1.376268	1.555047	4.735309
0.8	0.025733	0.0133	3.966206	-1.2		1.37781	1.53954	4.662443
0.9	0.025726	0.0150	3.96765	-1.1		1.378174	1.524032	4.590697
1	0.025724	0.0167	3.967972	-1		1.378255	1.508524	4.520056
1.1	0.025737	0.0183	3.965401	-0.9		1.377607	1.493017	4.450502
1.2	0.025745	0.0200	3.963794	-0.8		1.377202	1.477509	4.382018
1.3	0.025729	0.0217	3.967008	-0.7		1.378012	1.462002	4.314587
1.4	0.025723	0.0233	3.968134	-0.6		1.378296	1.446494	4.248195
1.5	0.025757	0.0250	3.961383	-0.5		1.376593	1.430987	4.182824
1.6	0.025724	0.0267	3.967972	-0.4		1.378255	1.415479	4.118459
1.7	0.025738	0.0283	3.965241	-0.3		1.377567	1.399971	4.055084
1.8	0.028393	0.0300	3.440431	-0.2		1.235597	1.384464	3.992685
1.9	0.027117	0.0317	3.692789	-0.1		1.306382	1.368956	3.931246
2	0.026979	0.0333	3.719955	0	*	1.313711	1.353449	3.870752
2.1	0.027091	0.0350	3.697933	0.1	*	1.307774	1.337941	3.811189
2.2	0.027361	0.0367	3.644407	0.2	*	1.293194	1.322434	3.752542
2.3	0.027502	0.0383	3.616601	0.3	*	1.285535	1.306926	3.694799
2.4	0.027696	0.0400	3.578344	0.4	*	1.2749	1.291418	3.637943
2.5	0.027974	0.0417	3.523372	0.5	*	1.259418	1.275911	3.581963
2.6	0.028286	0.0433	3.461648	0.6	*	1.241745	1.260403	3.526844
2.7	0.028597	0.0450	3.400247	0.7	*	1.223848	1.244896	3.472573
2.8	0.02876	0.0467	3.367939	0.8	*	1.214301	1.229388	3.419137
2.9	0.029054	0.0483	3.309913	0.9	*	1.196922	1.213881	3.366524
3	0.029323	0.0500	3.256708	1	*	1.180717	1.198373	3.31472
3.1	0.029594	0.0517	3.203182	1.1	*	1.164145	1.182866	3.263713
3.2	0.029842	0.0533	3.154158	1.2	*	1.148722	1.167358	3.213491
3.3	0.030071	0.0550	3.10899	1.3	*	1.134298	1.15185	3.164042
3.4	0.030244	0.0567	3.074753	1.4	*	1.123225	1.136343	3.115354
3.5	0.030447	0.0583	3.034569	1.5	*	1.110069	1.120835	3.067415
3.6	0.030685	0.0600	2.987472	1.6	*	1.094428	1.105328	3.020214
3.7	0.0309	0.0617	2.945038	1.7	*	1.080122	1.08982	2.973739
3.8	0.031123	0.0633	2.900996	1.8	*	1.065054	1.074313	2.927979
3.9	0.031339	0.0650	2.858399	1.9	*	1.050262	1.058805	2.882924
4	0.031573	0.0667	2.812107	2	*	1.033934	1.043297	2.838562
4.1	0.03167	0.0683	2.792818	2.1	*	1.027051	1.02779	2.794882
4.2	0.031876	0.0700	2.752152	2.2	*	1.012383	1.012282	2.751875
4.3	0.032087	0.0717	2.710522	2.3	*	0.997141	0.996775	2.709529
4.4	0.03233	0.0733	2.66246	2.4	*	0.979251	0.981267	2.667835
4.5	0.032516	0.0750	2.625652	2.5	*	0.965329	0.96576	2.626782
4.6	0.032594	0.0767	2.610381	2.6	*	0.959496	0.950252	2.586362
4.7	0.03279	0.0783	2.571482	2.7	*	0.944482	0.934745	2.546563
4.8	0.03298	0.0800	2.534032	2.8	*	0.929812	0.919237	2.507376
4.9	0.033183	0.0817	2.493846	2.9	*	0.913826	0.903729	2.468793

5	0.033381	0.0833	2.454787	3	*	0.89804	0.888222	2.430803
5.1	0.033473	0.0850	2.436623	3.1	*	0.890613	0.872714	2.393398
5.2	0.033679	0.0867	2.395957	3.2	*	0.873783	0.857207	2.356569
5.3	0.03387	0.0883	2.358184	3.3	*	0.857892	0.841699	2.320306
5.4	0.034031	0.0900	2.326198	3.4	*	0.844235	0.826192	2.284601
5.5	0.034223	0.0917	2.288263	3.5	*	0.827793	0.810684	2.249446
5.6	0.034318	0.0933	2.269617	3.6	*	0.819611	0.795176	2.214832
5.7	0.03449	0.0950	2.235542	3.7	*	0.804483	0.779669	2.18075
5.8	0.03467	0.0967	2.200018	3.8	*	0.788465	0.764161	2.147193
5.9	0.034831	0.0983	2.168192	3.9	*	0.773894	0.748654	2.114152
6	0.035003	0.1000	2.134275	4	*	0.758127	0.733146	2.081619
6.1	0.035181	0.1017	2.099073	4.1	*	0.741496	0.717639	2.049588
6.2	0.035253	0.1033	2.084769	4.2	*	0.734658	0.702131	2.018049
6.3	0.035393	0.1050	2.057123	4.3	*	0.721308	0.686623	1.986995
6.4	0.035598	0.1067	2.016617	4.4	*	0.701421	0.671116	1.956419
6.5	0.035778	0.1083	1.981093	4.5	*	0.683649	0.655608	1.926314
6.6	0.035966	0.1100	1.943802	4.6	*	0.664646	0.640101	1.896672
6.7	0.036052	0.1117	1.926925	4.7	*	0.655925	0.624593	1.867486
6.8	0.036237	0.1133	1.890277	4.8	*	0.636723	0.609086	1.838749
6.9	0.036381	0.1150	1.861826	4.9	*	0.621558	0.593578	1.810455
7	0.036593	0.1167	1.820034	5	*	0.598855	0.578071	1.782596
7.1	0.036752	0.1183	1.78853	5.1	*	0.581394	0.562563	1.755165
7.2	0.036933	0.1200	1.752846	5.2	*	0.561241	0.547055	1.728157
7.3	0.037016	0.1217	1.736451	5.3	*	0.551843	0.531548	1.701564
7.4	0.037168	0.1233	1.706391	5.4	*	0.534381	0.51604	1.67538
7.5	0.037329	0.1250	1.674565	5.5	*	0.515554	0.500533	1.6496
7.6	0.037504	0.1267	1.639846	5.6	*	0.494602	0.485025	1.624216
7.7	0.037681	0.1283	1.604966	5.7	*	0.473103	0.469518	1.599223
7.8	0.037847	0.1300	1.572176	5.8	*	0.452461	0.45401	1.574614
7.9	0.037935	0.1317	1.554816	5.9	*	0.441357	0.438502	1.550384
8	0.03805	0.1333	1.531992	6	*	0.426569	0.422995	1.526527
8.1	0.038213	0.1350	1.499844	6.1	*	0.405361	0.407487	1.503036
8.2	0.038358	0.1367	1.471071	6.2	*	0.385991	0.39198	1.479908
8.3	0.038482	0.1383	1.44664	6.3	*	0.369244	0.376472	1.457135
8.400001	0.038525	0.1400	1.438121	6.400001	*	0.363337	0.360965	1.434713
8.5	0.038641	0.1417	1.415134	6.5	*	.347224	0.345457	1.412635
8.6	0.03877	0.1433	1.389737	6.6	*	0.329115	0.32995	1.390898
8.7	0.038903	0.1450	1.363377	6.7	*	0.309965	0.314442	1.369495
8.8	0.039016	0.1467	1.341196	6.8	*	0.293561	0.298934	1.348421
8.900001	0.039102	0.1483	1.324158	6.900001	*	0.280777	0.283427	1.327672
9	0.039231	0.1500	1.298599	7	*	0.261286	0.267919	1.307242
9.1	0.039305	0.1517	1.283972	7.1	*	0.249959	0.252412	1.287126
9.2	0.039393	0.1533	1.266613	7.2	*	0.236346	0.236904	1.26732
9.3	0.039524	0.1550	1.240735	7.3	*	0.215704	0.221397	1.247818
9.400001	0.03963	0.1567	1.219678	7.400001	*	0.198587	0.205889	1.228617
9.5	0.039757	0.1583	1.194603	7.5	*	0.177814	0.190381	1.209711
9.6	0.039798	0.1600	1.186565	7.6	*	0.171063	0.174874	1.191096
9.7	0.039898	0.1617	1.166794	7.7	*	0.15426	0.159366	1.172767
9.8	0.039998	0.1633	1.147024	7.8	*	0.137171	0.143859	1.154721
9.900001	0.040122	0.1650	1.122593	7.900001	*	0.115641	0.128351	1.136952
10	0.04014	0.1667	1.118895	8	*	0.112342	0.112844	1.119457
10.2	0.040312	0.1700	1.08498	8.2	*	0.081562	0.081829	1.08527
10.4	0.04047	0.1733	1.053796	8.4	*	0.052399	0.050813	1.052127
10.6	0.040707	0.1767	1.006862	8.6	*	0.006838	0.019798	1.019996
10.8	0.040827	0.1800	0.983233	8.8	*	-0.01691	-0.01122	0.988846
11	0.041005	0.1833	0.94803	9	*	-0.05337	-0.04223	0.958647

11.2	0.041207	0.1867	0.908168	9.2	*	-0.09633	-0.07325	0.929371
11.4	0.041273	0.1900	0.894986	9.4	*	-0.11095	-0.10426	0.900989
11.6	0.041478	0.1933	0.854642	9.6	*	-0.15707	-0.13528	0.873474
11.8	0.04159	0.1967	0.83246	9.8	*	-0.18337	-0.16629	0.846798
12	0.041763	0.2000	0.798223	10	*	-0.22537	-0.19731	0.820938
12.2	0.041883	0.2033	0.774595	10.2	*	-0.25542	-0.22832	0.795867
12.4	0.042022	0.2067	0.746949	10.4	*	-0.29176	-0.25934	0.771562
12.6	0.042141	0.2100	0.72348	10.6		-0.32368	-0.29035	0.747999
12.8	0.042292	0.2133	0.693743	10.8		-0.36565	-0.32137	0.725156
13	0.04241	0.2167	0.670277	11		-0.40006	-0.35238	0.703011
13.2	0.042547	0.2200	0.643273	11.2		-0.44119	-0.3834	0.681541
13.4	0.042651	0.2233	0.622698	11.4		-0.47369	-0.41441	0.660728
13.6	0.042786	0.2267	0.596016	11.6		-0.51749	-0.44543	0.64055
13.8	0.042885	0.2300	0.576405	11.8		-0.55094	-0.47644	0.620988
14	0.043016	0.2333	0.550526	12		-0.59688	-0.50746	0.602023
14.2	0.043098	0.2367	0.534453	12.2		-0.62651	-0.53847	0.583638
14.4	0.043199	0.2400	0.514522	12.4		-0.66452	-0.56949	0.565814
14.6	0.043322	0.2433	0.490089	12.6		-0.71317	-0.6005	0.548535
14.8	0.043394	0.2467	0.475943	12.8		-0.74246	-0.63152	0.531783
15	0.043501	0.2500	0.454727	13		-0.78806	-0.66253	0.515543
15.2	0.043574	0.2533	0.440421	13.2		-0.82002	-0.69355	0.499799
15.4	0.043661	0.2567	0.423061	13.4		-0.86024	-0.72456	0.484535
15.6	0.043783	0.2600	0.398951	13.6		-0.91892	-0.75558	0.469738
15.8	0.043844	0.2633	0.386895	13.8		-0.9496	-0.7866	0.455393
16	0.043917	0.2667	0.372589	14		-0.98728	-0.81761	0.441485
16.2	0.044007	0.2700	0.354747	14.2		-1.03635	-0.84863	0.428003
16.4	0.044053	0.2733	0.345585	14.4		-1.06252	-0.87964	0.414932
16.6	0.044156	0.2767	0.325332	14.6		-1.12291	-0.91066	0.40226
16.8	0.044209	0.2800	0.314883	14.8		-1.15555	-0.94167	0.389976
17	0.044283	0.2833	0.300257	15		-1.20312	-0.97269	0.378066
17.2	0.044353	0.2867	0.286435	15.2		-1.25024	-1.0037	0.36652
17.4	0.044388	0.2900	0.279362	15.4		-1.27525	-1.03472	0.355327
17.6	0.044469	0.2933	0.263449	15.6		-1.3339	-1.06573	0.344476
17.8	0.044524	0.2967	0.252518	15.8		-1.37627	-1.09675	0.333956
18	0.044591	0.3000	0.239338	16		-1.42988	-1.12776	0.323757
18.2	0.044627	0.3033	0.232265	16.2		-1.45988	-1.15878	0.31387
18.4	0.044705	0.3067	0.216834	16.4		-1.52862	-1.18979	0.304285
18.6	0.044741	0.3100	0.209601	16.6		-1.56255	-1.22081	0.294992
18.8	0.044798	0.3133	0.19851	16.8		-1.61692	-1.25182	0.285983
19	0.044846	0.3167	0.189028	17		-1.66586	-1.28284	0.27725
19.2	0.044893	0.3200	0.179704	17.2		-1.71645	-1.31385	0.268783
19.4	0.04494	0.3233	0.170381	17.4		-1.76972	-1.34487	0.260574
19.6	0.044983	0.3267	0.161862	17.6		-1.82101	-1.37588	0.252617
19.8	0.045022	0.3300	0.154146	17.8		-1.86985	-1.4069	0.244902
20	0.045054	0.3333	0.147877	18		-1.91137	-1.43791	0.237423
20.2	0.04509	0.3367	0.140644	18.2		-1.96152	-1.46893	0.230172
21.2	0.045288	0.3533	0.101585	19.2		-2.28686	-1.624	0.197108
22.2	0.045403	0.3700	0.078921	20.2		-2.53931	-1.77908	0.168794
23.2	0.04552	0.3867	0.055775	21.2		-2.88643	-1.93415	0.144546
24.2	0.04558	0.4033	0.043881	22.2		-3.12626	-2.08923	0.123782
25.2	0.045635	0.4200	0.033111	23.2		-3.4079	-2.24431	0.106001
26.2	0.045709	0.4367	0.018324	24.2		-3.99954	-2.39938	0.090774
27.2	0.045743	0.4533	0.011573	25.2		-4.45907	-2.55446	0.077734
28.2	0.045765	0.4700	0.007233	26.2		-4.92907	-2.70953	0.066568
29.2	0.045781	0.4867	0.004178	27.2		-5.47795	-2.86461	0.057005
30.2	0.045776	0.5033	0.005142	28.2		-5.27026	-3.01968	0.048817

LENZ OIL
MW06D DUPLICATE RISING HEAD PRESSURE TEST DATA (5-30-91)

THIS SPREADSHEET CALCULATES HYDRAULIC CONDUCTIVITY BASED ON THE BOUWER AND RICE (1976) METHOD. AIR PRESSURE WAS USED TO PUSH THE WATER DOWN IN THE WELL AND RECOVERY RATE WAS MEASURED.

THE FOLLOWING STEPS ARE REQUIRED TO CALCULATE HYDRAULIC CONDUCTIVITY:
1.) IMPORT HERMIT DATA INTO COLUMNS UNDER RAW DATA
2.) DECIDE WHICH DATA IS APPROPRIATE, CHOOSE THE INITIAL INDUCED HEAD, TRANSLATE TIME VALUES
3.) DO THE REGRESSION CALCULATION FOR LEAST SQUARES FIT
4.) CHOOSE APPROPRIATE SLUG TEST PARAMETERS
5.) CHOOSE A VALUE FOR TIME t AND ITS CORRESPONDING Yt

Note: Values of time are translated to the first meaningful data point. The initial theoretical induced head (Yo) is chosen on the regression line at the translated time t=0. (see Pandit and and Miner, 1986. Ground Water. V. 24, No. 6, p. 743-749).

LINEAR REGRESSION DATA

Regression Output:		Regression line equation:
Constant	1.275024	
Std Err of Y Est	0.015824	Ln Y = -0.15221 t+1.275024
R Squared	0.998676	
No. of Observations	93	Ln Y intercept: 1.275024
Degrees of Freedom	91	
X Coefficient(s)	-0.15221	
Std Err of Coef.	0.000581	

SLUG TEST PARAMETERS

Length of slug (Ls)=		ft.	Initial theoret. induced head (Yo):
Slug diameter (Ds)=		ft.	Induced head (Yt) at time t:
Initial theoret. induced head (Yo)=	3.578788	ft.	Ordered pair on regression
Actual initial induced head (Ho)=	3.408929	ft.	line (t,Yt):
Radius of developed zone (rw)=	0.25	ft.	
Radius of well casing (rc)=	0.0833	ft.	Note: Choose Yt and t
Effective length of inflow (L)=	5	ft.	
Saturated thickness of aquifer (D)=	175	ft.	Yo = 3.578788 ft.
L/rw=	20		Yt = 2.762873 ft.
A=	2.1686		t = 1.7 sec.
Constants based on L/rw: B=	0.318		
C=	1.6788		
Distance between top of aquifer and screen bottom (H)=	37.4	ft.	RADIUS OF INFLUENCE
D > H Ln (R/rw)=	2.361386		R= 2.65141 ft.
D = H Ln (R/rw)=	3.293915		
Note: Ln((D-H)/rw)=	6		CALCULATION OF HYDRAULIC CONDUCTIVITY

If Ln((D-H)/rw)>6, set Ln((D-H)/rw)=6

where:
D > H Ln(R/rw)=[1.1/Ln(H/rw)+(A+BLn[(D-H)/rw])/L/rw]**-1
D = H Ln(R/rw)=[1.1/Ln(H/rw)+C/(L/rw)]**-1

K= 0.007602 cm/sec
K= 161.1553 gal/day-ft**2

K=rc**2*Ln(R/rw)*Ln(Yo/Yt))/2Lt

RAW DATA Note: 1 ft. head = 0.00506 volts
Induced head = final head reading-transducer head at time t

Time (sec.)	Transducer Head (Volts)	Time (min.)	Induced head Value Y (ft)	Translated Time (sec.)	Data used in linear fit	Ln (Y)	Ln (Yt) (theor.)	Yt
0.1	0.02728	0.0017	3.662091	-1.9		1.298034	1.564219	4.778941
0.2	0.027275	0.0033	3.663055	-1.8		1.298298	1.548998	4.706753
0.3	0.027246	0.0050	3.668842	-1.7		1.299876	1.533777	4.635655
0.4	0.027282	0.0067	3.661609	-1.6		1.297903	1.518557	4.565631
0.5	0.027274	0.0083	3.663375	-1.5		1.298385	1.503336	4.496665
0.6	0.027296	0.0100	3.658875	-1.4		1.297156	1.488115	4.42874
0.7	0.027305	0.0117	3.657107	-1.3		1.296672	1.472894	4.361842
0.8	0.027287	0.0133	3.660804	-1.2		1.297683	1.457674	4.295954
0.9	0.027308	0.0150	3.656625	-1.1		1.29654	1.442453	4.231061
1	0.027299	0.0167	3.658393	-1		1.297024	1.427232	4.167149
1.1	0.0273	0.0183	3.658233	-0.9		1.29698	1.412011	4.104202
1.2	0.027306	0.0200	3.656947	-0.8		1.296629	1.396791	4.042206
1.3	0.027328	0.0217	3.652607	-0.7		1.295441	1.38157	3.981146
1.4	0.027295	0.0233	3.659198	-0.6		1.297244	1.366349	3.921009
1.5	0.027305	0.0250	3.657107	-0.5		1.296672	1.351128	3.86178
1.6	0.027301	0.0267	3.657911	-0.4		1.296892	1.335907	3.803446
1.7	0.030454	0.0283	3.034731	-0.3		1.110123	1.320687	3.745993
1.8	0.029391	0.0300	3.244814	-0.2		1.177058	1.305466	3.689407
1.9	0.028696	0.0317	3.382245	-0.1		1.21854	1.290245	3.633677
2	0.028561	0.0333	3.408929	0	*	1.226398	1.275024	3.578788
2.1	0.02857	0.0350	3.40716	0.1	*	1.225879	1.259804	3.524729
2.2	0.028742	0.0367	3.373245	0.2	*	1.215875	1.244583	3.471486
2.3	0.028815	0.0383	3.358779	0.3	*	1.211577	1.229362	3.419048
2.4	0.029096	0.0400	3.303162	0.4	*	1.19488	1.214141	3.367401
2.5	0.029331	0.0417	3.256709	0.5	*	1.180717	1.19892	3.316535
2.6	0.029596	0.0433	3.204308	0.6	*	1.164496	1.1837	3.266437
2.7	0.029883	0.0450	3.147569	0.7	*	1.14663	1.168479	3.217095
2.8	0.030018	0.0467	3.121047	0.8	*	1.138169	1.153258	3.1685
2.9	0.030266	0.0483	3.072022	0.9	*	1.122336	1.138037	3.120638
3	0.030487	0.0500	3.0283	1	*	1.108002	1.122817	3.073499
3.1	0.03073	0.0517	2.980241	1.1	*	1.092004	1.107596	3.027072
3.2	0.030968	0.0533	2.933144	1.2	*	1.076075	1.092375	2.981347
3.3	0.031099	0.0550	2.907427	1.3	*	1.067268	1.077154	2.936312
3.4	0.031296	0.0567	2.868368	1.4	*	1.053743	1.061934	2.891957
3.5	0.031549	0.0583	2.818377	1.5	*	1.036161	1.046713	2.848273
3.6	0.031735	0.0600	2.781729	1.6	*	1.023073	1.031492	2.805248
3.7	0.031923	0.0617	2.744599	1.7	*	1.009635	1.016271	2.762873
3.8	0.032146	0.0633	2.700395	1.8	*	0.993398	1.00105	2.721139
3.9	0.032233	0.0650	2.683198	1.9	*	0.987009	0.98583	2.680034
4	0.032426	0.0667	2.645103	2	*	0.97271	0.970609	2.639551
4.1	0.032663	0.0683	2.598328	2.1	*	0.954868	0.955388	2.599679
4.2	0.032845	0.0700	2.562322	2.2	*	0.940914	0.940167	2.56041
4.3	0.033018	0.0717	2.528085	2.3	*	0.927462	0.924947	2.521733
4.4	0.033116	0.0733	2.508796	2.4	*	0.919803	0.909726	2.483641
4.5	0.033296	0.0750	2.473113	2.5	*	0.905478	0.894505	2.446125
4.6	0.033482	0.0767	2.436464	2.6	*	0.890548	0.879284	2.409175
4.7	0.033674	0.0783	2.39837	2.7	*	0.874789	0.864063	2.372783
4.8	0.033828	0.0800	2.36799	2.8	*	0.862042	0.848843	2.336941
4.9	0.034028	0.0817	2.328449	2.9	*	0.845202	0.833622	2.30164

5	0.03419	0.0833	2.296462	3	*	0.83137	0.818401	2.266873
5.1	0.034273	0.0850	2.280067	3.1	*	0.824205	0.80318	2.23263
5.2	0.034473	0.0867	2.240524	3.2	*	0.80671	0.78796	2.198905
5.3	0.034609	0.0883	2.213682	3.3	*	0.794657	0.772739	2.16569
5.4	0.034759	0.0900	2.183945	3.4	*	0.781133	0.757518	2.132976
5.5	0.034961	0.0917	2.144083	3.5	*	0.762712	0.742297	2.100756
5.6	0.035013	0.0933	2.133794	3.6	*	0.757902	0.727076	2.069023
5.7	0.035204	0.0950	2.096022	3.7	*	0.740041	0.711856	2.037769
5.8	0.035369	0.0967	2.063391	3.8	*	0.724351	0.696635	2.006988
5.9	0.035507	0.0983	2.036227	3.9	*	0.711099	0.681414	1.976671
6	0.035746	0.1000	1.98897	4	*	0.687617	0.666193	1.946812
6.1	0.035792	0.1017	1.979968	4.1	*	0.683081	0.650973	1.917405
6.2	0.035972	0.1033	1.944285	4.2	*	0.664894	0.635752	1.888441
6.3	0.036173	0.1050	1.904583	4.3	*	0.644263	0.620531	1.859916
6.4	0.036345	0.1067	1.870506	4.4	*	0.626209	0.60531	1.831821
6.5	0.036498	0.1083	1.840289	4.5	*	0.609922	0.59009	1.80415
6.6	0.036678	0.1100	1.804765	4.6	*	0.59043	0.574869	1.776897
6.7	0.036853	0.1117	1.770206	4.7	*	0.571096	0.559648	1.750056
6.8	0.036942	0.1133	1.752526	4.8	*	0.561058	0.544427	1.723621
6.9	0.037095	0.1150	1.722466	4.9	*	0.543757	0.529206	1.697585
7	0.037263	0.1167	1.689196	5	*	0.524252	0.513986	1.671942
7.1	0.037444	0.1183	1.65335	5.1	*	0.502803	0.498765	1.646686
7.2	0.037597	0.1200	1.62313	5.2	*	0.484357	0.483544	1.621812
7.3	0.037677	0.1217	1.607379	5.3	*	0.474605	0.468323	1.597314
7.4	0.037834	0.1233	1.576356	5.4	*	0.455116	0.453103	1.573186
7.5	0.037953	0.1250	1.552887	5.5	*	0.440116	0.437882	1.549422
7.6	0.038115	0.1267	1.520741	5.6	*	0.419198	0.422661	1.526017
7.7	0.038246	0.1283	1.494862	5.7	*	0.402034	0.40744	1.502966
7.8	0.038317	0.1300	1.480877	5.8	*	0.392635	0.392219	1.480263
7.9	0.038434	0.1317	1.457731	5.9	*	0.376881	0.376999	1.457902
8	0.038541	0.1333	1.436676	6	*	0.362332	0.361778	1.43588
8.1	0.038691	0.1350	1.406939	6.1	*	0.341416	0.346557	1.41419
8.2	0.038777	0.1367	1.389901	6.2	*	0.329233	0.331336	1.392828
8.3	0.038901	0.1383	1.365468	6.3	*	0.311498	0.316116	1.371789
8.400001	0.038963	0.1400	1.353253	6.400001	*	0.302511	0.300895	1.351067
8.5	0.03906	0.1417	1.333962	6.5	*	0.288154	0.285674	1.330659
8.6	0.039188	0.1433	1.308727	6.6	*	0.269055	0.270453	1.310558
8.7	0.039314	0.1450	1.283814	6.7	*	0.249836	0.255233	1.290762
8.8	0.039382	0.1467	1.270472	6.8	*	0.239389	0.240012	1.271264
8.900001	0.039468	0.1483	1.253433	6.900001	*	0.225886	0.224791	1.252061
9	0.039557	0.1500	1.235753	7	*	0.21168	0.20957	1.233148
9.1	0.039651	0.1517	1.217269	7.1	*	0.19661	0.194349	1.214521
9.2	0.039786	0.1533	1.190585	7.2	*	0.174445	0.179129	1.196175
9.3	0.039879	0.1550	1.172261	7.3	*	0.158934	0.163908	1.178106
9.400001	0.039957	0.1567	1.15667	7.400001	*	0.145545	0.148687	1.16031
9.5	0.04006	0.1583	1.136417	7.5	*	0.12788	0.133466	1.142783
9.6	0.040107	0.1600	1.127095	7.6	*	0.119643	0.118246	1.12552
9.7	0.040245	0.1617	1.099769	7.7	*	0.0951	0.103025	1.108519
9.8	0.040328	0.1633	1.083374	7.8	*	0.08008	0.087804	1.091774
9.900001	0.040434	0.1650	1.062478	7.900001	*	0.060604	0.072583	1.075282
10	0.040464	0.1667	1.05653	8	*	0.05499	0.057362	1.05904
10.2	0.040586	0.1700	1.032419	8.2	*	0.031905	0.026921	1.027287
10.4	0.04074	0.1733	1.00204	8.4	*	0.002037	-0.00352	0.996486
10.6	0.040973	0.1767	0.955909	8.6	*	-0.04509	-0.03396	0.966608
10.8	0.041064	0.1800	0.938067	8.8	*	-0.06393	-0.0644	0.937626
11	0.041251	0.1833	0.900937	9	*	-0.10432	-0.09485	0.909514

11.2	0.041374	0.1867	0.876664	9.2	*	-0.13163	-0.12529	0.882244
11.4	0.041513	0.1900	0.84934	9.4	*	-0.1633	-0.15573	0.855792
11.6	0.041698	0.1933	0.81269	9.6	*	-0.20741	-0.18617	0.830133
11.8	0.041831	0.1967	0.78633	9.8	*	-0.24038	-0.21661	0.805243
12	0.041942	0.2000	0.76447	10	*	-0.26857	-0.24705	0.781099
12.2	0.042083	0.2033	0.736662	10.2	*	-0.30563	-0.27749	0.75768
12.4	0.042167	0.2067	0.719947	10.4	*	-0.32858	-0.30794	0.734962
12.6	0.042351	0.2100	0.683619	10.6		-0.38036	-0.33838	0.712926
12.8	0.042452	0.2133	0.663688	10.8		-0.40994	-0.36882	0.69155
13	0.042516	0.2167	0.650988	11		-0.42926	-0.39926	0.670816
13.2	0.042715	0.2200	0.611769	11.2		-0.4914	-0.4297	0.650703
13.4	0.042775	0.2233	0.599874	11.4		-0.51104	-0.46014	0.631193
13.6	0.042908	0.2267	0.573514	11.6		-0.55597	-0.49059	0.612268
13.8	0.042977	0.2300	0.55985	11.8		-0.58009	-0.52103	0.59391
14	0.043095	0.2333	0.536543	12		-0.62261	-0.55147	0.576103
14.2	0.043186	0.2367	0.518542	12.2		-0.65674	-0.58191	0.55883
14.4	0.043282	0.2400	0.499573	12.4		-0.694	-0.61235	0.542075
14.6	0.043414	0.2433	0.473534	12.6		-0.74753	-0.64279	0.525822
14.8	0.043455	0.2467	0.465498	12.8		-0.76465	-0.67323	0.510056
15	0.043556	0.2500	0.445565	13		-0.80841	-0.70368	0.494763
15.2	0.043579	0.2533	0.440905	13.2		-0.81893	-0.73412	0.479929
15.4	0.0437	0.2567	0.417115	13.4		-0.87439	-0.76456	0.465539
15.6	0.04379	0.2600	0.399273	13.6		-0.91811	-0.795	0.451581
15.8	0.043861	0.2633	0.385128	13.8		-0.95418	-0.82544	0.438041
16	0.043972	0.2667	0.363269	14		-1.01261	-0.85588	0.424907
16.2	0.044	0.2700	0.357802	14.2		-1.02777	-0.88633	0.412168
16.4	0.044075	0.2733	0.342854	14.4		-1.07045	-0.91677	0.39981
16.6	0.044145	0.2767	0.329032	14.6		-1.1116	-0.94721	0.387822
16.8	0.044236	0.2800	0.311028	14.8		-1.16787	-0.97765	0.376194
17	0.044291	0.2833	0.300259	15		-1.20311	-1.00809	0.364915
17.2	0.044341	0.2867	0.290292	15.2		-1.23687	-1.03853	0.353974
17.4	0.044404	0.2900	0.277917	15.4		-1.28043	-1.06897	0.34336
17.6	0.044431	0.2933	0.272613	15.6		-1.2997	-1.09942	0.333065
17.8	0.044514	0.2967	0.256215	15.8		-1.36174	-1.12986	0.323079
18	0.044557	0.3000	0.247698	16		-1.39555	-1.1603	0.313392
18.2	0.044623	0.3033	0.234678	16.2		-1.44954	-1.19074	0.303996
18.4	0.04467	0.3067	0.225356	16.4		-1.49008	-1.22118	0.294881
18.6	0.044708	0.3100	0.2178	16.6		-1.52418	-1.25162	0.28604
18.8	0.044776	0.3133	0.204458	16.8		-1.58739	-1.28207	0.277464
19	0.044822	0.3167	0.195296	17		-1.63324	-1.31251	0.269144
19.2	0.044841	0.3200	0.191601	17.2		-1.65234	-1.34295	0.261075
19.4	0.044904	0.3233	0.179061	17.4		-1.72003	-1.37339	0.253247
19.6	0.044932	0.3267	0.173597	17.6		-1.75102	-1.40383	0.245654
19.8	0.044963	0.3300	0.16749	17.8		-1.78683	-1.43427	0.238288
20	0.044985	0.3333	0.162988	18		-1.81408	-1.46471	0.231144
20.2	0.045039	0.3367	0.152379	18.2		-1.88138	-1.49516	0.224214
21.2	0.045222	0.3533	0.116213	19.2		-2.15233	-1.64736	0.192557
22.2	0.045338	0.3700	0.093229	20.2		-2.37269	-1.79957	0.16537
23.2	0.045452	0.3867	0.070885	21.2		-2.64669	-1.95178	0.142021
24.2	0.045503	0.4033	0.060759	22.2		-2.80084	-2.10399	0.121969
25.2	0.045591	0.4200	0.043399	23.2		-3.13731	-2.2562	0.104748
26.2	0.045636	0.4367	0.034397	24.2		-3.36978	-2.4084	0.089959
27.2	0.045688	0.4533	0.024111	25.2		-3.7251	-2.56061	0.077258
28.2	0.045715	0.4700	0.018806	26.2		-3.97356	-2.71282	0.06635
29.2	0.04575	0.4867	0.011895	27.2		-4.43162	-2.86503	0.056982
30.2	0.045768	0.5033	0.00836	28.2		-4.78433	-3.01723	0.048936

LENZ OIL
MW07S RISING HEAD SLUG TEST DATA (5-30-91)

THIS SPREADSHEET CALCULATES HYDRAULIC CONDUCTIVITY BASED ON THE BOUWER AND RICE (1976) METHOD.

THE FOLLOWING STEPS ARE REQUIRED TO CALCULATE HYDRAULIC CONDUCTIVITY:
1.) IMPORT HERMIT DATA INTO COLUMNS UNDER RAW DATA
2.) DECIDE WHICH DATA IS APPROPRIATE, CHOOSE THE INITIAL INDUCED HEAD, TRANSLATE TIME VALUES
3.) DO THE REGRESSION CALCULATION FOR LEAST SQUARES FIT
4.) CHOOSE APPROPRIATE SLUG TEST PARAMETERS
5.) CHOOSE A VALUE FOR TIME t AND ITS CORRESPONDING Yt

Note: Values of time are translated to the first meaningful data point. The initial theoretical induced head (Yo) is chosen on the regression line at the translated time t=0. (see Pandit and and Miner, 1986. Ground Water. V. 24, No. 6, p. 743-749).

LINEAR REGRESSION DATA

Regression Output:

Constant	0.124461
Std Err of Y Est	0.032097
R Squared	0.997729
No. of Observations	9
Degrees of Freedom	7
X Coefficient(s)	-0.30352
Std Err of Coef.	0.005473

Regression line equation:

Ln Y = -0.30352 t+0.124461

Ln Y intercept: 0.124461

SLUG TEST PARAMETERS

Length of slug (Ls)=		ft.
Slug diameter (Ds)=		ft.
Initial theoret. induced head (Yo)=	1.132538	ft.
Actual initial induced head (Ho)=	1.18	ft.
Radius of developed zone (rw)=	0.25	ft.
Radius of well casing (rc)=	0.0833	ft.
Effective length of inflow (L)=	4.3	ft.
Saturated thickness of aquifer (D)=	175	ft.
L/rw=	17.2	
A=	2.0621	
Constants based on L/rw: B=	0.3037	
C=	1.5792	
Distance between top of aquifer and screen bottom (H)=	13.3	ft.
D > H Ln (R/rw)=	1.989549	
D = H Ln (R/rw)=	2.712901	
Note: Ln((D-H)/rw)=	6	

If Ln((D-H)/rw)>6, set Ln((D-H)/rw)=6

where:
D > H Ln(R/rw)=[1.1/Ln(H/rw)+(A+BLn[(D-H)/rw])/L/rw]**-1
D = H Ln(R/rw)=[1.1/Ln(H/rw)+C/(L/rw)]**-1

K=rc**2*Ln(R/rw)*Ln(Yo/Yt))/2Lt

Initial theoret. induced head (Yo):
Induced head (Yt) at time t:
Ordered pair on regression line (t,Yt):

Note: Choose Yt and t

Yo = 1.132538 ft.
Yt = 0.207077 ft.
t = 5.598 sec.

RADIUS OF INFLUENCE

R= 1.828058 ft.

CALCULATION OF HYDRAULIC CONDUCTIVITY

K= 0.014851 cm/sec
K= 314.8396 gal/day-ft**2

RAW DATA

Time (min.)	Transducer Head (ft.)	Time (sec.)	Induced head Value Y (ft)	Translated Time (sec.)	Data used in linear fit	Ln (Y)	Ln (Yt) (theor.)	Yt
0	-0.44	0.0000	0.44	-1.398		-0.82098	0.548787	1.731152
0.0033	-2.23	0.1980	2.23	-1.2		0.802002	0.488689	1.630178
0.0066	-2.39	0.3960	2.39	-1.002		0.871293	0.428592	1.535094
0.0099	-1.84	0.5940	1.84	-0.804		0.609766	0.368494	1.445556
0.0133	-0.42	0.7980	0.42	-0.6		-0.8675	0.306575	1.358764
0.0166	-0.85	0.9960	0.85	-0.402		-0.16252	0.246477	1.27951
0.02	-1.21	1.2000	1.21	-0.198		0.19062	0.184559	1.202688
0.0233	-1.18	1.3980	1.18	2.22E-16	*	0.165514	0.124461	1.132538
0.0266	-1.08	1.5960	1.08	0.198	*	0.076961	0.064363	1.06648
0.03	-1.02	1.8000	1.02	0.402	*	0.019803	0.002445	1.002448
0.0333	-0.92	1.9980	0.92	0.6	*	-0.08338	-0.05765	0.943977
0.05	-0.67	3.0000	0.67	1.602	*	-0.40048	-0.36178	0.696433
.0666	-0.5	3.9960	0.5	2.598	*	-0.69315	-0.66409	0.51474
0.0833	-0.37	4.9980	0.37	3.6	*	-0.99425	-0.96822	0.379757
0.1	-0.29	6.0000	0.29	4.602	*	-1.23787	-1.27235	0.280171
0.1166	-0.21	6.9960	0.21	5.598	*	-1.56065	-1.57466	0.207077
0.1333	-0.16	7.9980	0.16	6.6		-1.83258	-1.87879	0.152774
0.15	-0.13	9.0000	0.13	7.602		-2.04022	-2.18292	0.112711
0.1666	-0.1	9.9960	0.1	8.598		-2.30259	-2.48523	0.083306
0.1833	-0.08	10.9980	0.08	9.6		-2.52573	-2.78936	0.06146
0.2	-0.06	12.0000	0.06	10.602		-2.81341	-3.0935	0.045343
2166	-0.05	12.9960	0.05	11.598		-2.99573	-3.3958	0.033514
0.2333	-0.04	13.9980	0.04	12.6		-3.21888	-3.69994	0.024725
0.25	-0.03	15.0000	0.03	13.602		-3.50656	-4.00407	0.018241
0.2666	-0.02	15.9960	0.02	14.598		-3.91202	-4.30638	0.013482
0.2833	-0.01	16.9980	0.01	15.6		-4.60517	-4.61051	0.009947

..NZ OIL (2 FT. RECOVERY TEST)
MW07S RISING HEAD PRESSURE TEST DATA (5-30-91)

THIS SPREADSHEET CALCULATES HYDRAULIC CONDUCTIVITY BASED ON THE BOUWER AND RICE (1976) METHOD. AIR PRESSURE WAS USED TO PUSH THE WATER DOWN IN THE WELL AND RECOVERY RATE WAS MEASURED.

THE FOLLOWING STEPS ARE REQUIRED TO CALCULATE HYDRAULIC CONDUCTIVITY:
1.) IMPORT HERMIT DATA INTO COLUMNS UNDER RAW DATA
2.) DECIDE WHICH DATA IS APPROPRIATE, CHOOSE THE INITIAL INDUCED HEAD, TRANSLATE TIME VALUES
3.) DO THE REGRESSION CALCULATION FOR LEAST SQUARES FIT
4.) CHOOSE APPROPRIATE SLUG TEST PARAMETERS
5.) CHOOSE A VALUE FOR TIME t AND ITS CORRESPONDING Yt

Note: Values of time are translated to the first meaningful data point. The initial theoretical induced head (Yo) is chosen on the regression line at the translated time t=0. (see Pandit and and Miner, 1986. Ground Water. V. 24, No. 6, p. 743-749).

LINEAR REGRESSION DATA

Regression Output:	
Constant	0.399209
Std Err of Y Est	0.022064
R Squared	0.997913
No. of Observations	57
Degrees of Freedom	55
X Coefficient(s)	-0.28805
Std Err of Coef.	0.001776

Regression line equation:

Ln Y = -0.28805 t+0.399209

Ln Y intercept: 0.399209

SLUG TEST PARAMETERS

Length of slug (Ls)=		ft.
Slug diameter (Ds)=		ft.
Initial theoret. induced head (Yo)=	1.490645	ft.
Actual initial induced head (Ho)=	1.589875	ft.
Radius of developed zone (rw)=	0.25	ft.
Radius of well casing (rc)=	0.0833	ft.
Effective length of inflow (L)=	4.3	ft.
Saturated thickness of aquifer (D)=	175	ft.
L/rw=	17.2	
A=	2.0621	
Constants based on L/rw: B=	0.3037	
C=	1.5792	
Distance between top of aquifer and screen bottom (H)=	13.3	ft.
D > H Ln (R/rw)=	1.989549	
D = H Ln (R/rw)=	2.712901	
Note: Ln((D-H)/rw)=	6	

If Ln((D-H)/rw)>6, set Ln((D-H)/rw)=6

where:
D > H Ln(R/rw)=[1.1/Ln(H/rw)+(A+BLn[(D-H)/rw])/L/rw]**-1
D = H Ln(R/rw)=[1.1/Ln(H/rw)+C/(L/rw)]**-1

K=rc**2*Ln(R/rw)*Ln(Yo/Yt))/2Lt

Initial theoret. induced head (Yo):
Induced head (Yt) at time t:
Order pair on regression line (t,Yt):

Note: Choose Yt and t

Yo = 1.490645 ft.
Yt = 1.32842 ft.
t = 0.4 sec.

RADIUS OF INFLUENCE

R= 1.828058 ft.

CALCULATION OF HYDRAULIC CONDUCTIVITY

K= 0.014094 cm/sec
K= 298.7849 gal/day-ft**2

RAW DATA Note: 1 ft. head = 0.00506 volts

Induced head = final head reading-transducer head at time t

Time (sec.)	Transducer Head (Volts)	Time (min.)	Induced head Value Y (ft)	Translated Time (sec.)	Data used in linear fit	Ln (Y)	Ln (Yt) (theor.)	Yt
0.1	0.041248	0.0017	1.848182	-3.7		0.614202	1.464979	4.327452
0.2	0.041243	0.0033	1.849306	-3.6		0.614811	1.436174	4.204579
0.3	0.041228	0.0050	1.8522	-3.5		0.616374	1.40737	4.085196
0.4	0.041263	0.0067	1.845289	-3.4		0.612636	1.378565	3.969202
0.5	0.041247	0.0083	1.848504	-3.3		0.614377	1.34976	3.856502
0.6	0.041252	0.0100	1.847377	-3.2		0.613767	1.320956	3.747001
0.7	0.041255	0.0117	1.846895	-3.1		0.613506	1.292151	3.64061
0.8	0.041234	0.0133	1.850915	-3		0.61568	1.263347	3.53724
0.9	0.041244	0.0150	1.848986	-2.9		0.614637	1.234542	3.436804
1	0.041264	0.0167	1.844966	-2.8		0.612461	1.205738	3.339221
1.1	0.041234	0.0183	1.851075	-2.7		0.615767	1.176933	3.244408
1.2	0.041245	0.0200	1.848824	-2.6		0.61455	1.148128	3.152287
1.3	0.04126	0.0217	1.845771	-2.5		0.612897	1.119324	3.062782
1.4	0.041263	0.0233	1.845289	-2.4		0.612636	1.090519	2.975819
1.5	0.041251	0.0250	1.84754	-2.3		0.613855	1.061715	2.891324
1.6	0.041253	0.0267	1.847217	-2.2		0.61368	1.03291	2.809229
1.7	0.04126	0.0283	1.845771	-2.1		0.612897	1.004105	2.729464
1.8	0.041272	0.0300	1.84352	-2		0.611677	0.975301	2.651965
1.9	0.041273	0.0317	1.843198	-1.9		0.611502	0.946496	2.576666
2	0.041282	0.0333	1.841591	-1.8		0.61063	0.917692	2.503505
2.1	0.041297	0.0350	1.838538	-1.7		0.60897	0.888887	2.432421
2.2	0.041288	0.0367	1.840306	-1.6		0.609932	0.860082	2.363356
2.3	0.041256	0.0383	1.846735	-1.5		0.613419	0.831278	2.296251
2.4	0.041286	0.0400	1.840787	-1.4		0.610193	0.802473	2.231052
2.5	0.041272	0.0417	1.84352	-1.3		0.611677	0.773669	2.167704
2.6	0.041309	0.0433	1.836126	-1.2		0.607658	0.744864	2.106155
2.7	0.041299	0.0450	1.838215	-1.1		0.608795	0.716059	2.046354
2.8	0.041257	0.0467	1.846413	-1		0.613245	0.687255	1.98825
2.9	0.04129	0.0483	1.839984	-0.9		0.609757	0.65845	1.931796
3	0.041309	0.0500	1.836126	-0.8		0.607658	0.629646	1.876945
3.1	0.041295	0.0517	1.83902	-0.7		0.609233	0.600841	1.823652
3.2	0.041365	0.0533	1.825036	-0.6		0.601599	0.572037	1.771872
3.3	0.041516	0.0550	1.795298	-0.5		0.585171	0.543232	1.721562
3.4	0.044407	0.0567	1.223875	-0.4		0.202022	0.514427	1.67268
3.5	0.043887	0.0583	1.326587	-0.3		0.282609	0.485623	1.625187
3.6	0.042375	0.0600	1.625399	-0.2		0.485753	0.456818	1.579042
3.7	0.042715	0.0617	1.558211	-0.1		0.443539	0.428014	1.534207
3.8	0.042555	0.0633	1.589875	0	*	0.463656	0.399209	1.490645
3.9	0.042848	0.0650	1.53201	0.1	*	0.426581	0.370404	1.44832
4	0.043153	0.0667	1.471733	0.2	*	0.386441	0.3416	1.407197
4.1	0.043443	0.0683	1.414512	0.3	*	0.346784	0.312795	1.367242
4.2	0.043761	0.0700	1.351502	0.4	*	0.301217	0.283991	1.32842
4.3	0.043967	0.0717	1.310836	0.5	*	0.270665	0.255186	1.290702
4.4	0.04427	0.0733	1.251042	0.6	*	0.223976	0.226381	1.254054
4.5	0.04443	0.0750	1.219375	0.7	*	0.198339	0.197577	1.218447
4.6	0.044565	0.0767	1.192694	0.8	*	0.176214	0.168772	1.183851
4.7	0.044762	0.0783	1.153794	0.9	*	0.143056	0.139968	1.150237
4.8	0.044972	0.0800	1.112164	1	*	0.106308	0.111163	1.117577
4.9	0.045158	0.0817	1.075516	1.1	*	0.0728	0.082359	1.085845

5	0.045341	0.0833	1.03935	1.2	*	0.038595	0.053554	1.055014
5.1	0.045433	0.0850	1.021186	1.3	*	0.020964	0.024749	1.025058
5.2	0.045563	0.0867	0.995468	1.4	*	-0.00454	-0.00406	0.995953
5.3	0.045761	0.0883	0.956407	1.5	*	-0.04457	-0.03286	0.967674
5.4	0.045932	0.0900	0.922492	1.6	*	-0.08068	-0.06166	0.940198
5.5	0.046068	0.0917	0.89565	1.7	*	-0.11021	-0.09047	0.913503
5.6	0.046159	0.0933	0.877646	1.8	*	-0.13051	-0.11927	0.887565
5.7	0.046271	0.0950	0.855626	1.9	*	-0.15592	-0.14808	0.862364
5.8	0.046424	0.0967	0.825247	2	*	-0.19207	-0.17688	0.837878
5.9	0.046545	0.0983	0.801296	2.1	*	-0.22152	-0.20569	0.814088
6	0.046687	0.1000	0.773328	2.2	*	-0.25705	-0.23449	0.790973
6.1	0.046731	0.1017	0.764648	2.3	*	-0.26834	-0.2633	0.768514
6.2	0.046876	0.1033	0.736038	2.4	*	-0.30647	-0.2921	0.746693
6.3	0.046997	0.1050	0.712087	2.5	*	-0.33956	-0.32091	0.725492
6.4	0.04709	0.1067	0.693603	2.6	*	-0.36586	-0.34971	0.704892
6.5	0.047221	0.1083	0.667723	2.7	*	-0.40388	-0.37851	0.684878
6.6	0.047303	0.1100	0.65165	2.8	*	-0.42825	-0.40732	0.665432
6.7	0.047413	0.1117	0.629789	2.9	*	-0.46237	-0.43612	0.646537
6.8	0.047461	0.1133	0.620306	3	*	-0.47754	-0.46493	0.62818
6.9	0.047579	0.1150	0.596998	3.1	*	-0.51584	-0.49373	0.610344
7	0.047665	0.1167	0.580121	3.2	*	-0.54452	-0.52254	0.593014
7.1	0.047728	0.1183	0.567583	3.3	*	-0.56637	-0.55134	0.576176
7.2	0.047822	0.1200	0.549099	3.4	*	-0.59948	-0.58015	0.559816
7.3	0.047884	0.1217	0.536721	3.5	*	-0.62228	-0.60895	0.543921
7.4	0.047955	0.1233	0.522737	3.6	*	-0.64868	-0.63776	0.528477
7.5	0.048038	0.1250	0.506342	3.7	*	-0.68054	-0.66656	0.513471
7.6	0.048118	0.1267	0.490589	3.8	*	-0.71215	-0.69537	0.498892
7.7	0.04817	0.1283	0.480302	3.9	*	-0.73334	-0.72417	0.484727
7.8	0.048234	0.1300	0.467605	4	*	-0.76013	-0.75297	0.470964
7.9	0.048301	0.1317	0.454425	4.1	*	-0.78872	-0.78178	0.457591
8	0.048375	0.1333	0.439636	4.2	*	-0.82181	-0.81058	0.444598
8.1	0.048437	0.1350	0.427421	4.3	*	-0.84999	-0.83939	0.431975
8.2	0.048484	0.1367	0.418097	4.4	*	-0.87204	-0.86819	0.419709
8.3	0.048556	0.1383	0.403953	4.5	*	-0.90646	-0.897	0.407792
8.400001	0.048577	0.1400	0.399773	4.600001	*	-0.91686	-0.9258	0.396213
8.5	0.048649	0.1417	0.385628	4.7	*	-0.95288	-0.95461	0.384964
8.6	0.048715	0.1433	0.372609	4.8	*	-0.98723	-0.98341	0.374033
8.7	0.048716	0.1450	0.372287	4.9	*	-0.98809	-1.01222	0.363413
8.8	0.048764	0.1467	0.362804	5	*	-1.01389	-1.04102	0.353094
8.900001	0.048818	0.1483	0.352196	5.100001	*	-1.04357	-1.06983	0.343068
9	0.048849	0.1500	0.346087	5.2	*	-1.06107	-1.09863	0.333328
9.1	0.048915	0.1517	0.332907	5.3	*	-1.09989	-1.12743	0.323863
9.2	0.048971	0.1533	0.321976	5.4	*	-1.13328	-1.15624	0.314667
9.3	0.049003	0.1550	0.315708	5.5	*	-1.15294	-1.18504	0.305733
9.400001	0.049032	0.1567	0.309921	5.600001	*	-1.17144	-1.21385	0.297052
9.5	0.049087	0.1583	0.29899	5.7		-1.20734	-1.24265	0.288618
9.6	0.04909	0.1600	0.298348	5.8		-1.2095	-1.27146	0.280423
9.7	0.04916	0.1617	0.284524	5.9		-1.25694	-1.30026	0.27246
9.8	0.049195	0.1633	0.277613	6		-1.28153	-1.32907	0.264724
9.900001	0.049238	0.1650	0.269093	6.100001		-1.3127	-1.35787	0.257208
10	0.049229	0.1667	0.270862	6.2		-1.30615	-1.38668	0.249905
10.2	0.049295	0.1700	0.257842	6.4		-1.35541	-1.44428	0.235915
10.4	0.049348	0.1733	0.247393	6.6		-1.39678	-1.50189	0.222708
10.6	0.049424	0.1767	0.232447	6.8		-1.45909	-1.5595	0.210241
10.8	0.049476	0.1800	0.222158	7		-1.50437	-1.61711	0.198471
11	0.049527	0.1833	0.212032	7.2		-1.55102	-1.67472	0.18736

11.2	0.049573	0.1867	0.20303	7.4	-1.5944	-1.73233	0.176872
11.4	0.049608	0.1900	0.196119	7.6	-1.62904	-1.78994	0.16697
11.6	0.049645	0.1933	0.188725	7.8	-1.66746	-1.84755	0.157623
11.8	0.049691	0.1967	0.179723	8	-1.71634	-1.90516	0.148799
12	0.049752	0.2000	0.167668	8.2	-1.78577	-1.96277	0.140469
12.2	0.049784	0.2033	0.161237	8.4	-1.82488	-2.02038	0.132606
12.4	0.049796	0.2067	0.158988	8.6	-1.83893	-2.07799	0.125182
12.6	0.049832	0.2100	0.151755	8.8	-1.88549	-2.13559	0.118174
12.8	0.04988	0.2133	0.142271	9	-1.95002	-2.1952	0.111559
13	0.049878	0.2167	0.142593	9.2	-1.94776	-2.25081	0.105314
13.2	0.04994	0.2200	0.130377	9.4	-2.03732	-2.30842	0.099418
13.4	0.049941	0.2233	0.130215	9.6	-2.03857	-2.36603	0.093852
13.6	0.049957	0.2267	0.127162	9.8	-2.06229	-2.42364	0.088598
13.8	0.049961	0.2300	0.126198	10	-2.06991	-2.48125	0.083639
14	0.049987	0.2333	0.121215	10.2	-2.11019	-2.53886	0.078956
14.2	0.050035	0.2367	0.111571	10.4	-2.19309	-2.59647	0.074536
14.4	0.050066	0.2400	0.105462	10.6	-2.2494	-2.65408	0.070364
14.6	0.050069	0.2433	0.10498	10.8	-2.25398	-2.71169	0.066425
14.8	0.050082	0.2467	0.102407	11	-2.2788	-2.7693	0.062706
15	0.050097	0.2500	0.099354	11.2	-2.30907	-2.82691	0.059196
15.2	0.050116	0.2533	0.095658	11.4	-2.34697	-2.88451	0.055882
15.4	0.050112	0.2567	0.096462	11.6	-2.3386	-2.94212	0.052754
15.6	0.050168	0.2600	0.08537	11.8	-2.46077	-2.99973	0.0498
15.8	0.050149	0.2633	0.089067	12	-2.41836	-3.05734	0.047012
16	0.050175	0.2667	0.083923	12.2	-2.47786	-3.11495	0.044381
16.2	0.050197	0.2700	0.079583	12.4	-2.53095	-3.17256	0.041896
16.4	0.050218	0.2733	0.075565	12.6	-2.58276	-3.23017	0.039551
16.6	0.050203	0.2767	0.078458	12.8	-2.54519	-3.28778	0.037337
16.8	0.050226	0.2800	0.073957	13	-2.60428	-3.34539	0.035247
17	0.050207	0.2833	0.077654	13.2	-2.55549	-3.403	0.033273
17.2	0.050248	0.2867	0.069619	13.4	-2.66472	-3.46061	0.031411
17.4	0.050266	0.2900	0.066081	13.6	-2.71687	-3.51822	0.029652
17.6	0.050275	0.2933	0.064314	13.8	-2.74397	-3.57582	0.027992
17.8	0.050249	0.2967	0.069457	14	-2.66705	-3.63343	0.026425
18	0.050293	0.3000	0.060617	14.2	-2.80319	-3.69104	0.024946
18.2	0.050301	0.3033	0.059008	14.4	-2.83008	-3.74865	0.023549
18.4	0.050308	0.3067	0.057723	14.6	-2.85209	-3.80626	0.022231
18.6	0.050332	0.3100	0.052901	14.8	-2.93933	-3.86387	0.020987
18.8	0.050303	0.3133	0.058688	15	-2.83552	-3.92148	0.019812
19	0.050297	0.3167	0.059812	15.2	-2.81654	-3.97909	0.018703
19.2	0.050338	0.3200	0.051777	15.4	-2.96082	-4.0367	0.017656
19.4	0.050346	0.3233	0.050168	15.6	-2.99238	-4.09431	0.016667
19.6	0.050349	0.3267	0.049526	15.8	-3.00526	-4.15192	0.015734
19.8	0.050389	0.3300	0.04165	16	-3.17845	-4.20953	0.014853
20	0.050345	0.3333	0.05033	16.2	-2.98915	-4.26713	0.014022
20.2	0.050372	0.3367	0.045024	16.4	-3.10057	-4.32474	0.013237
21.2	0.050397	0.3533	0.040043	17.4	-3.21779	-4.61279	0.009924
22.2	0.050397	0.3700	0.040204	18.4	-3.2138	-4.90084	0.00744
23.2	0.050447	0.3867	0.030237	19.4	-3.49868	-5.18888	0.005578
24.2	0.050479	0.4033	0.023968	20.4	-3.73102	-5.47693	0.004182
25.2	0.050482	0.4200	0.023324	21.4	-3.75827	-5.76497	0.003135
26.2	0.050503	0.4367	0.019146	22.4	-3.95565	-6.05302	0.002351
27.2	0.050516	0.4533	0.016575	23.4	-4.09985	-6.34107	0.001762
28.2	0.050527	0.4700	0.014486	24.4	-4.23456	-6.62911	0.001321
29.2	0.050532	0.4867	0.013522	25.4	-4.30346	-6.91716	0.000991
30.2	0.05056	0.5033	0.007895	26.4	-4.84149	-7.2052	0.000743

31.2	0.050576	0.5200	0.00484	27.4	-5.33086	-7.49325	0.000557
32.2	0.050595	0.5367	0.000982	28.4	-6.9257	-7.78129	0.000417
33.2	0.050589	0.5533	0.002109	29.4	-6.16169	-8.06934	0.000313
34.2	0.05057	0.5700	0.005964	30.4	-5.12194	-8.35739	0.000235
35.2	0.05062	0.5867	-0.004	31.4	ERR	-8.64543	0.000176
36.2	0.050601	0.6033	-0.00014	32.4	ERR	-8.93348	0.000132
37.2	0.050615	0.6200	-0.00304	33.4	ERR	-9.22152	9.89E-05
38.2	0.050579	0.6367	0.004198	34.4	-5.47324	-9.50957	7.41E-05
39.2	0.050607	0.6533	-0.00143	35.4	ERR	-9.79762	5.56E-05
40.2	0.05062	0.6700	-0.004	36.4	ERR	-10.0857	4.17E-05
41.2	0.050632	0.6867	-0.00625	37.4	ERR	-10.3737	3.12E-05
42.2	0.050621	0.7033	-0.00416	38.4	ERR	-10.6618	2.34E-05
43.2	0.050597	0.7200	0.0005	39.4	-7.6009	-10.9498	1.76E-05
44.2	0.050624	0.7367	-0.0048	40.4	ERR	-11.2378	1.32E-05
45.2	0.050598	0.7533	0.00034	41.4	-7.9868	-11.5259	9.87E-06
46.2	0.050615	0.7700	-0.00304	42.4	ERR	-11.8139	7.4E-06
47.2	0.050632	0.7867	-0.00641	43.4	ERR	-12.102	5.55E-06
48.2	0.050646	0.8033	-0.00914	44.4	ERR	-12.39	4.16E-06
49.2	0.050633	0.8200	-0.00657	45.4	ERR	-12.6781	3.12E-06
50.2	0.05065	0.8367	-0.00995	46.4	ERR	-12.9661	2.34E-06
51.2	0.050606	0.8533	10	47.4	2.302585	-13.2542	1.75E-06
61.2	0.05064	1.0200	10	57.4	2.302585	-16.1346	9.84E-08
71.2	0.050624	1.1867	10	67.4	2.302585	-19.0151	5.52E-09
111.2	0.039223	1.8533	10	107.4	2.302585	-30.5369	5.47E-14
121.2	0.039539	2.0200	10	117.4	2.302585	-33.4174	3.07E-15
131.2	0.039792	2.1867	10	127.4	2.302585	-36.2978	1.72E-16
141.2	0.039943	2.3533	10	137.4	2.302585	-39.1783	9.66E-18

LENZ OIL (5 FT. RECOVERY)
MW07S RISING HEAD PRESSURE TEST DATA (5-30-91)

THIS SPREADSHEET CALCULATES HYDRAULIC CONDUCTIVITY BASED ON THE BOUWER AND RICE (1976) METHOD. AIR PRESSURE WAS USED TO PUSH THE WATER DOWN IN THE WELL AND RECOVERY RATE WAS MEASURED.

THE FOLLOWING STEPS ARE REQUIRED TO CALCULATE HYDRAULIC CONDUCTIVITY:
1.) IMPORT HERMIT DATA INTO COLUMNS UNDER RAW DATA
2.) DECIDE WHICH DATA IS APPROPRIATE, CHOOSE THE INITIAL INDUCED HEAD, TRANSLATE TIME VALUES
3.) DO THE REGRESSION CALCULATION FOR LEAST SQUARES FIT
4.) CHOOSE APPROPRIATE SLUG TEST PARAMETERS
5.) CHOOSE A VALUE FOR TIME t AND ITS CORRESPONDING Yt

Note: Values of time are translated to the first meaningful data point. The initial theoretical induced head (Yo) is chosen on the regression line at the translated time t=0. (see Pandit and and Miner, 1986. Ground Water. V. 24, No. 6, p. 743-749).

LINEAR REGRESSION DATA

Regression Output:

Constant	1.391372
Std Err of Y Est	0.012384
R Squared	0.999334
No. of Observations	65
Degrees of Freedom	63
X Coefficient(s)	-0.25182
Std Err of Coef.	0.000819

Regression line equation:

Ln Y = -0.25182 t+1.391372

Ln Y intercept: 1.391372

SLUG TEST PARAMETERS

Length of slug (Ls)=		ft.
Slug diameter (Ds)=		ft.
Initial theoret. induced head (Yo)=	4.020361	ft.
Actual initial induced head (Ho)=	4.196401	ft.
Radius of developed zone (rw)=	0.25	ft.
Radius of well casing (rc)=	0.0833	ft.
Effective length of inflow (L)=	4.3	ft.
Saturated thickness of aquifer (D)=	175	ft.
L/rw=	17.2	
A=	2.0621	
Constants based on L/rw: B=	0.3037	
C=	1.5792	
Distance between top of aquifer and screen bottom (H)=	13.3	ft.
D > H Ln (R/rw)=	1.989549	
D = H Ln (R/rw)=	2.712901	
Note: Ln((D-H)/rw)=	6	

If Ln((D-H)/rw)>6, set Ln((D-H)/rw)=6

where:

D > H Ln(R/rw)=[1.1/Ln(H/rw)+(A+BLn[(D-H)/rw])/L/rw]**-1

D = H Ln(R/rw)=[1.1/Ln(H/rw)+C/(L/rw)]**-1

Initial theoret. induced head (Yo):
Induced head (Yt) at time t:
Ordered pair on regression line (t,Yt):

Note: Choose Yt and t

Yo = 4.020361 ft.
Yt = 3.456579 ft.
t = 0.6 sec.

RADIUS OF INFLUENCE

R= 1.828058 ft.

CALCULATION OF HYDRAULIC CONDUCTIVITY

K= 0.012321 cm/sec
K= 261.2091 gal/day-ft**2

RAW DATA Note: 1 ft. head = 0.00506 volts

Induced head = final head reading-transducer head at time t

Time (sec.)	Transducer Head (Volts)	Time (min.)	Induced head Value Y (ft)	Translated Time (sec.)	Data used in linear fit	Ln (Y)	Ln (Yt) (theor.)	rt
0.1	0.026851	0.0017	4.693563	-3.5		1.546192	2.272744	9.705998
0.2	0.026847	0.0033	4.694366	-3.4		1.546363	2.247562	9.464632
0.3	0.02684	0.0050	4.695652	-3.3		1.546637	2.22238	9.229269
0.4	0.026847	0.0067	4.694366	-3.2		1.546363	2.197198	8.999759
0.5	0.026863	0.0083	4.691152	-3.1		1.545678	2.172016	8.775956
0.6	0.026852	0.0100	4.693241	-3		1.546123	2.146834	8.557719
0.7	0.026844	0.0117	4.694848	-2.9		1.546466	2.121652	8.344909
0.8	0.026837	0.0133	4.696294	-2.8		1.546774	2.09647	8.137391
0.9	0.026838	0.0150	4.696134	-2.7		1.54674	2.071287	7.935033
1	0.026811	0.0167	4.701439	-2.6		1.547869	2.046105	7.737707
1.1	0.026855	0.0183	4.692599	-2.5		1.545987	2.020923	7.545289
1.2	0.026865	0.0200	4.69067	-2.4		1.545575	1.995741	7.357655
1.3	0.02686	0.0217	4.691794	-2.3		1.545815	1.970559	7.174688
1.4	0.026751	0.0233	4.713334	-2.2		1.550396	1.945377	6.99627
1.5	0.02685	0.0250	4.693723	-2.1		1.546226	1.920195	6.822289
1.6	0.026855	0.0267	4.692759	-2		1.546021	1.895013	6.652635
1.7	0.02686	0.0283	4.691794	-1.9		1.545815	1.869831	6.4872
1.8	0.026845	0.0300	4.694688	-1.8		1.546432	1.844649	6.325879
1.9	0.026865	0.0317	4.69067	-1.7		1.545575	1.819467	6.168569
2	0.026851	0.0333	4.693401	-1.6		1.546158	1.794285	6.015171
2.1	0.02684	0.0350	4.695652	-1.5		1.546637	1.769103	5.865588
2.2	0.026851	0.0367	4.693401	-1.4		1.546158	1.743921	5.719725
2.3	0.026854	0.0383	4.692919	-1.3		1.546055	1.718739	5.577489
2.4	0.026811	0.0400	4.701439	-1.2		1.547869	1.693557	5.43879
2.5	0.026847	0.0417	4.694366	-1.1		1.546363	1.668374	5.30354
2.6	0.02687	0.0433	4.689706	-1		1.54537	1.643192	5.171653
2.7	0.026868	0.0450	4.690026	-0.9		1.545438	1.61801	5.043046
2.8	0.026868	0.0467	4.690026	-0.8		1.545438	1.592828	4.917638
2.9	0.026871	0.0483	4.689543	-0.7		1.545335	1.567646	4.795348
3	0.026845	0.0500	4.694688	-0.6		1.546432	1.542464	4.676099
3.1	0.026858	0.0517	4.692117	-0.5		1.545884	1.517282	4.559815
3.2	0.029491	0.0533	4.171808	-0.4		1.42835	1.4921	4.446423
3.3	0.031124	0.0550	3.849045	-0.3		1.347825	1.466918	4.335851
3.4	0.030445	0.0567	3.983263	-0.2		1.382101	1.441736	4.228029
3.5	0.029043	0.0583	4.260213	-0.1		1.449319	1.416554	4.122888
3.6	0.029366	0.0600	4.196401	0	*	1.434227	1.391372	4.020361
3.7	0.030248	0.0617	4.02216	0.1	*	1.391819	1.36619	3.920384
3.8	0.030842	0.0633	3.904822	0.2	*	1.362212	1.341008	3.822894
3.9	0.031549	0.0650	3.76498	0.3	*	1.325743	1.315826	3.727827
4	0.031847	0.0667	3.70615	0.4	*	1.309994	1.290644	3.635125
4.1	0.032459	0.0683	3.585115	0.5	*	1.27679	1.265461	3.544728
4.2	0.03303	0.0700	3.472277	0.6	*	1.24481	1.240279	3.456579
4.3	0.033466	0.0717	3.386121	0.7	*	1.219685	1.215097	3.370622
4.4	0.034005	0.0733	3.279551	0.8	*	1.187707	1.189915	3.286803
4.5	0.034475	0.0750	3.186806	0.9	*	1.159019	1.164733	3.205068
4.6	0.034707	0.0767	3.140836	1	*	1.144489	1.139551	3.125365
4.7	0.035072	0.0783	3.068824	1.1	*	1.121294	1.114369	3.047645
4.8	0.035595	0.0800	2.96547	1.2	*	1.087036	1.089187	2.971857
4.9	0.03602	0.0817	2.881405	1.3	*	1.058278	1.064005	2.897954

5	0.036422	0.0833	2.802	1.4	*	1.030333	1.038823	2.825889
5.1	0.036592	0.0850	2.768405	1.5	*	1.018271	1.013641	2.755615
5.2	0.037004	0.0867	2.686913	1.6	*	0.988393	0.988459	2.68709
5.3	0.03738	0.0883	2.61265	1.7	*	0.960365	0.963277	2.620268
5.4	0.03775	0.0900	2.539516	1.8	*	0.931973	0.938095	2.555108
5.5	0.038135	0.0917	2.463486	1.9	*	0.901577	0.912913	2.491569
5.6	0.038469	0.0933	2.397423	2	*	0.874394	0.88773	2.429609
5.7	0.038638	0.0950	2.36399	2.1	*	0.860351	0.862548	2.369191
5.8	0.038982	0.0967	2.295998	2.2	*	0.831168	0.837366	2.310275
5.9	0.039301	0.0983	2.232988	2.3	*	0.803341	0.812184	2.252823
6	0.039599	0.1000	2.174158	2.4	*	0.776642	0.787002	2.196801
6.1	0.039898	0.1017	2.115006	2.5	*	0.749058	0.76182	2.142172
6.2	0.040068	0.1033	2.081413	2.6	*	0.733047	0.736638	2.088901
6.3	0.040334	0.1050	2.028852	2.7	*	0.70747	0.711456	2.036955
6.4	0.040622	0.1067	1.971949	2.8	*	0.679022	0.686274	1.986301
6.5	0.040889	0.1083	1.919227	2.9	*	0.651923	0.661092	1.936906
6.6	0.041184	0.1100	1.860879	3	*	0.621049	0.63591	1.88874
6.7	0.041441	0.1117	1.810087	3.1	*	0.593375	0.610728	1.841771
6.8	0.041573	0.1133	1.784047	3.2	*	0.578885	0.585546	1.795971
6.9	0.041797	0.1150	1.739684	3.3	*	0.553703	0.560364	1.751309
7	0.04202	0.1167	1.695642	3.4	*	0.528062	0.535182	1.707758
7.1	0.042284	0.1183	1.643561	3.5	*	0.496865	0.51	1.66529
7.2	0.0425	0.1200	1.600806	3.6	*	0.470507	0.484817	1.623879
7.3	0.042732	0.1217	1.554996	3.7	*	0.441473	0.459635	1.583497
7.4	0.042835	0.1233	1.534583	3.8	*	0.428259	0.434453	1.544119
7.5	0.043042	0.1250	1.493595	3.9	*	0.401186	0.409271	1.50572
7.6	0.043236	0.1267	1.455338	4	*	0.375238	0.384089	1.468276
7.7	0.043451	0.1283	1.412903	4.1	*	0.345647	0.358907	1.431764
7.8	0.0436	0.1300	1.383328	4.2	*	0.324492	0.333725	1.396159
7.9	0.043708	0.1317	1.362111	4.3	*	0.309035	0.308543	1.36144
8	0.043894	0.1333	1.325302	4.4	*	0.281641	0.283361	1.327584
8.1	0.044079	0.1350	1.288654	4.5	*	0.253598	0.258179	1.29457
8.2	0.044259	0.1367	1.25313	4.6	*	0.225645	0.232997	1.262377
8.3	0.044425	0.1383	1.22034	4.7	*	0.199129	0.207815	1.230985
8.400001	0.044589	0.1400	1.188032	4.800001	*	0.172298	0.182632	1.200373
8.5	0.04466	0.1417	1.173885	4.9	*	0.160319	0.157451	1.170523
8.6	0.044846	0.1433	1.137077	5	*	0.128461	0.132269	1.141415
8.7	0.044994	0.1450	1.107824	5.1	*	0.102398	0.107087	1.113031
8.8	0.04512	0.1467	1.083069	5.2	*	0.079799	0.081904	1.085352
8.900001	0.045267	0.1483	1.053976	5.300001	*	0.05257	0.056722	1.058362
9	0.045342	0.1500	1.039188	5.4	*	0.038439	0.03154	1.032043
9.1	0.045467	0.1517	1.014435	5.5	*	0.014332	0.006358	1.006379
9.2	0.045596	0.1533	0.988877	5.6	*	-0.01118	-0.01882	0.981352
9.3	0.045699	0.1550	0.968625	5.7	*	-0.03188	-0.04401	0.956948
9.400001	0.045834	0.1567	0.941943	5.800001	*	-0.05981	-0.06919	0.933151
9.5	0.045965	0.1583	0.916063	5.9	*	-0.08767	-0.09437	0.909946
9.6	0.046022	0.1600	0.90465	6	*	-0.10021	-0.11955	0.887318
9.7	0.046157	0.1617	0.878128	6.1	*	-0.12996	-0.14473	0.865252
9.8	0.046249	0.1633	0.859966	6.2	*	-0.15086	-0.16992	0.843736
9.900001	0.046361	0.1650	0.837785	6.300001	*	-0.17699	-0.1951	0.822754
10	0.046406	0.1667	0.828783	6.4	*	-0.1878	-0.22028	0.802294
10.2	0.046595	0.1700	0.791492	6.6		-0.23384	-0.27064	0.762888
10.4	0.046748	0.1733	0.761273	6.8		-0.27276	-0.32101	0.725417
10.6	0.04698	0.1767	0.715462	7		-0.33483	-0.37137	0.689787
10.8	0.047129	0.1800	0.685887	7.2		-0.37704	-0.42174	0.655907
11	0.047249	0.1833	0.662259	7.4		-0.4121	-0.4721	0.623691

11.2	0.047456	0.1867	0.621271
11.4	0.047548	0.1900	0.603107
11.6	0.047697	0.1933	0.573692
11.8	0.047801	0.1967	0.553117
12	0.047931	0.2000	0.527559
12.2	0.048044	0.2033	0.505217
12.4	0.048132	0.2067	0.487698
12.6	0.048255	0.2100	0.463425
12.8	0.048336	0.2133	0.447352
13	0.048419	0.2167	0.430957
13.2	0.048567	0.2200	0.401862
13.4	0.04863	0.2233	0.389326
13.6	0.048695	0.2267	0.376466
13.8	0.048776	0.2300	0.360393
14	0.048857	0.2333	0.344478
14.2	0.048955	0.2367	0.32503
14.4	0.048994	0.2400	0.317476
14.6	0.049046	0.2433	0.307028
14.8	0.049093	0.2467	0.297866
15	0.04917	0.2500	0.282595
15.2	0.049202	0.2533	0.276326
15.4	0.049281	0.2567	0.260735
15.6	0.049279	0.2600	0.261057
15.8	0.049358	0.2633	0.245464
16	0.049422	0.2667	0.232767
16.2	0.049452	0.2700	0.22682
16.4	0.049453	0.2733	0.226658
16.6	0.049521	0.2767	0.213316
16.8	0.049575	0.2800	0.202547
17	0.049568	0.2833	0.203994
17.2	0.049611	0.2867	0.195476
17.4	0.049664	0.2900	0.185028
17.6	0.049704	0.2933	0.177152
17.8	0.049744	0.2967	0.169115
18	0.04975	0.3000	0.16799
18.2	0.049766	0.3033	0.164775
18.4	0.049804	0.3067	0.157381
18.6	0.049835	0.3100	0.151113
18.8	0.049853	0.3133	0.147575
19	0.049877	0.3167	0.142915
19.2	0.049846	0.3200	0.149022
19.4	0.049924	0.3233	0.133591

7.6	-0.47599	-0.52247	0.593057
7.8	-0.50566	-0.57283	0.563928
8	-0.55566	-0.62319	0.536229
8.2	-0.59219	-0.67356	0.509891
8.4	-0.63949	-0.72392	0.484847
8.6	-0.68277	-0.77429	0.461033
8.8	-0.71806	-0.82465	0.438388
9	-0.76911	-0.87501	0.416856
9.2	-0.80441	-0.92538	0.396382
9.4	-0.84175	-0.97574	0.376912
9.6	-0.91165	-1.02611	0.3584
9.8	-0.94334	-1.07647	0.340796
10	-0.97693	-1.12683	0.324057
10.2	-1.02056	-1.1772	0.308141
10.4	-1.06572	-1.22756	0.293006
10.6	-1.12384	-1.27793	0.278614
10.8	-1.14735	-1.32829	0.26493
11	-1.18082	-1.37866	0.251917
11.2	-1.21111	-1.42902	0.239544
11.4	-1.26374	-1.47938	0.227778
11.6	-1.28617	-1.52975	0.21659
11.8	-1.34425	-1.58011	0.205952
12	-1.34302	-1.63048	0.195836
12.2	-1.4046	-1.68084	0.186217
12.4	-1.45772	-1.7312	0.177071
12.6	-1.4836	-1.78157	0.168374
12.8	-1.48431	-1.83193	0.160104
13	-1.54498	-1.8823	0.15224
13.2	-1.59678	-1.93266	0.144763
13.4	-1.58966	-1.98302	0.137652
13.6	-1.63232	-2.03339	0.130891
13.8	-1.68725	-2.08375	0.124462
14	-1.73075	-2.13412	0.118349
14.2	-1.77718	-2.18448	0.112536
14.4	-1.78385	-2.23485	0.107009
14.6	-1.80318	-2.28521	0.101753
14.8	-1.84908	-2.33557	0.096755
15	-1.88973	-2.38594	0.092003
15.2	-1.91342	-2.4363	0.087484
15.4	-1.94551	-2.48667	0.083187
15.6	-1.90366	-2.53703	0.079101
15.8	-2.01297	-2.58739	0.075216

_NZ OIL
MW07D RISING HEAD PRESSURE TEST DATA (5-30-91)

THIS SPREADSHEET CALCULATES HYDRAULIC CONDUCTIVITY BASED ON THE BOUWER AND RICE (1976) METHOD. AIR PRESSURE WAS USED TO PUSH THE WATER DOWN IN THE WELL AND RECOVERY RATE WAS MEASURED.

THE FOLLOWING STEPS ARE REQUIRED TO CALCULATE HYDRAULIC CONDUCTIVITY:
1.) IMPORT HERMIT DATA INTO COLUMNS UNDER RAW DATA
2.) DECIDE WHICH DATA IS APPROPRIATE, CHOOSE THE INITIAL INDUCED HEAD, TRANSLATE TIME VALUES
3.) DO THE REGRESSION CALCULATION FOR LEAST SQUARES FIT
4.) CHOOSE APPROPRIATE SLUG TEST PARAMETERS
5.) CHOOSE A VALUE FOR TIME t AND ITS CORRESPONDING Yt

Note: Values of time are translated to the first meaningful data point. The initial theoretical induced head (Yo) is chosen on the regression line at the translated time t=0. (see Pandit and and Miner, 1986. Ground Water. V. 24, No. 6, p. 743-749).

LINEAR REGRESSION DATA

Regression Output:

Constant	1.289272
Std Err of Y Est	0.030119
R Squared	0.996858
No. of Observations	157
Degrees of Freedom	155
X Coefficient(s)	-0.0632
Std Err of Coef.	0.000285

Regression line equation:

Ln Y = -0.0632 t+1.289272

Ln Y intercept: 1.289272

SLUG TEST PARAMETERS

Length of slug (Ls)=		ft.
Slug diameter (Ds)=		ft.
Initial theoret. induced head (Yo)=	3.630142	ft.
Actual initial induced head (Ho)=	3.51614	ft.
Radius of developed zone (rw)=	0.25	ft.
Radius of well casing (rc)=	0.0833	ft.
Effective length of inflow (L)=	5	ft.
Saturated thickness of aquifer (D)=	175	ft.
L/rw=	20	
A=	2.1686	
Constants based on L/rw: B=	0.318	
C=	1.6788	
Distance between top of aquifer and screen bottom (H)=	36.4	ft.
D > H Ln (R/rw)=	2.35474	
D = H Ln (R/rw)=	3.280999	
Note: Ln((D-H)/rw)=	6	

If Ln((D-H)/rw)>6, set Ln((D-H)/rw)=6

where:

D > H Ln(R/rw)=[1.1/Ln(H/rw)+(A+BLn[(D-H)/rw])/L/rw]**-1

D = H Ln(R/rw)=[1.1/Ln(H/rw)+C/(L/rw)]**-1

K=rc**2*Ln(R/rw)*Ln(Yo/Yt))/2Lt

Initial theoret. induced head (Yo):
Induced head (Yt) at time t:
Ordered pair on regression line (t,Yt):

Note: Choose Yt and t

Yo = 3.630142 ft.
Yt = 3.11921 ft.
t = 2.4 sec.

RADIUS OF INFLUENCE

R= 2.633848 ft.

CALCULATION OF HYDRAULIC CONDUCTIVITY

K= 0.003148 cm/sec
K= 66.73215 gal/day-ft**2

RAW DATA Note: 1 ft. head = 0.00506 volts

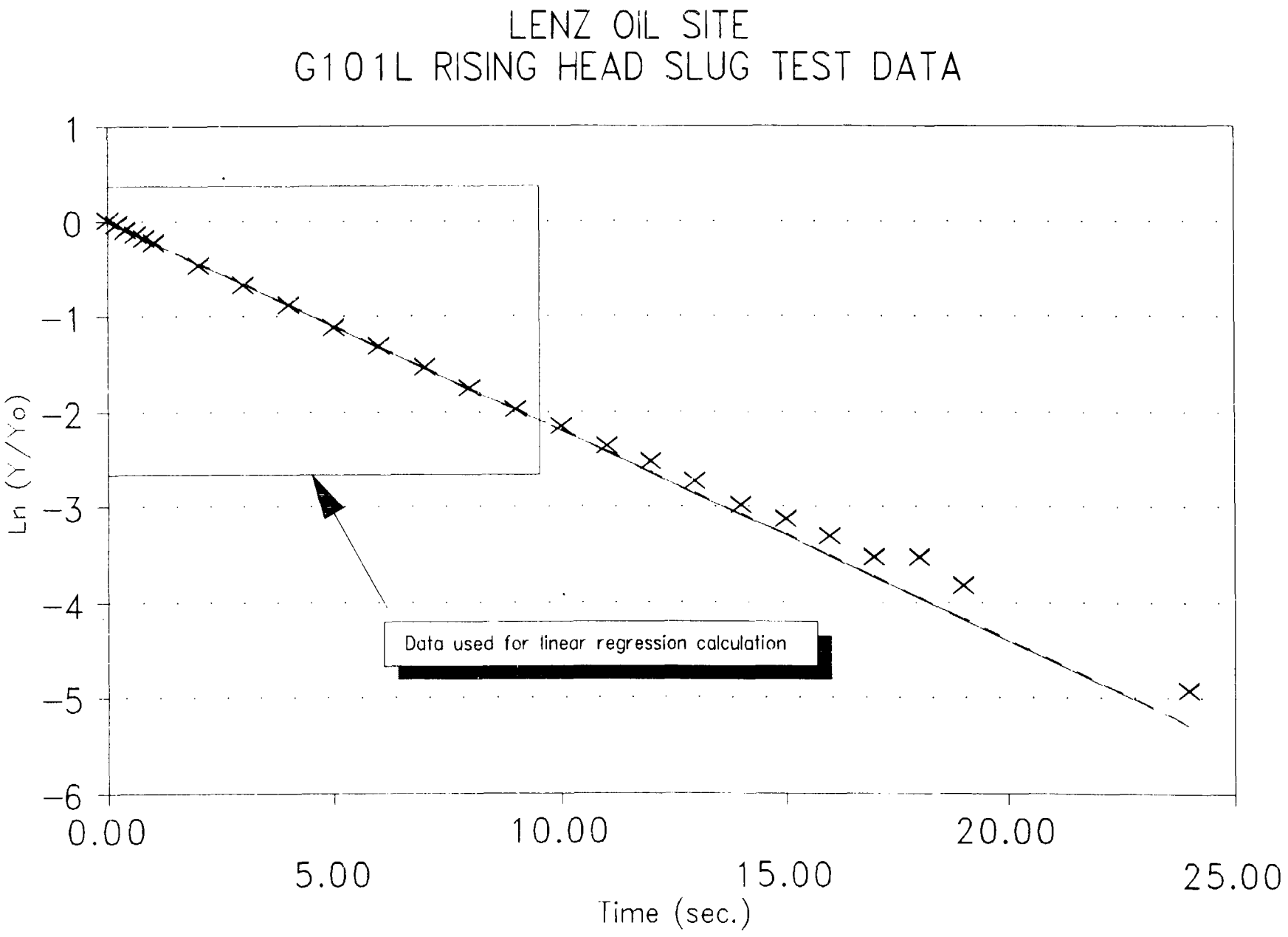
Induced head = final head reading-transducer head at time t

Time (sec.)	Transducer Head (Volts)	Time (min.)	Induced head Value Y (ft)	Translated Time (sec.)	Data used in linear fit	Ln (Y)	Ln (Yt) (theor.)	rt
0.1	0.025778	0.0017	3.511638	-1.2		1.256083	1.365118	3.916184
0.2	0.02577	0.0033	3.513085	-1.1		1.256495	1.358797	3.89151
0.3	0.025771	0.0050	3.512925	-1		1.256449	1.352477	3.866991
0.4	0.025783	0.0067	3.510674	-0.9		1.255808	1.346156	3.842627
0.5	0.02578	0.0083	3.511156	-0.8		1.255945	1.339836	3.818416
0.6	0.025777	0.0100	3.5118	-0.7		1.256129	1.333515	3.794358
0.7	0.02575	0.0117	3.517105	-0.6		1.257638	1.327195	3.770451
0.8	0.025755	0.0133	3.51614	-0.5		1.257364	1.320874	3.746695
0.9	0.025766	0.0150	3.514049	-0.4		1.256769	1.314554	3.723089
1	0.025787	0.0167	3.50987	-0.3		1.255579	1.308233	3.699632
1.1	0.025744	0.0183	3.518229	-0.2		1.257958	1.301913	3.676322
1.2	0.025739	0.0200	3.519354	-0.1		1.258277	1.295592	3.653159
1.3	0.025755	0.0217	3.51614	0	*	1.257364	1.289272	3.630142
1.4	0.02602	0.0233	3.463739	0.1	*	1.242349	1.282951	3.60727
1.5	0.026623	0.0250	3.344632	0.2	*	1.207357	1.276631	3.584542
1.6	0.026781	0.0267	3.313449	0.3	*	1.19799	1.27031	3.561957
1.7	0.026374	0.0283	3.393818	0.4	*	1.221956	1.26399	3.539515
1.8	0.026679	0.0300	3.333542	0.5	*	1.204035	1.257669	3.517214
1.9	0.02645	0.0317	3.37887	0.6	*	1.217541	1.251349	3.495054
2	0.026802	0.0333	3.309271	0.7	*	1.196728	1.245028	3.473033
2.1	0.026641	0.0350	3.341097	0.8	*	1.206299	1.238708	3.451151
2.2	0.026865	0.0367	3.296733	0.9	*	1.192932	1.232387	3.429407
2.3	0.026818	0.0383	3.306055	1	*	1.195756	1.226067	3.407799
2.4	0.027003	0.0400	3.269407	1.1	*	1.184609	1.219746	3.386328
2.5	0.02704	0.0417	3.262174	1.2	*	1.182394	1.213426	3.364993
2.6	0.027187	0.0433	3.233081	1.3	*	1.173436	1.207105	3.343791
2.7	0.027265	0.0450	3.21781	1.4	*	1.168701	1.200785	3.322723
2.8	0.027321	0.0467	3.206719	1.5	*	1.165248	1.194464	3.301788
2.9	0.027398	0.0483	3.191449	1.6	*	1.160475	1.188144	3.280985
3	0.027525	0.0500	3.166374	1.7	*	1.152587	1.181823	3.260313
3.1	0.027578	0.0517	3.155927	1.8	*	1.149282	1.175503	3.239771
3.2	0.02771	0.0533	3.129725	1.9	*	1.140945	1.169182	3.219359
3.3	0.027749	0.0550	3.12201	2	*	1.138477	1.162862	3.199075
3.4	0.027862	0.0567	3.099828	2.1	*	1.131347	1.156541	3.178919
3.5	0.027949	0.0583	3.082468	2.2	*	1.125731	1.150221	3.15889
3.6	0.028046	0.0600	3.063342	2.3	*	1.119506	1.1439	3.138988
3.7	0.028136	0.0617	3.04566	2.4	*	1.113718	1.13758	3.11921
3.8	0.028219	0.0633	3.029105	2.5	*	1.108267	1.131259	3.099557
3.9	0.02834	0.0650	3.005314	2.6	*	1.100382	1.124939	3.080028
4	0.028387	0.0667	2.995992	2.7	*	1.097275	1.118618	3.060622
4.1	0.028479	0.0683	2.977828	2.8	*	1.091194	1.112298	3.041339
4.2	0.028563	0.0700	2.961113	2.9	*	1.085565	1.105977	3.022177
4.3	0.028653	0.0717	2.943431	3	*	1.079576	1.099657	3.003135
4.4	0.028747	0.0733	2.924785	3.1	*	1.073221	1.093336	2.984214
4.5	0.02879	0.0750	2.916267	3.2	*	1.070304	1.087016	2.965412
4.6	0.028863	0.0767	2.90196	3.3	*	1.065387	1.080695	2.946728
4.7	0.02898	0.0783	2.878814	3.4	*	1.057378	1.074375	2.928162
4.8	0.029062	0.0800	2.862579	3.5	*	1.051723	1.068054	2.909713
4.9	0.029158	0.0817	2.843613	3.6	*	1.045075	1.061734	2.89138

5	0.029245	0.0833	2.826413	3.7	*	1.039008	1.055413	2.873162
5.1	0.029262	0.0850	2.823038	3.8	*	1.037813	1.049093	2.85506
5.2	0.029361	0.0867	2.803589	3.9	*	1.0309	1.042772	2.837071
5.3	0.029438	0.0883	2.788318	4	*	1.025439	1.036452	2.819196
5.4	0.029496	0.0900	2.776745	4.1	*	1.021279	1.030131	2.801434
5.5	0.029622	0.0917	2.751832	4.2	*	1.012267	1.023811	2.783783
5.6	0.029705	0.0933	2.735597	4.3	*	1.00635	1.01749	2.766244
5.7	0.029761	0.0950	2.724506	4.4	*	1.002287	1.01117	2.748815
5.8	0.029831	0.0967	2.710682	4.5	*	0.9972	1.004849	2.731496
5.9	0.029892	0.0983	2.698466	4.6	*	0.992684	0.998529	2.714286
6	0.029994	0.1000	2.678374	4.7	*	0.98521	0.992208	2.697184
6.1	0.030068	0.1017	2.663747	4.8	*	0.979734	0.985888	2.68019
6.2	0.030104	0.1033	2.656674	4.9	*	0.977075	0.979567	2.663304
6.3	0.030197	0.1050	2.63835	5	*	0.970154	0.973247	2.646523
6.4	0.030293	0.1067	2.619383	5.1	*	0.962939	0.966926	2.629849
6.5	0.030357	0.1083	2.606686	5.2	*	0.95808	0.960606	2.613279
6.6	0.030459	0.1100	2.586593	5.3	*	0.950342	0.954285	2.596814
6.7	0.030518	0.1117	2.57486	5.4	*	0.945795	0.947965	2.580453
6.8	0.030582	0.1133	2.56216	5.5	*	0.940851	0.941644	2.564194
6.9	0.030638	0.1150	2.551069	5.6	*	0.936513	0.935324	2.548039
7	0.030715	0.1167	2.53596	5.7	*	0.930572	0.929003	2.531985
7.1	0.030809	0.1183	2.517314	5.8	*	0.923193	0.922683	2.516032
7.2	0.030882	0.1200	2.502848	5.9	*	0.917429	0.916362	2.500179
7.3	0.030935	0.1217	2.492401	6	*	0.913247	0.910042	2.484427
7.4	0.031014	0.1233	2.476808	6.1	*	0.906971	0.903721	2.468773
7.5	0.031061	0.1250	2.467486	6.2	*	0.9032	0.897401	2.453219
7.6	0.031132	0.1267	2.453502	6.3	*	0.897516	0.89108	2.437762
7.7	0.031224	0.1283	2.435338	6.4	*	0.890086	0.88476	2.422403
7.8	0.031269	0.1300	2.426498	6.5	*	0.886449	0.878439	2.40714
7.9	0.031339	0.1317	2.412514	6.6	*	0.880669	0.872119	2.391974
8	0.031446	0.1333	2.391457	6.7	*	0.871903	0.865798	2.376903
8.1	0.031512	0.1350	2.378437	6.8	*	0.866443	0.859478	2.361927
8.2	0.03156	0.1367	2.368955	6.9	*	0.862449	0.853157	2.347046
8.3	0.031607	0.1383	2.35963	7	*	0.858505	0.846837	2.332258
8.400001	0.031657	0.1400	2.349664	7.100001	*	0.854272	0.840516	2.317563
8.5	0.031759	0.1417	2.329573	7.2	*	0.845685	0.834196	2.302962
8.6	0.031832	0.1433	2.315107	7.3	*	0.839456	0.827875	2.288452
8.7	0.031902	0.1450	2.301283	7.4	*	0.833467	0.821555	2.274033
8.8	0.031957	0.1467	2.290354	7.5	*	0.828706	0.815234	2.259705
8.900001	0.032028	0.1483	2.27637	7.600001	*	0.822582	0.808914	2.245468
9	0.032049	0.1500	2.27219	7.7	*	0.820744	0.802593	2.23132
9.1	0.032151	0.1517	2.252097	7.8	*	0.811862	0.796273	2.217262
9.2	0.032235	0.1533	2.235542	7.9	*	0.804483	0.789952	2.203292
9.3	0.032286	0.1550	2.225415	8	*	0.799943	0.783632	2.18941
9.400001	0.032369	0.1567	2.20902	8.100001	*	0.792549	0.777311	2.175615
9.5	0.032411	0.1583	2.200662	8.2	*	0.788758	0.770991	2.161908
9.6	0.032441	0.1600	2.194875	8.3	*	0.786125	0.76467	2.148286
9.7	0.032497	0.1617	2.183783	8.4	*	0.781059	0.75835	2.134751
9.8	0.032569	0.1633	2.169478	8.5	*	0.774487	0.752029	2.121301
9.900001	0.032659	0.1650	2.151796	8.600001	*	0.766303	0.745709	2.107935
10	0.032672	0.1667	2.149065	8.7	*	0.765033	0.739388	2.094654
10.2	0.032786	0.1700	2.126561	8.9	*	0.754506	0.726747	2.068342
10.4	0.03289	0.1733	2.106148	9.1	*	0.744861	0.714106	2.042361
10.6	0.033065	0.1767	2.071429	9.3	*	0.728239	0.701465	2.016706
10.8	0.033146	0.1800	2.055516	9.5	*	0.720527	0.688824	1.991373
11	0.033273	0.1833	2.030441	9.7	*	0.708253	0.676183	1.966359

11.2	0.033425	0.1867	2.000381	9.9	*	0.693338	0.663542	1.941658
11.4	0.033487	0.1900	1.988004	10.1	*	0.687131	0.650902	1.917268
11.6	0.033631	0.1933	1.959715	10.3	*	0.672799	0.638261	1.893185
11.8	0.033744	0.1967	1.937211	10.5	*	0.66125	0.62562	1.869404
12	0.033857	0.2000	1.91503	10.7	*	0.649733	0.612979	1.845921
12.2	0.033988	0.2033	1.88899	10.9	*	0.636042	0.600338	1.822734
12.4	0.034056	0.2067	1.87565	11.1	*	0.628955	0.587697	1.799838
12.6	0.034159	0.2100	1.855235	11.3	*	0.618011	0.575056	1.777229
12.8	0.034289	0.2133	1.829678	11.5	*	0.60414	0.562415	1.754905
13	0.034382	0.2167	1.811194	11.7	*	0.593986	0.549774	1.732861
13.2	0.03452	0.2200	1.783868	11.9	*	0.578784	0.537133	1.711093
13.4	0.03463	0.2233	1.762168	12.1	*	0.566545	0.524492	1.6896
13.6	0.034721	0.2267	1.744166	12.3	*	0.556277	0.511851	1.668376
13.8	0.034823	0.2300	1.724073	12.5	*	0.54469	0.49921	1.647419
14	0.034948	0.2333	1.69932	12.7	*	0.530228	0.486569	1.626725
14.2	0.035042	0.2367	1.680676	12.9	*	0.519196	0.473928	1.606291
14.4	0.035164	0.2400	1.656565	13.1	*	0.504746	0.461287	1.586113
14.6	0.035291	0.2433	1.631488	13.3	*	0.489493	0.448646	1.566189
14.8	0.035387	0.2467	1.612522	13.5	*	0.477799	0.436005	1.546516
15	0.035491	0.2500	1.591947	13.7	*	0.464958	0.423364	1.527089
15.2	0.035555	0.2533	1.579409	13.9	*	0.457051	0.410723	1.507907
15.4	0.035734	0.2567	1.544047	14.1	*	0.434407	0.398082	1.488966
15.6	0.035857	0.2600	1.519615	14.3	*	0.418457	0.385441	1.470262
15.8	0.035898	0.2633	1.511579	14.5	*	0.413155	0.3728	1.451793
16	0.036046	0.2667	1.482324	14.7	*	0.393611	0.360159	1.433557
16.2	0.03614	0.2700	1.46384	14.9	*	0.381063	0.347518	1.415549
16.4	0.036246	0.2733	1.442783	15.1	*	0.366574	0.334877	1.397768
16.6	0.036333	0.2767	1.425583	15.3	*	0.354581	0.322236	1.38021
16.8	0.03645	0.2800	1.402599	15.5	*	0.338327	0.309595	1.362873
17	0.036555	0.2833	1.381702	15.7	*	0.323316	0.296954	1.345753
17.2	0.036638	0.2867	1.365306	15.9	*	0.311379	0.284313	1.328848
17.4	0.036733	0.2900	1.3465	16.1	*	0.297509	0.271672	1.312156
17.6	0.036847	0.2933	1.323998	16.3	*	0.280656	0.259031	1.295674
17.8	0.036932	0.2967	1.307281	16.5	*	0.267949	0.24639	1.279398
18	0.037033	0.3000	1.28735	16.7	*	0.252586	0.233749	1.263327
18.2	0.037142	0.3033	1.26581	16.9	*	0.235712	0.221108	1.247458
18.4	0.037245	0.3067	1.245395	17.1	*	0.219453	0.208467	1.231788
18.6	0.037307	0.3100	1.23318	17.3	*	0.209596	0.195826	1.216315
18.8	0.037398	0.3133	1.215178	17.5	*	0.19489	0.183185	1.201036
19	0.037504	0.3167	1.194281	17.7	*	0.177544	0.170544	1.185949
19.2	0.037583	0.3200	1.17853	17.9	*	0.164268	0.157903	1.171052
19.4	0.037677	0.3233	1.160045	18.1	*	0.148459	0.145262	1.156342
19.6	0.037746	0.3267	1.146381	18.3	*	0.13661	0.132621	1.141817
19.8	0.03784	0.3300	1.127735	18.5	*	0.120211	0.11998	1.127474
20	0.037892	0.3333	1.117449	18.7	*	0.111048	0.107339	1.113311
20.2	0.03798	0.3367	1.100091	18.9	*	0.095393	0.094698	1.099327
21.2	0.038354	0.3533	1.02631	19.9	*	0.02597	0.031493	1.031994
22.2	0.03865	0.3700	0.967802	20.9	*	-0.03273	-0.03171	0.968785
23.2	0.038953	0.3867	0.907848	21.9	*	-0.09668	-0.09492	0.909448
24.2	0.039207	0.4033	0.857696	22.9	*	-0.15351	-0.15812	0.853745
25.2	0.039513	0.4200	0.797099	23.9	*	-0.22678	-0.22133	0.801454
26.2	0.03979	0.4367	0.742449	24.9	*	-0.2978	-0.28453	0.752366
27.2	0.040037	0.4533	0.693583	25.9	*	-0.36588	-0.34774	0.706285
28.2	0.040219	0.4700	0.657579	26.9	*	-0.41919	-0.41094	0.663025
29.2	0.040476	0.4867	0.606785	27.9	*	-0.49958	-0.47415	0.622416
30.2	0.040641	0.5033	0.574316	28.9	*	-0.55458	-0.53735	0.584293

31.2	0.040851	0.5200	0.532686	29.9	*	-0.62982	-0.60056	0.548506
32.2	0.04103	0.5367	0.497322	30.9	*	-0.69852	-0.66376	0.514911
33.2	0.041182	0.5533	0.467425	31.9	*	-0.76052	-0.72697	0.483373
34.2	0.041384	0.5700	0.427401	32.9	*	-0.85003	-0.79017	0.453767
35.2	0.041534	0.5867	0.397666	33.9	*	-0.92214	-0.85338	0.425974
36.2	0.041672	0.6033	0.3705	34.9	*	-0.9929	-0.91658	0.399884
37.2	0.041805	0.6200	0.34414	35.9	*	-1.06671	-0.97979	0.375391
38.2	0.041961	0.6367	0.313279	36.9	*	-1.16066	-1.04299	0.352399
39.2	0.042084	0.6533	0.289006	37.9		-1.24131	-1.1062	0.330815
40.2	0.042187	0.6700	0.268753	38.9		-1.31396	-1.1694	0.310553
41.2	0.042311	0.6867	0.24416	39.9		-1.40993	-1.23261	0.291532
42.2	0.042393	0.7033	0.228087	40.9		-1.47803	-1.29581	0.273676
43.2	0.042455	0.7200	0.215709	41.9		-1.53382	-1.35902	0.256913
44.2	0.042583	0.7367	0.190474	42.9		-1.65824	-1.42222	0.241178
45.2	0.042683	0.7533	0.170704	43.9		-1.76783	-1.48543	0.226406
46.2	0.042764	0.7700	0.15463	44.9		-1.86672	-1.54863	0.212539
47.2	0.042803	0.7867	0.146915	45.9		-1.9179	-1.61184	0.199521
48.2	0.042891	0.8033	0.129555	46.9		-2.04365	-1.67504	0.1873
49.2	0.042945	0.8200	0.118945	47.9		-2.1291	-1.73825	0.175828
50.2	0.042996	0.8367	0.10882	48.9		-2.21806	-1.80145	0.165059
51.2	0.043051	0.8533	0.098049	49.9		-2.32228	-1.86466	0.154949
61.2	0.04336	1.0200	0.036808	59.9		-3.30203	-2.49671	0.082356
71.2	0.043513	1.1867	0.006589	69.9		-5.02236	-3.12876	0.043772


LENZ OIL SITE
G101L RISING HEAD SLUG TEST DATA
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0
-1
-2
-3
-4
-5
-6
Ln (Y/Yo)
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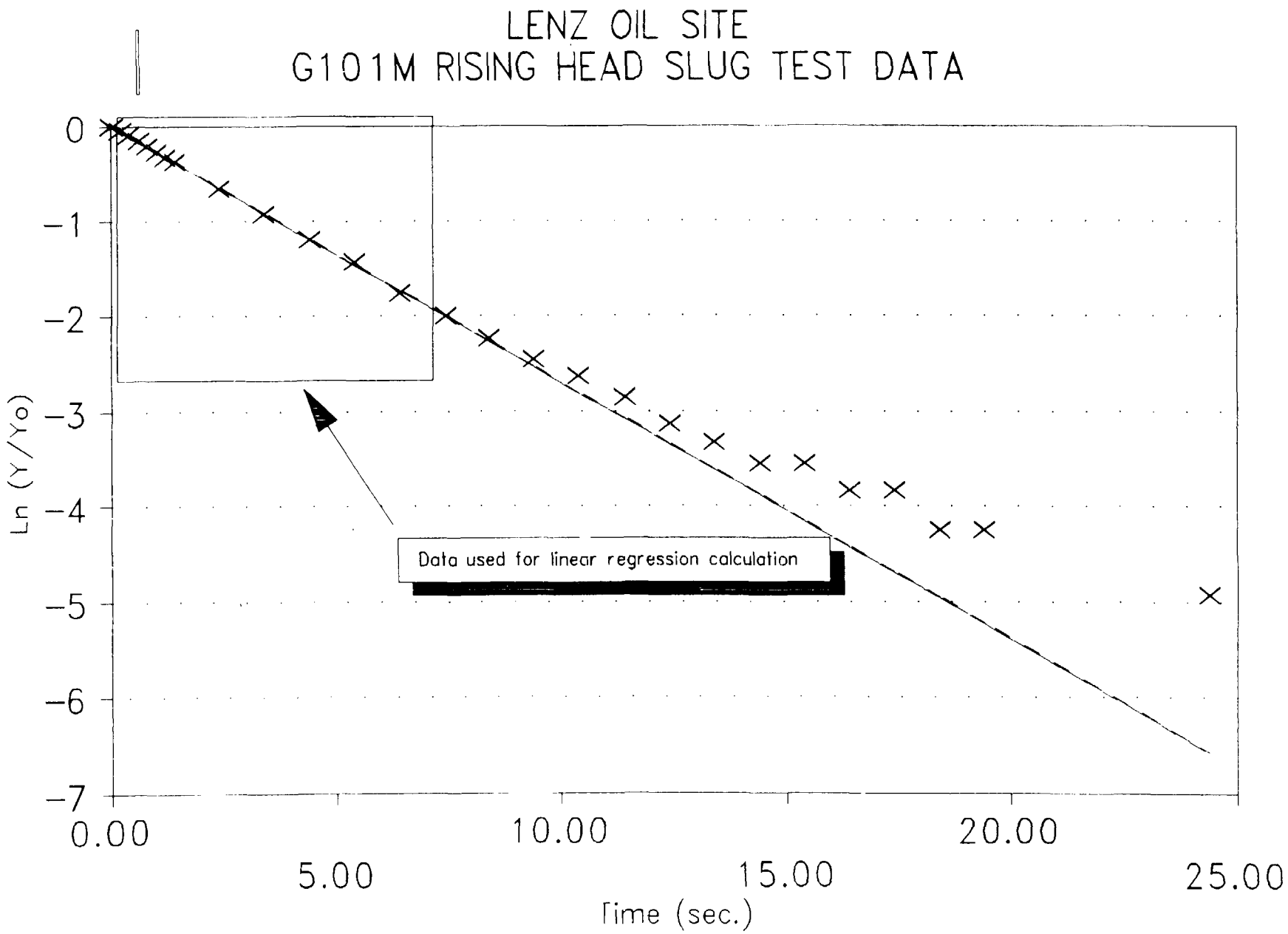
5.00
10.00
15.00
20.00
25.00
Time (sec.)
Data used for linear regression calculation


LENZ OIL SITE
G101M RISING HEAD SLUG TEST DATA
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-2
-3
-4
-5
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Ln (Y/Yo)
Data used for linear regression calculation
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5.00
10.00
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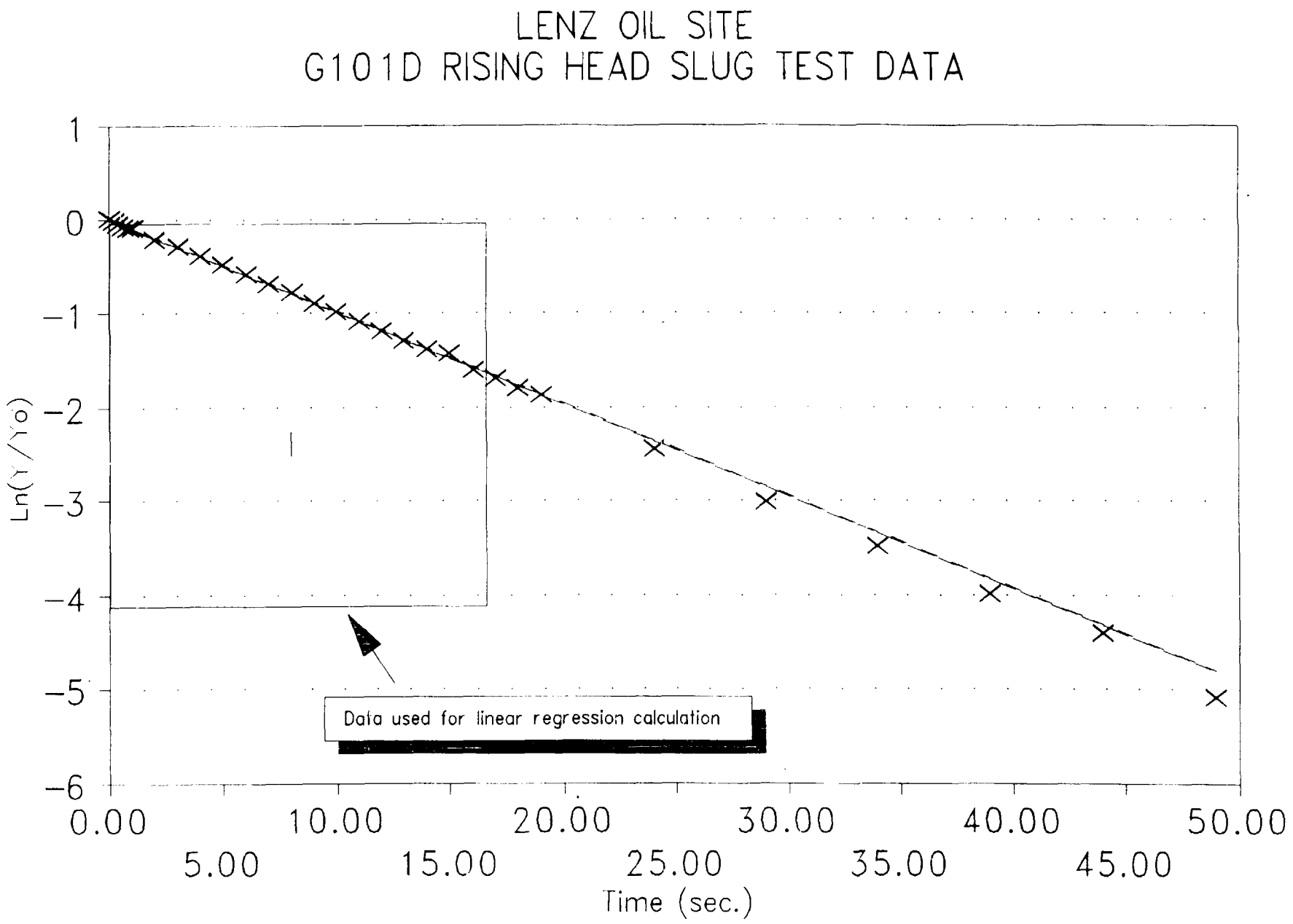
20.00
25.00
Time (sec.)


LENZ OIL SITE
G101D RISING HEAD SLUG TEST DATA
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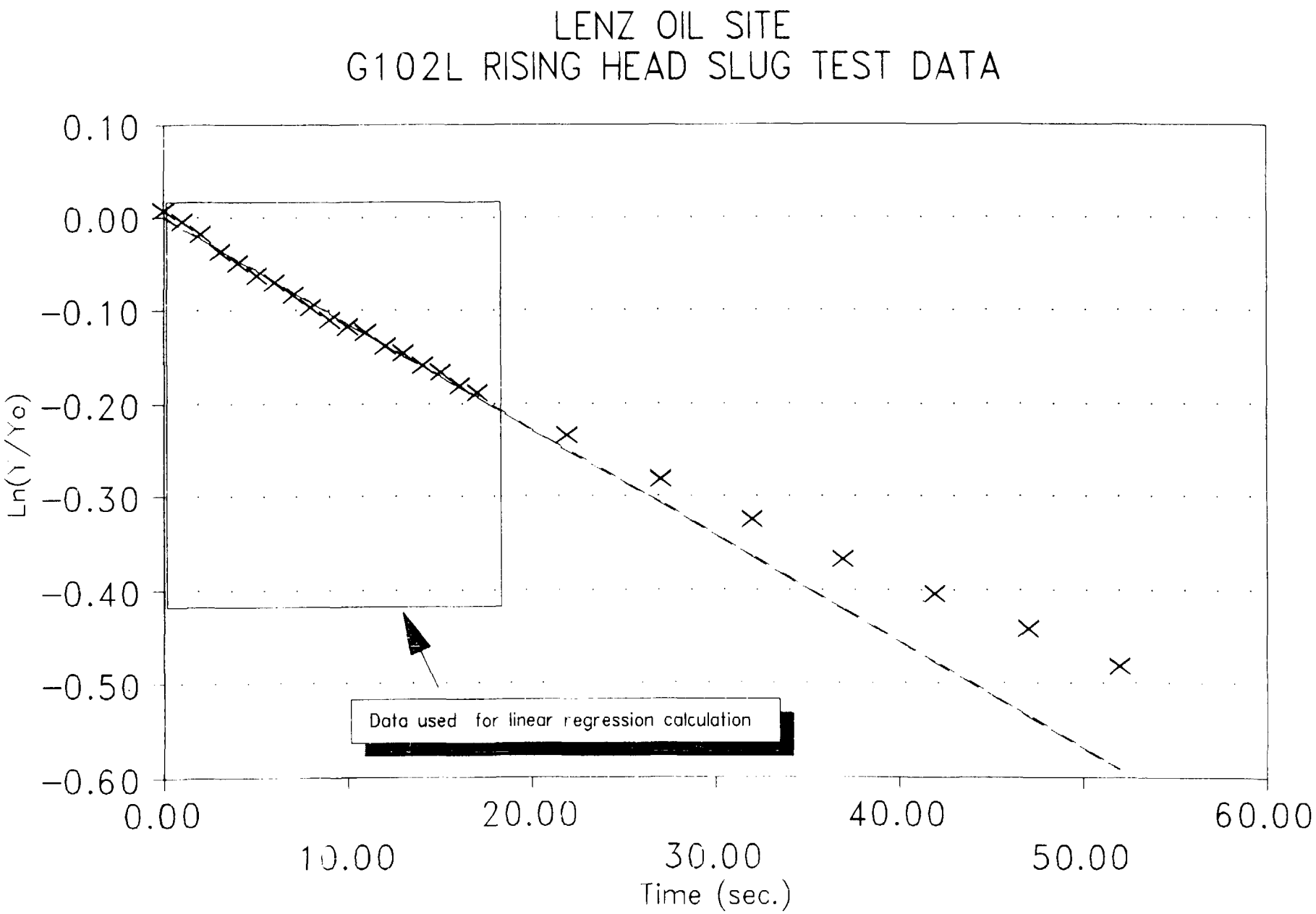
0
-1
-2
-3
-4
-5
-6
Ln(Y/Yo)
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
50.00
Time (sec.)
Data used for linear regression calculation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G102L RISING HEAD SLUG TEST DATA
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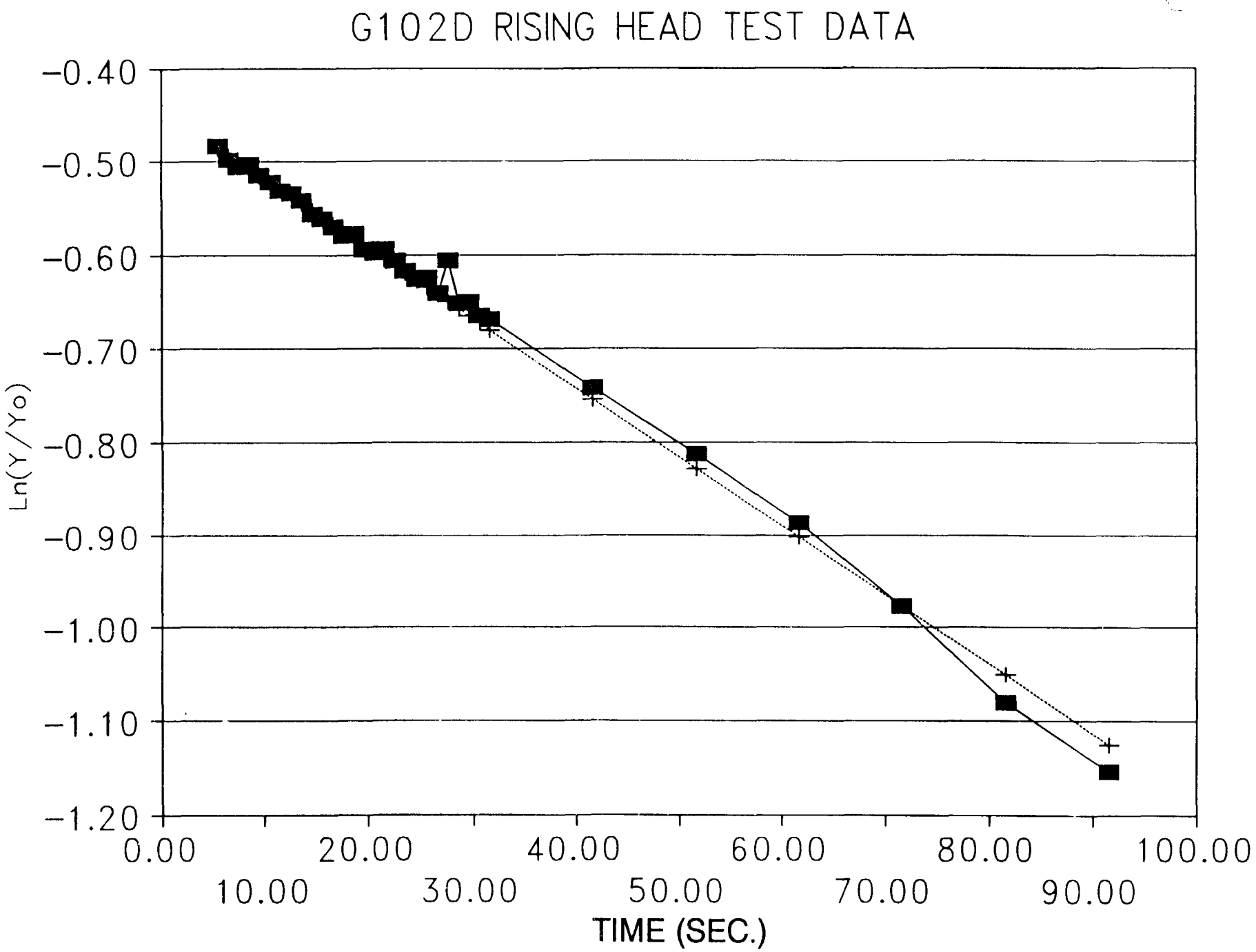
-0.20
-0.30
-0.40
-0.50
-0.60
Ln(Y/Yo)
0.00
10.00
20.00
30.00
40.00
50.00
60.00
Time (sec.)
Data used for linear regression calculation


G102D RISING HEAD TEST DATA
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-1.00
-1.10
-1.20
Ln(Y/Yo)
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10.00
20.00
30.00
40.00
50.00
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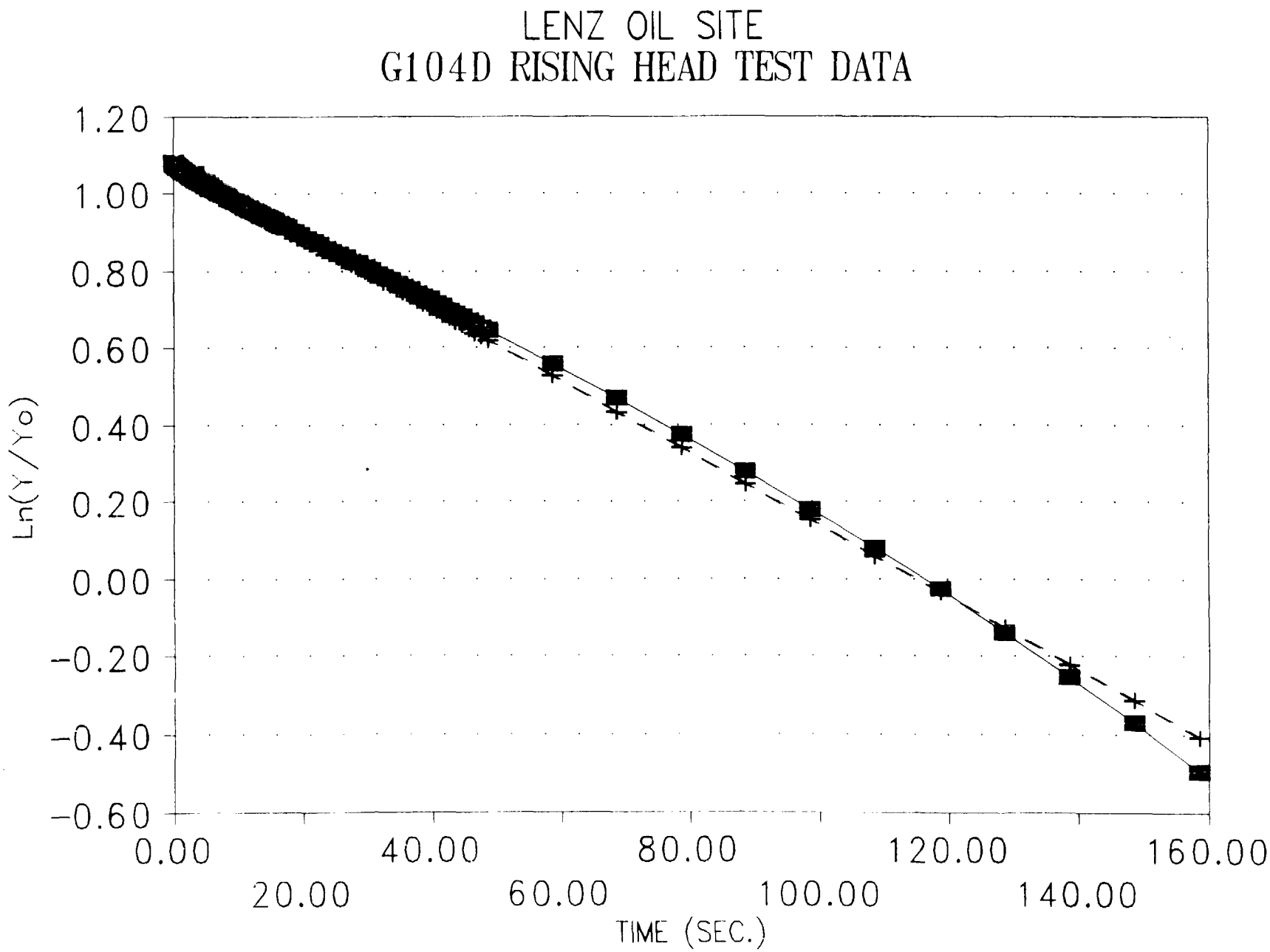
TIME (SEC.)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G104D RISING HEAD TEST DATA
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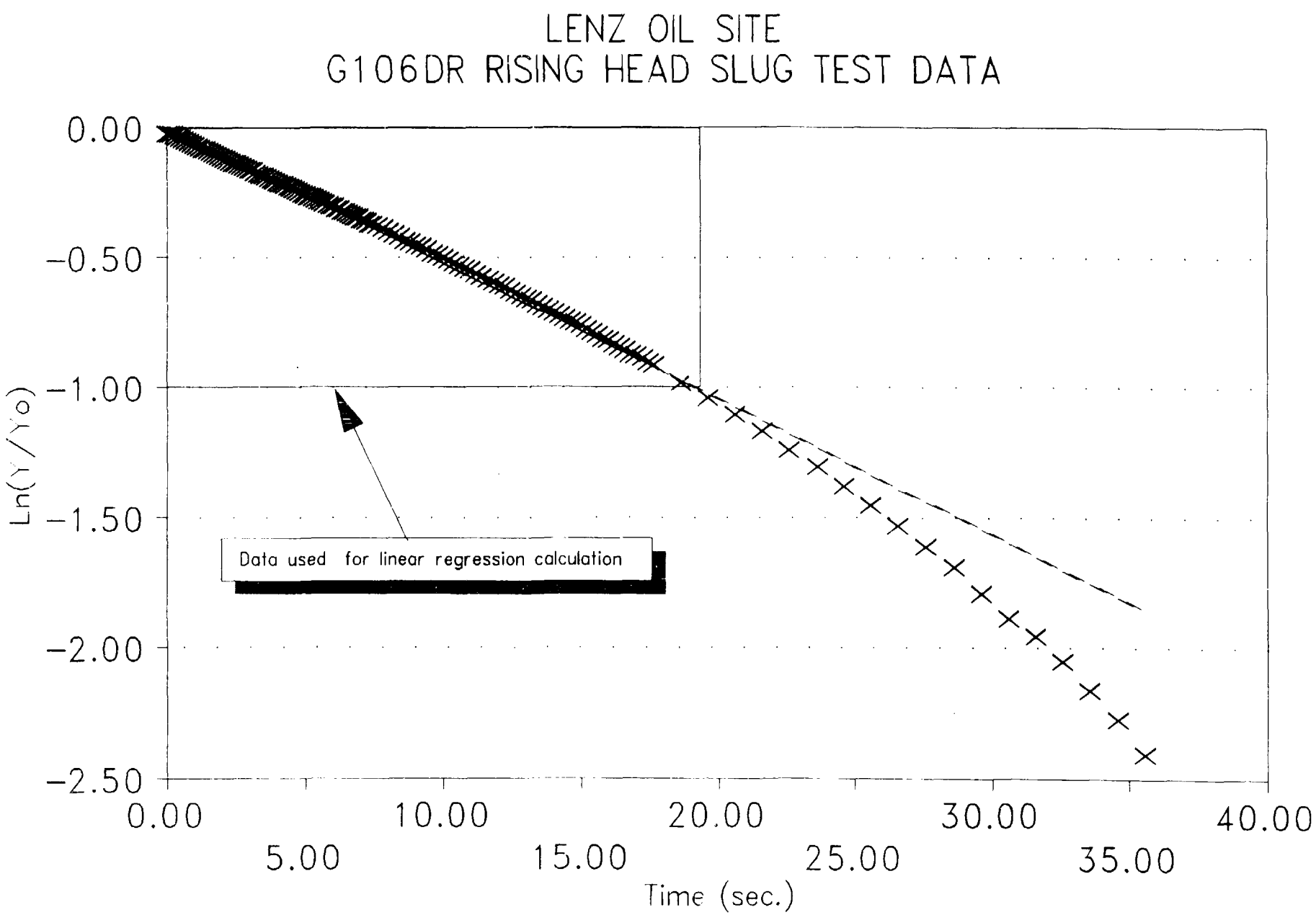
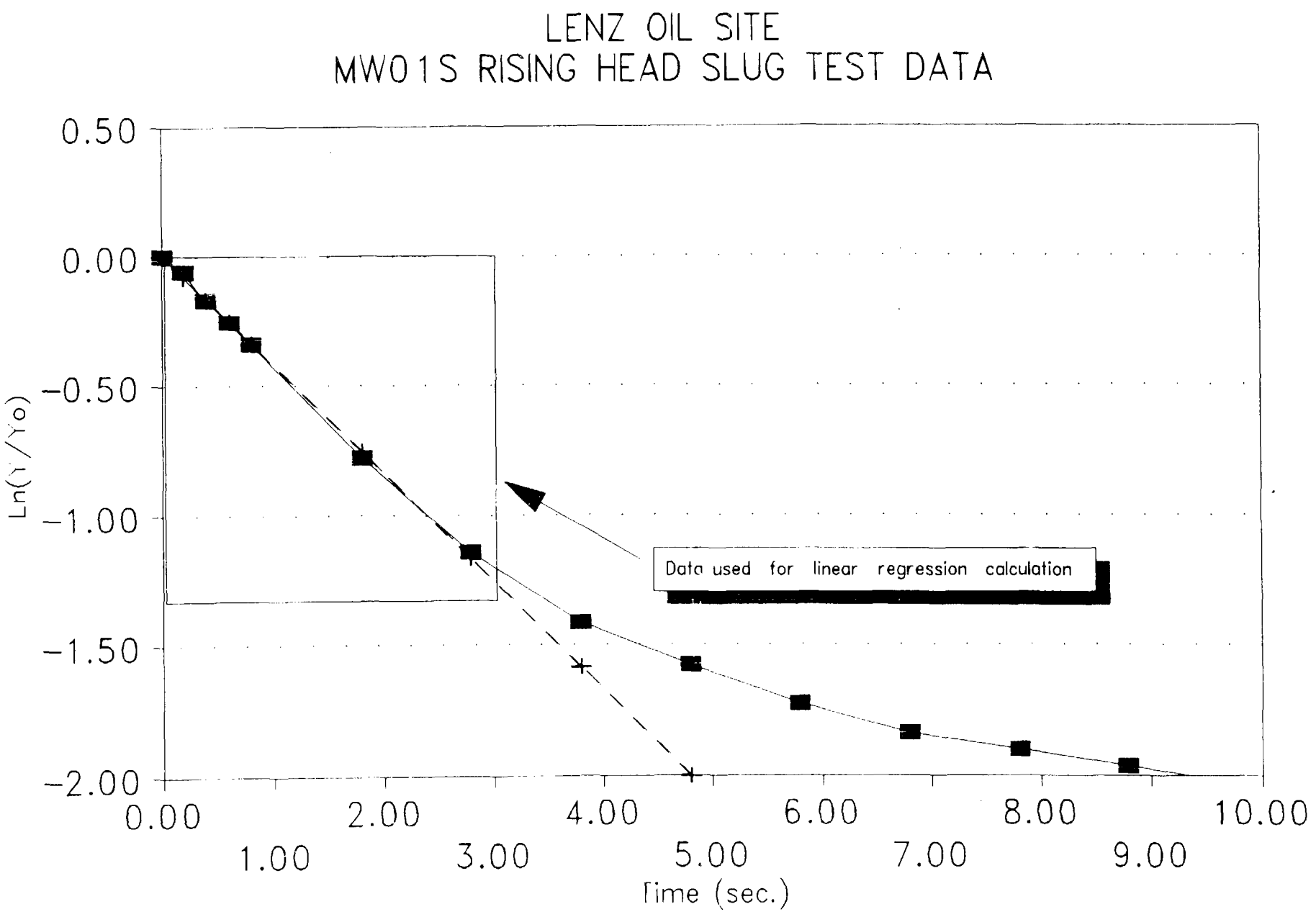
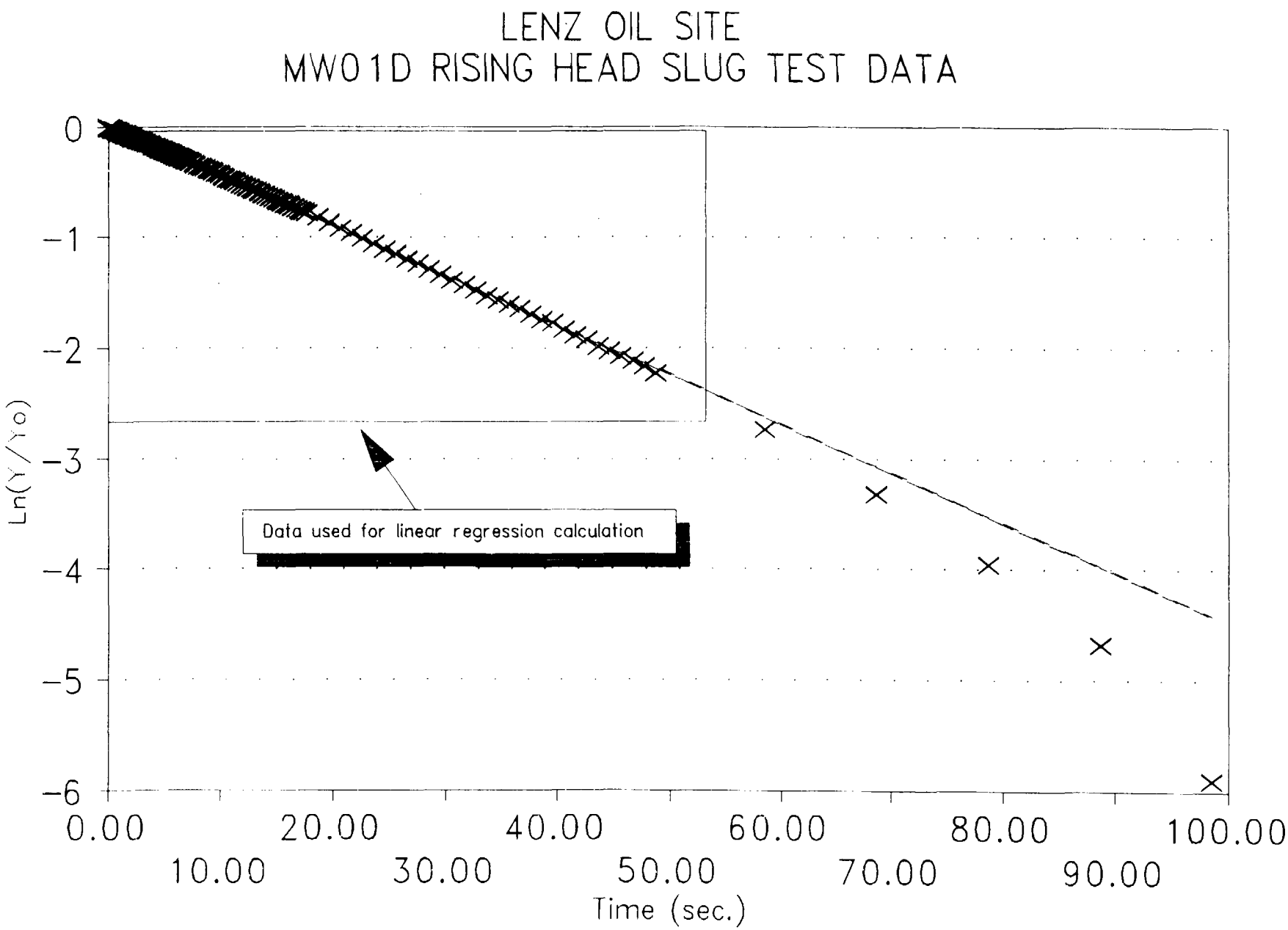
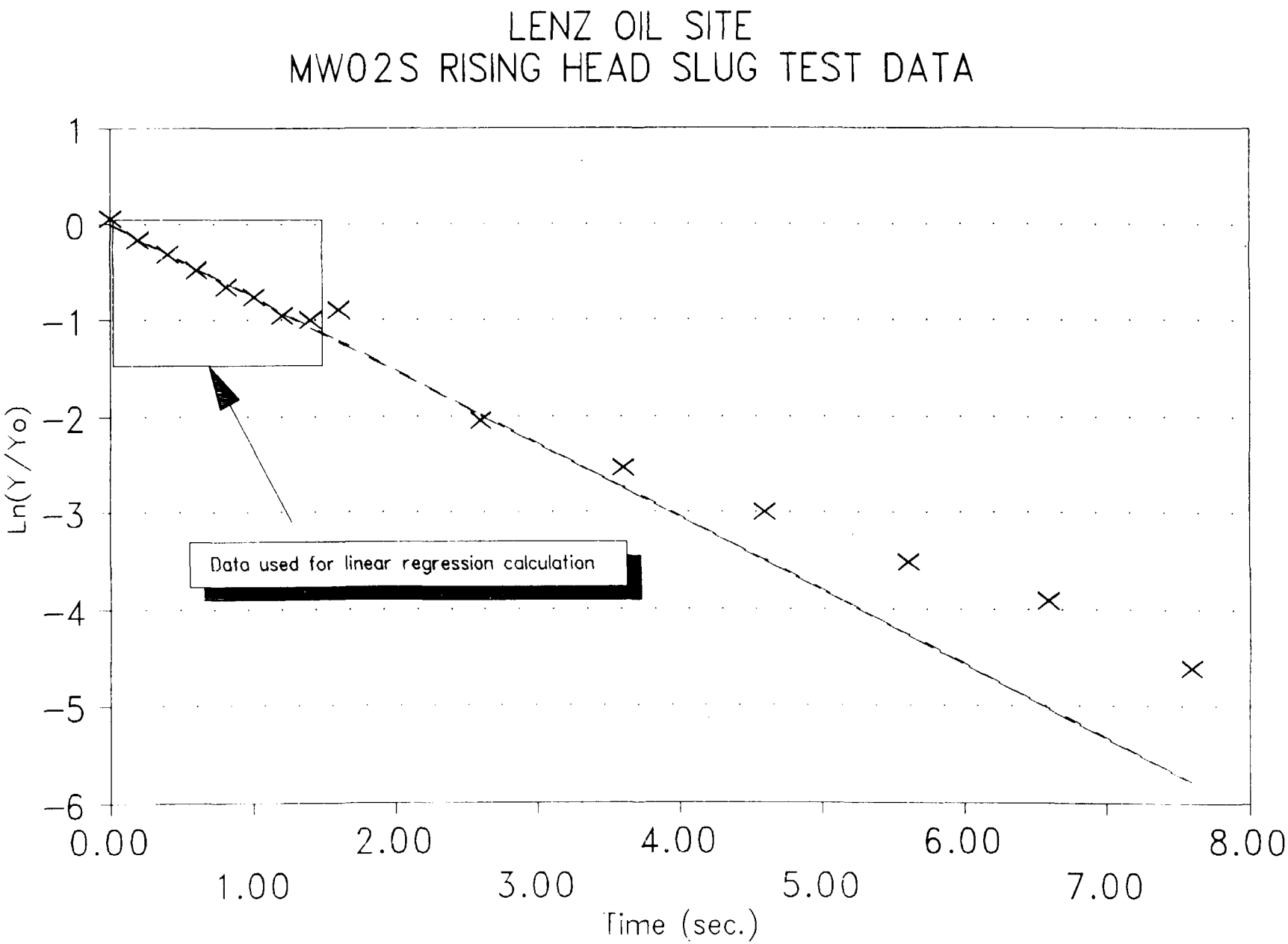
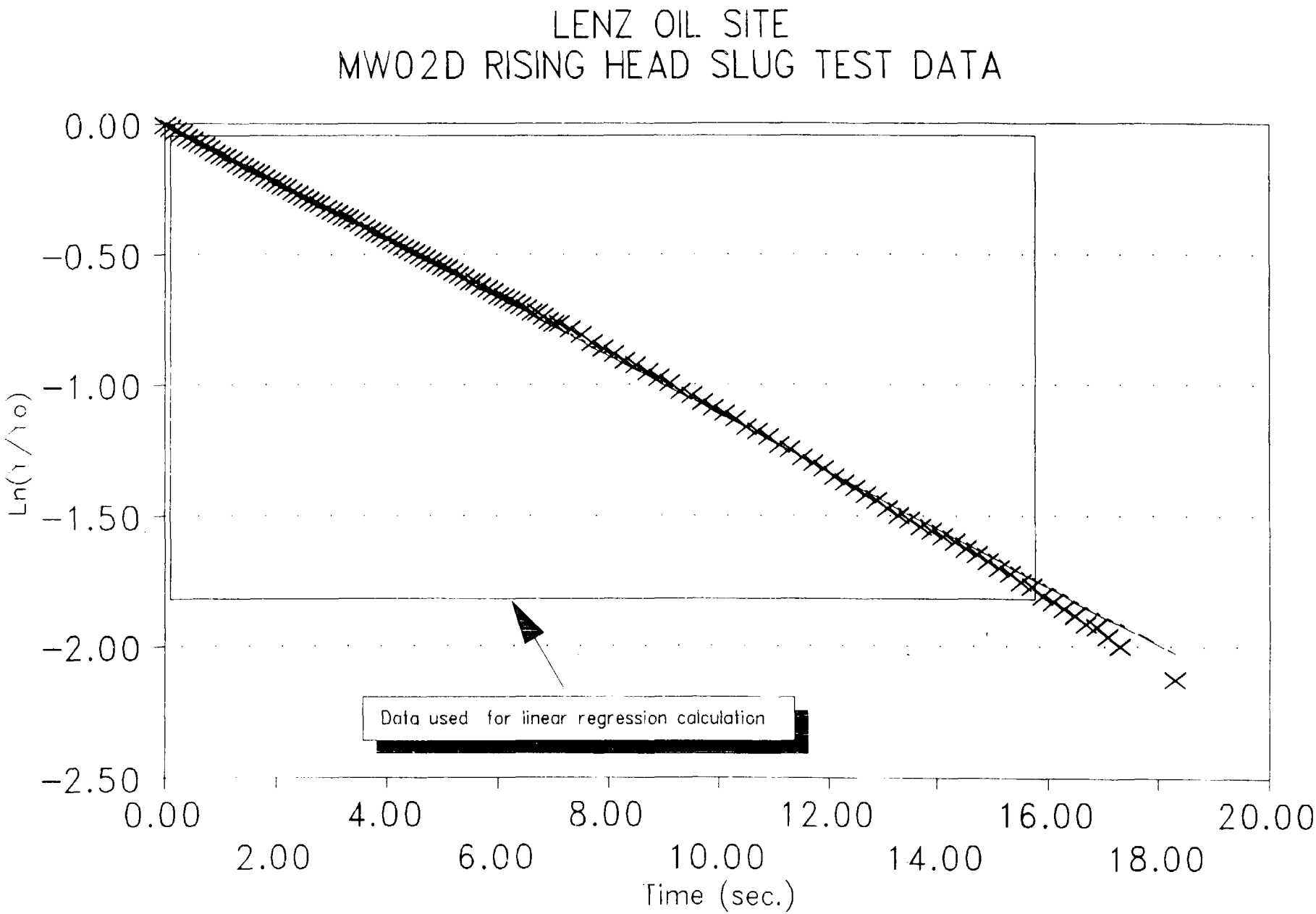
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
Ln(Y/Yo)
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
TIME (SEC.)

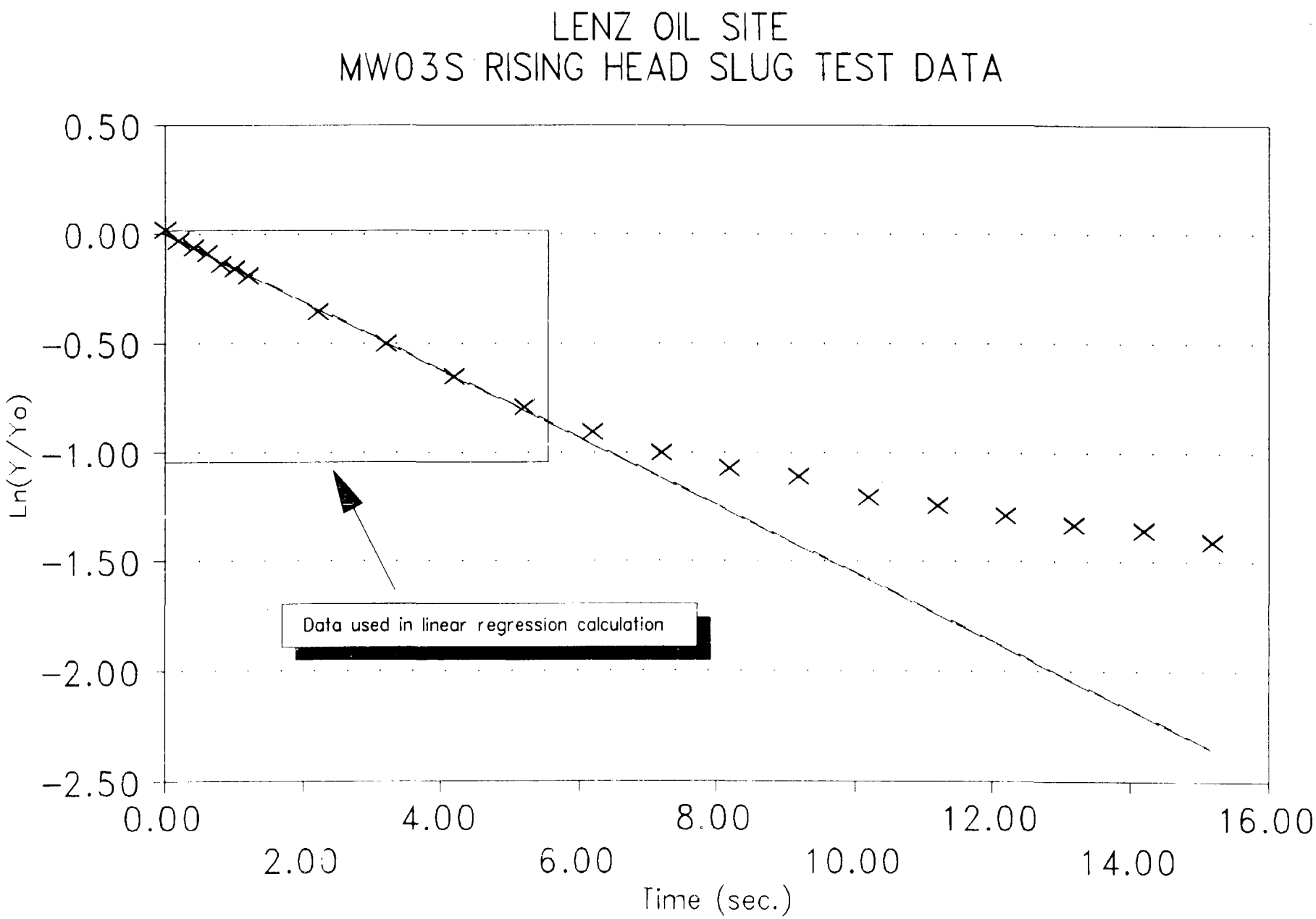

LENZ OIL SITE
G106DR RISING HEAD SLUG TEST DATA
0.00
-0.50
-1.00
-1.50
-2.00
-2.50
Ln(Y/Yo)
Data used for linear regression calculation
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
Time (sec.)

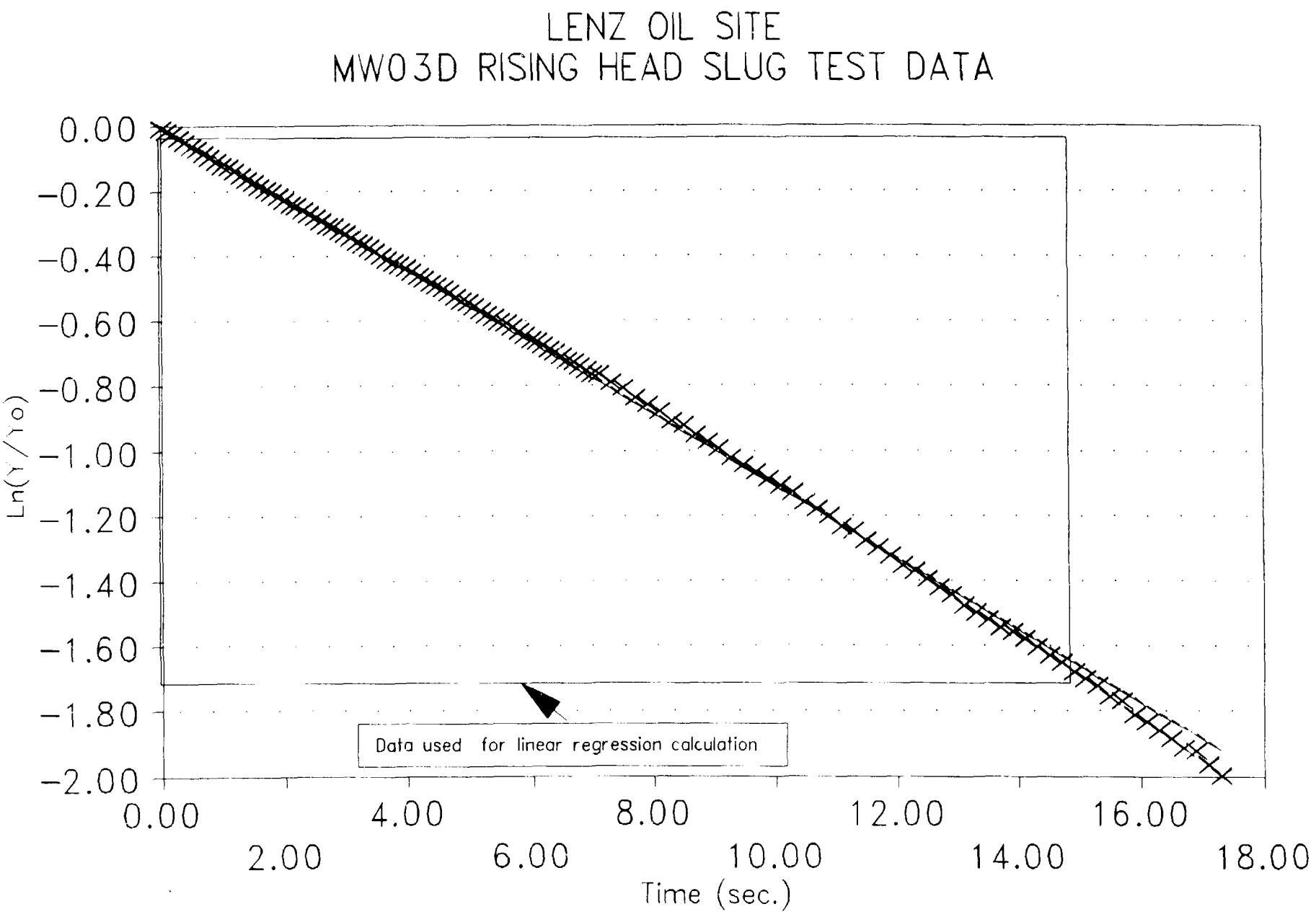

LENZ OIL SITE
MW01S RISING HEAD SLUG TEST DATA
0.50
0.00
-0.50
-1.00
-1.50
-2.00
Ln(Y/Yo)
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
Time (sec.)
Data used for linear regression calculation

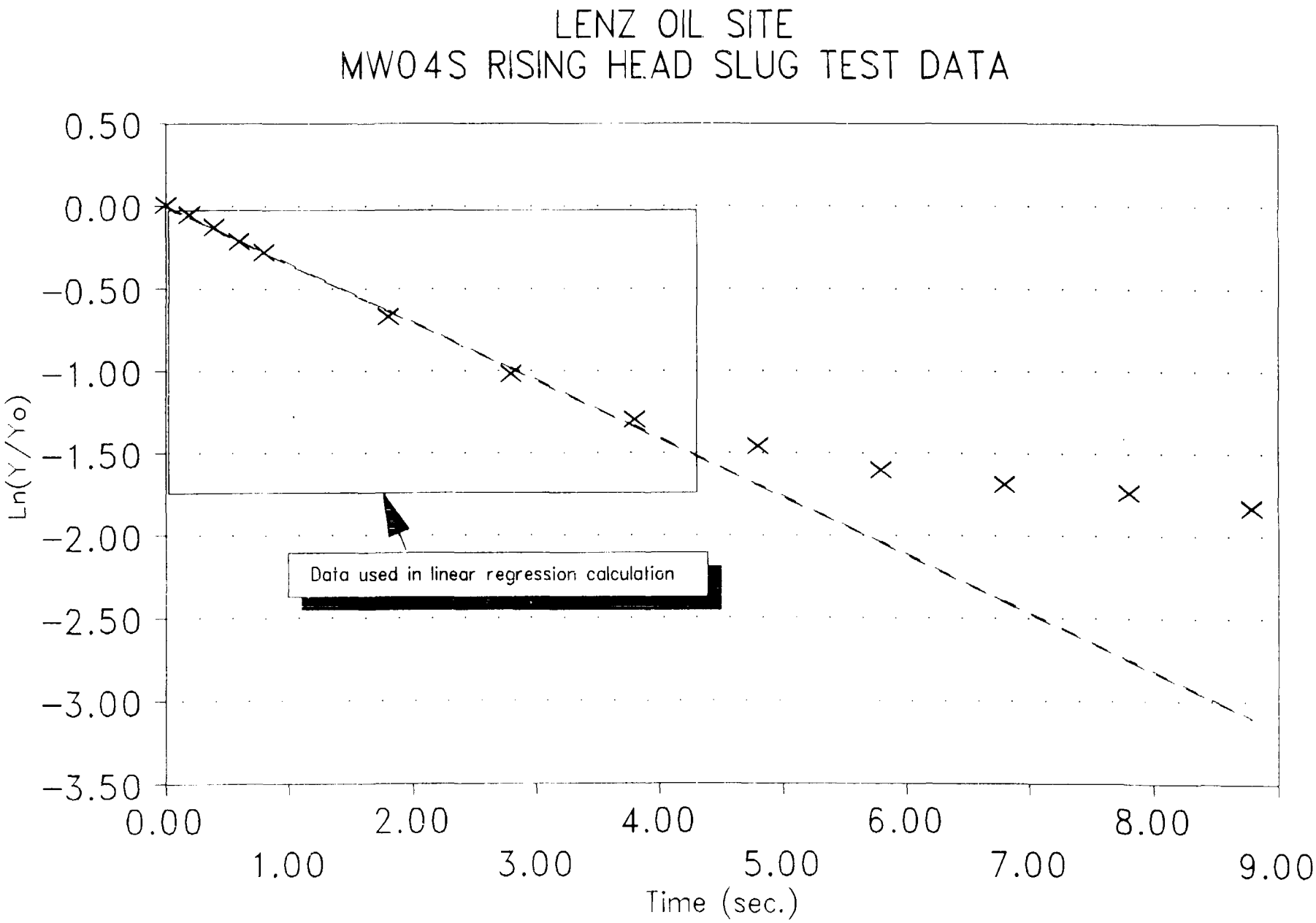

LENZ OIL SITE
MW01D RISING HEAD SLUG TEST DATA
0
-1
-2
-3
-4
-5
-6
Ln(Y/Yo)
Data used for linear regression calculation
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
Time (sec.)


LENZ OIL SITE
MW02S RISING HEAD SLUG TEST DATA
1
0
−1
−2
−3
−4
−5
−6
Ln(Y/Yo)
Data used for linear regression calculation
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
Time (sec.)

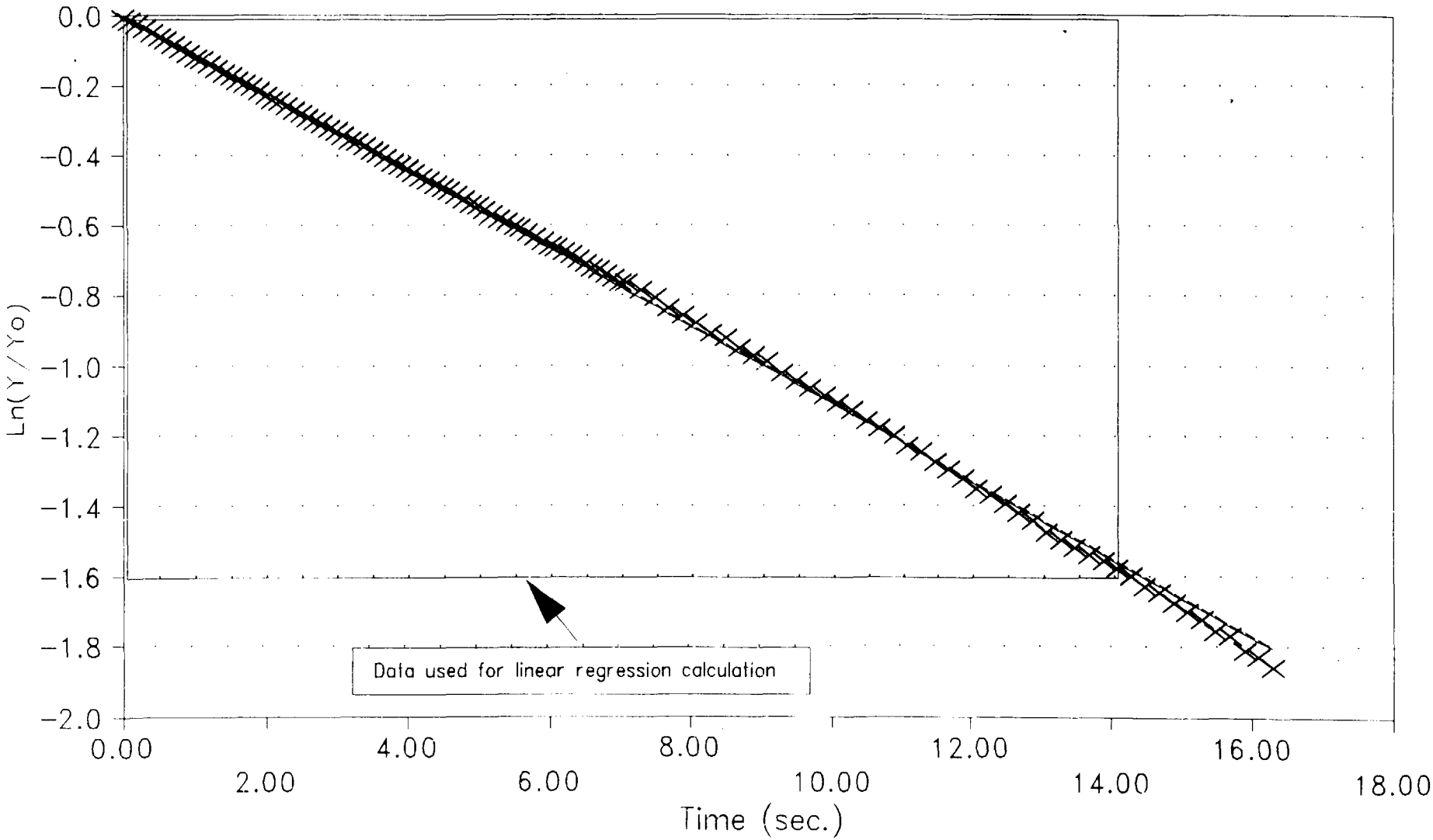

LENZ OIL SITE
MW02D RISING HEAD SLUG TEST DATA
0.00
-0.50
-1.00
-1.50
-2.00
-2.50
Ln(h/ho)
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
Time (sec.)
Data used for linear regression calculation

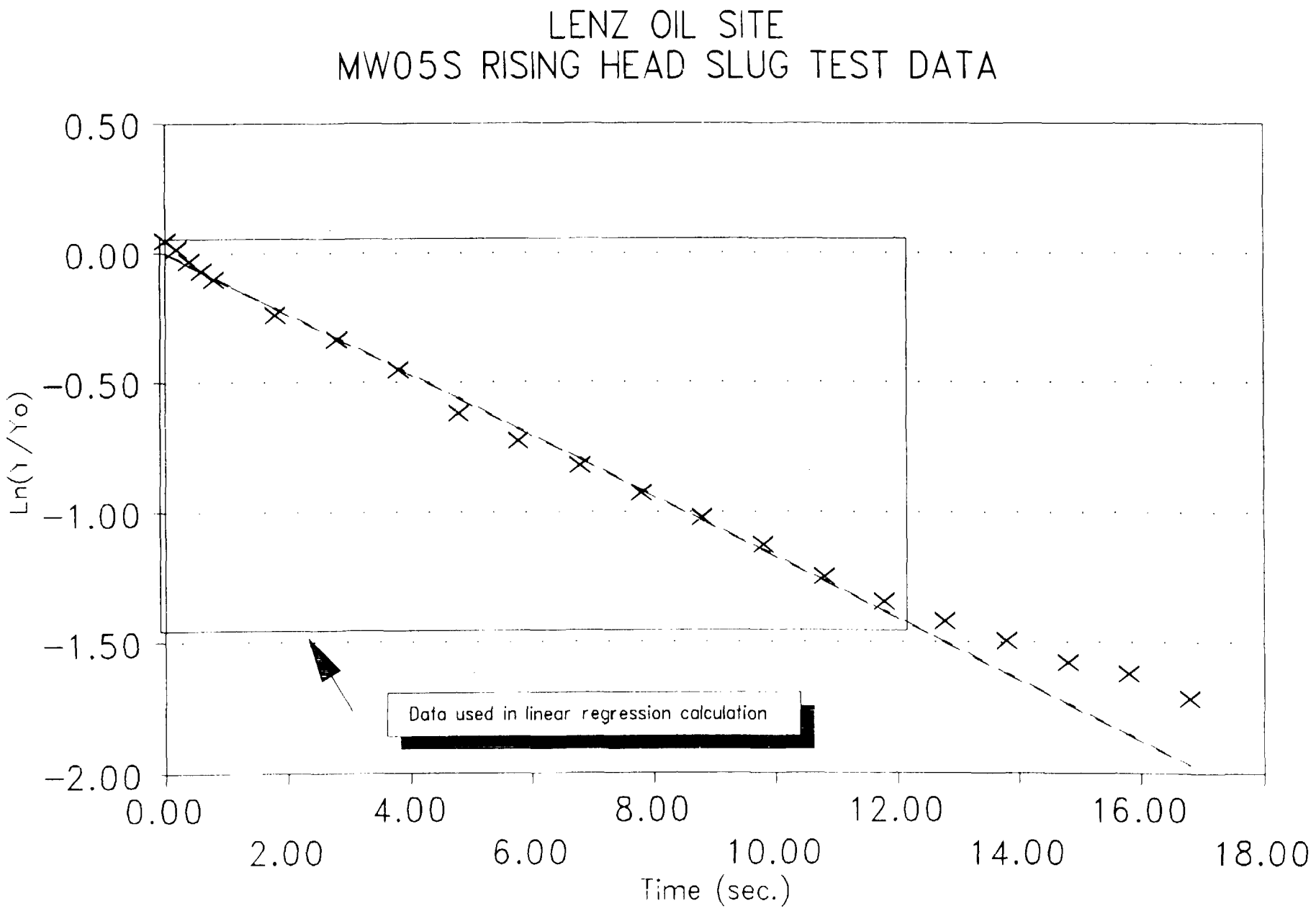

LENZ OIL SITE
MW03S RISING HEAD SLUG TEST DATA
0.50
0.00
-0.50
-1.00
-1.50
-2.00
-2.50
Ln(Y/Yo)
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
Time (sec.)
Data used in linear regression calculation

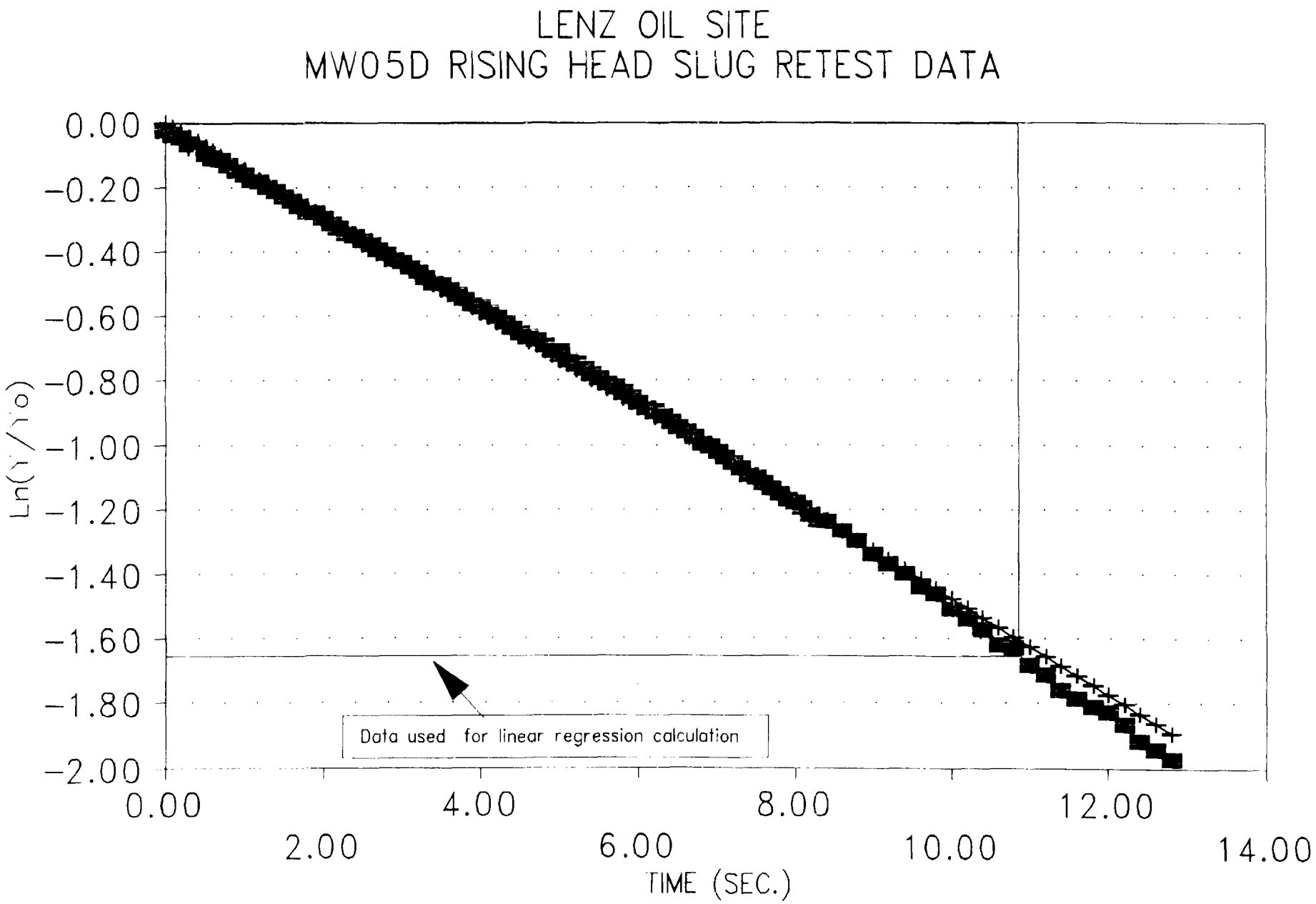

LENZ OIL SITE
MW03D RISING HEAD SLUG TEST DATA
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-1.20
-1.40
-1.60
-1.80
-2.00
Ln(Y/Yo)
Data used for linear regression calculation
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
Time (sec.)

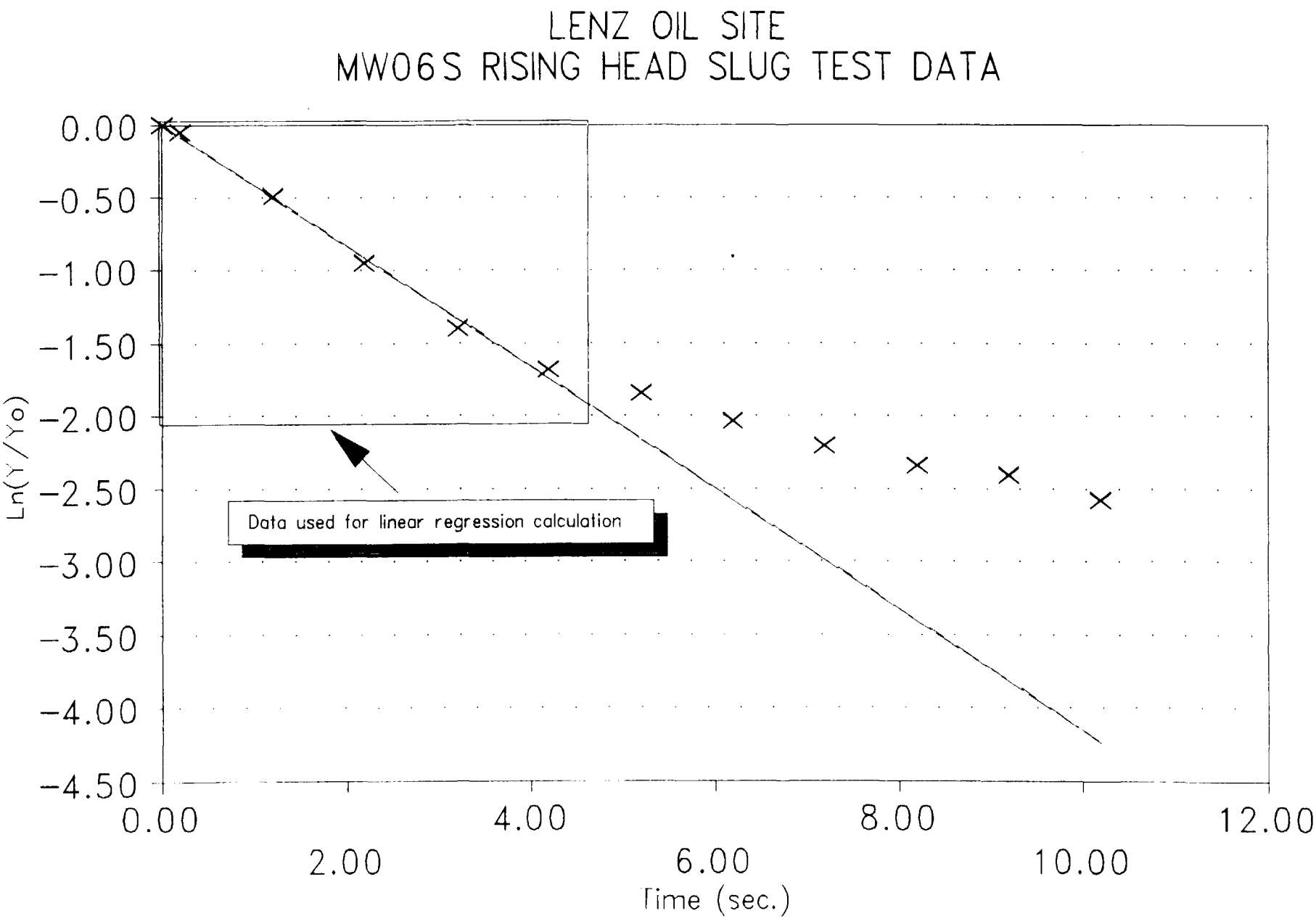

LENZ OIL SITE
MW04S RISING HEAD SLUG TEST DATA
0.50
0.00
-0.50
-1.00
-1.50
-2.00
-2.50
-3.00
-3.50
Ln(Y/Yo)
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
Time (sec.)
Data used in linear regression calculation

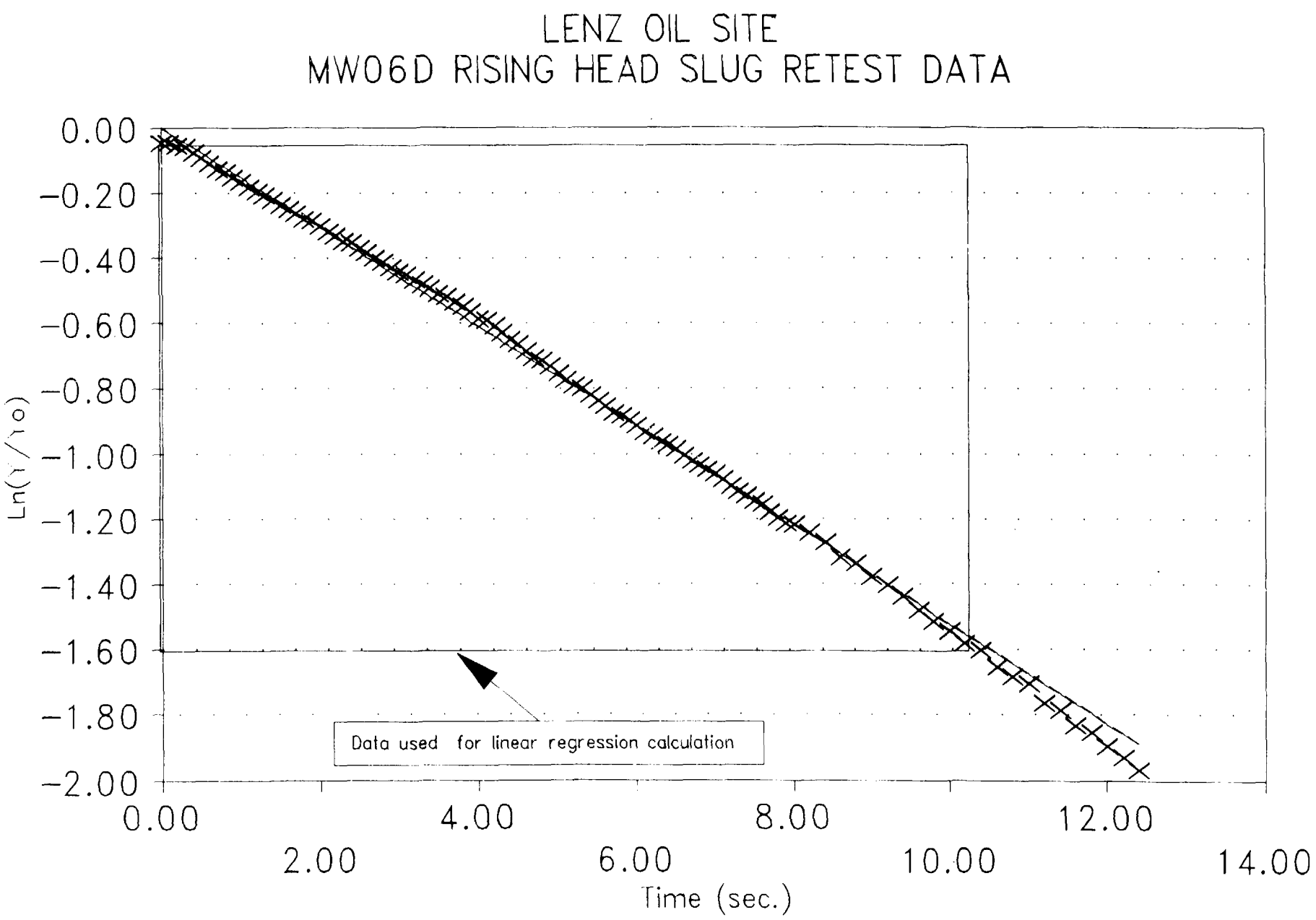
LENZ OIL SITE
MW04D RISING HEAD SLUG TEST DATA

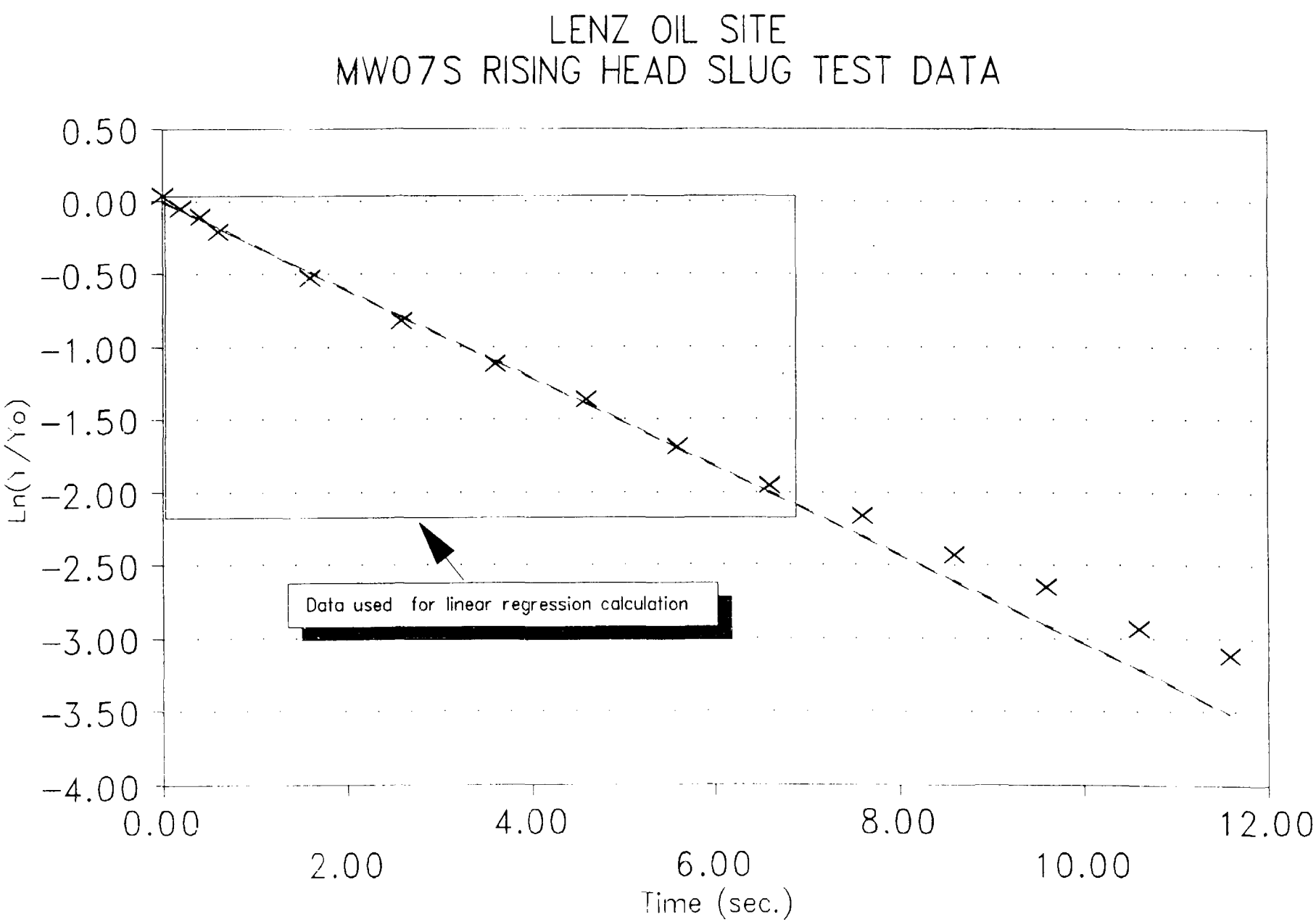


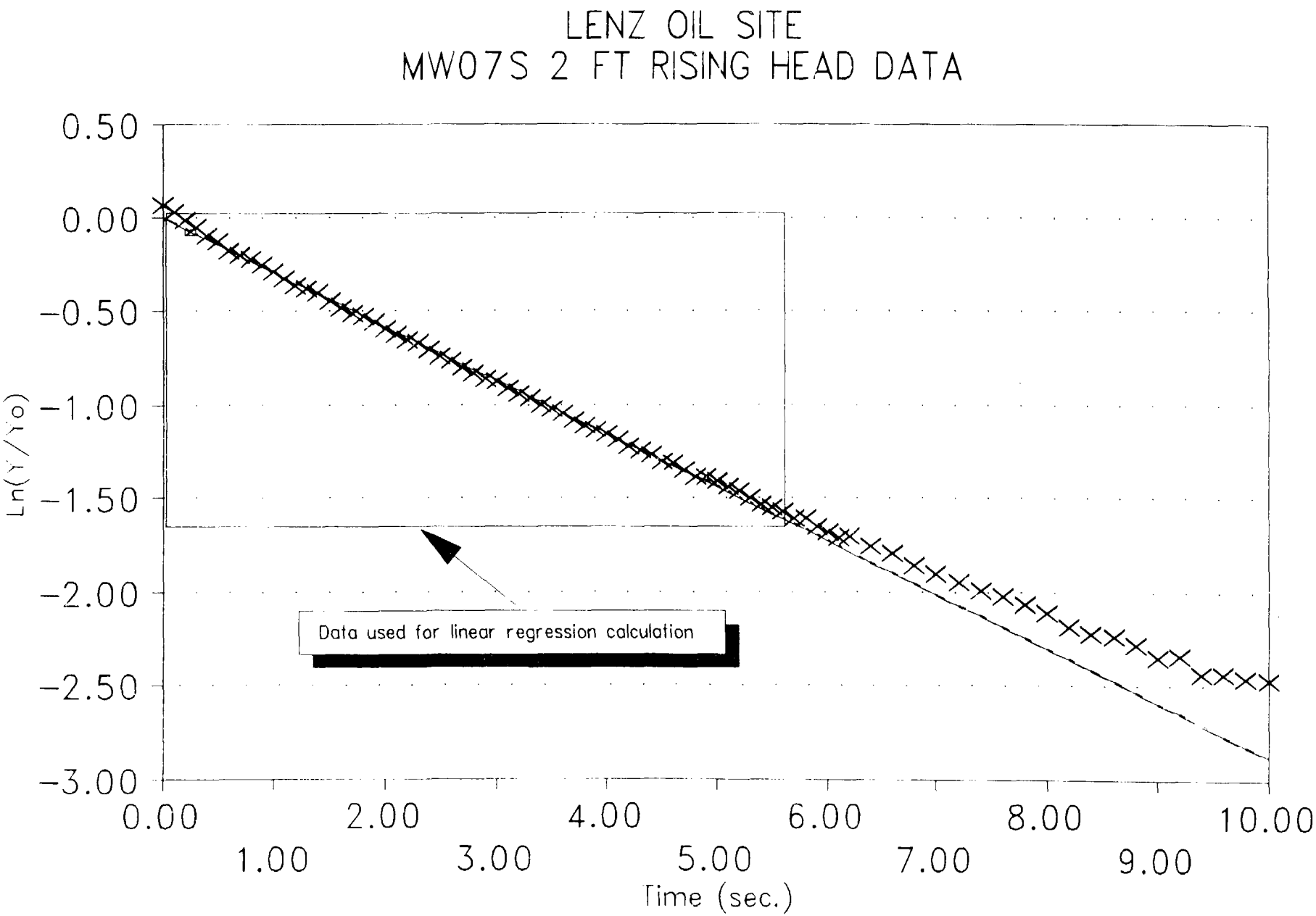

LENZ OIL SITE
MW05S RISING HEAD SLUG TEST DATA
0.50
0.00
-0.50
-1.00
-1.50
-2.00
Ln(Y/Yo)
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
Time (sec.)
Data used in linear regression calculation

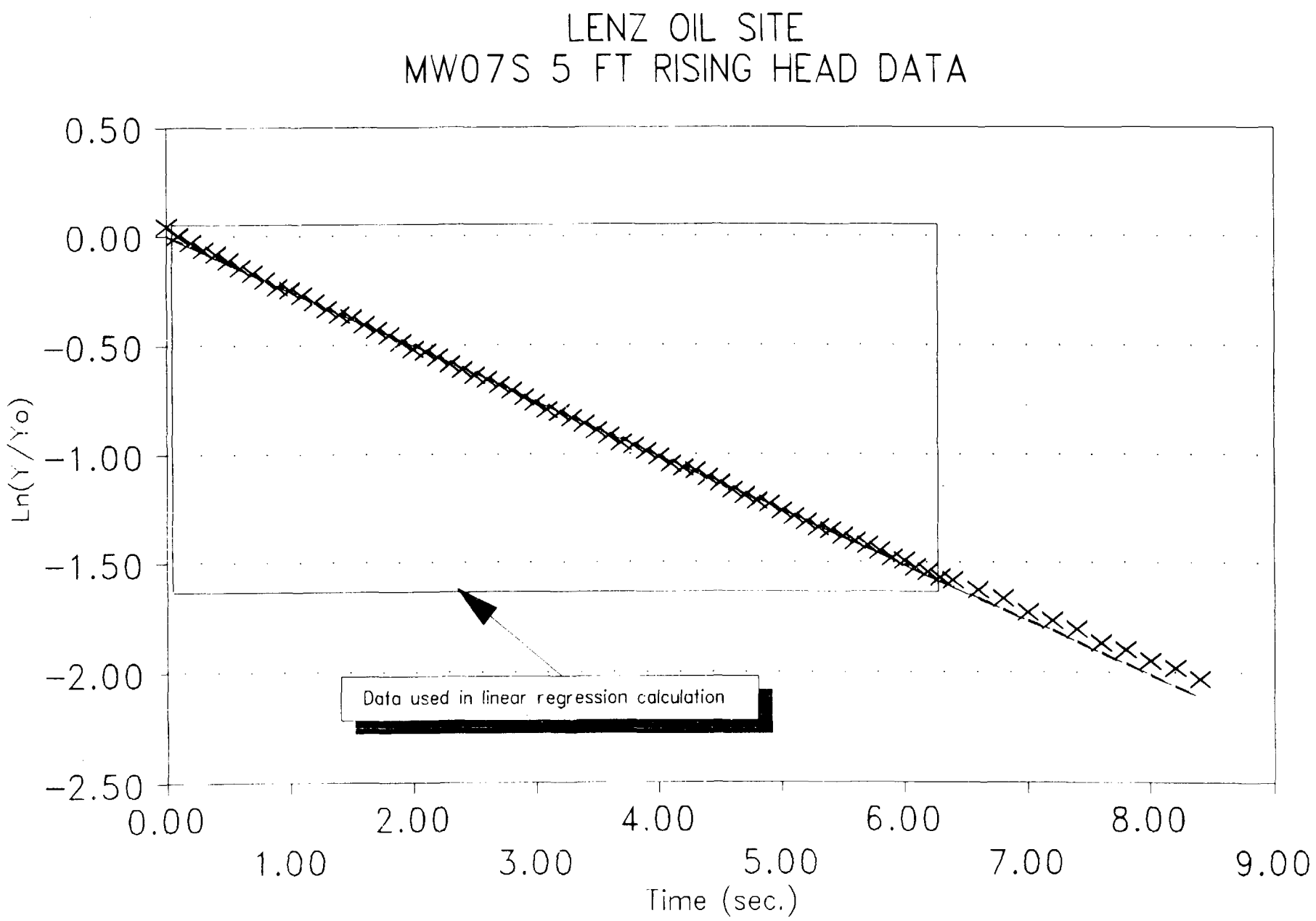

LENZ OIL SITE
MW05D RISING HEAD SLUG RETEST DATA
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-1.20
-1.40
-1.60
-1.80
-2.00
Ln(h/ho)
Data used for linear regression calculation
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
TIME (SEC.)

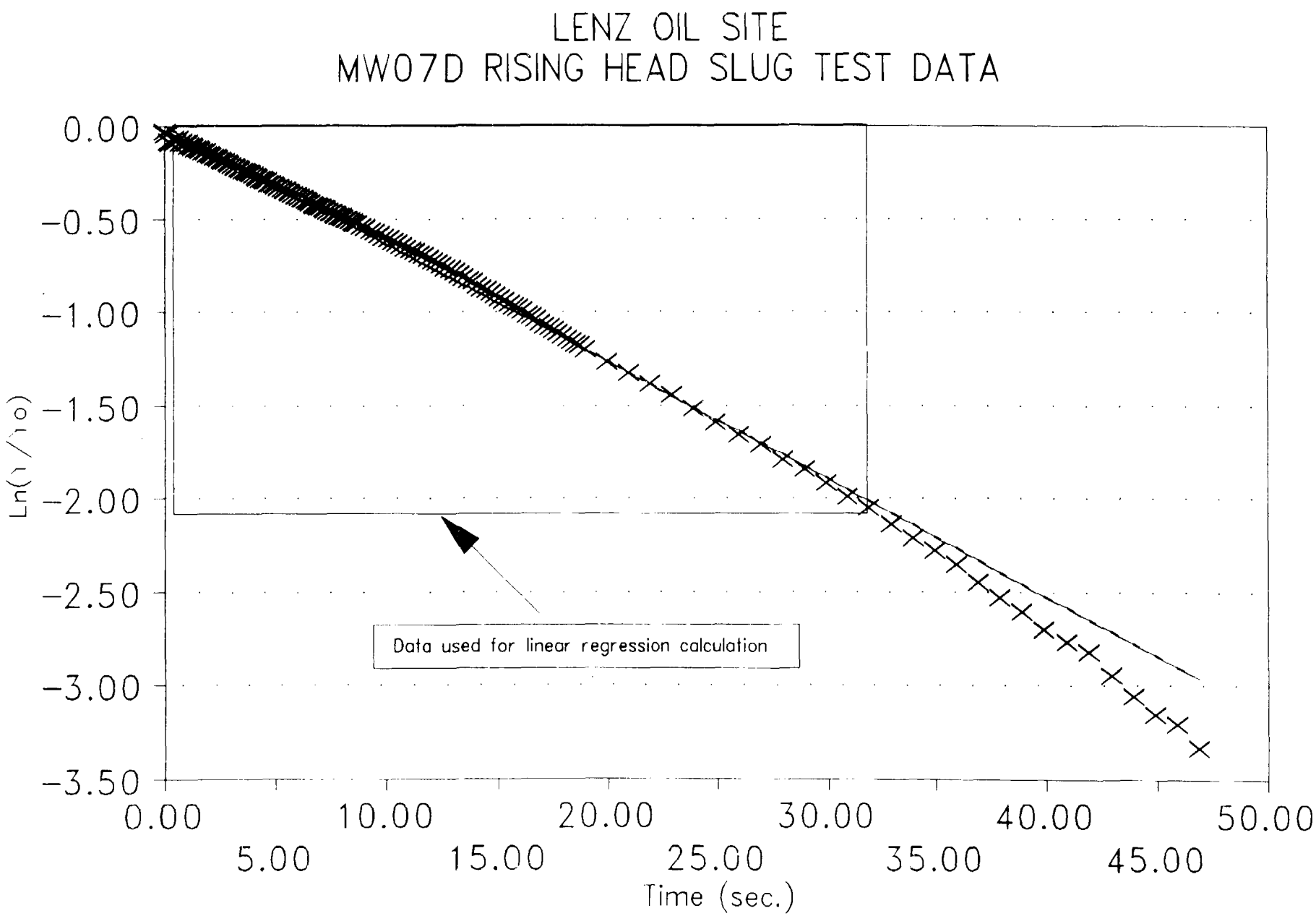

LENZ OIL SITE
MW06S RISING HEAD SLUG TEST DATA
0.00
-0.50
-1.00
-1.50
-2.00
-2.50
-3.00
-3.50
-4.00
-4.50
Ln(Y/Yo)
Data used for linear regression calculation
0.00
2.00
4.00
6.00
8.00
10.00
12.00
Time (sec.)


LENZ OIL SITE
MW06D RISING HEAD SLUG RETEST DATA
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-1.20
-1.40
-1.60
-1.80
-2.00
Ln(Y/Yo)
Data used for linear regression calculation
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
Time (sec.)


LENZ OIL SITE
MW07S RISING HEAD SLUG TEST DATA
0.50
0.00
-0.50
-1.00
-1.50
-2.00
-2.50
-3.00
-3.50
-4.00
Ln(Y/Yo)
0.00
2.00
4.00
6.00
8.00
10.00
12.00
Time (sec.)
Data used for linear regression calculation


LENZ OIL SITE
MW07S 2 FT RISING HEAD DATA
0.50
0.00
-0.50
-1.00
-1.50
-2.00
-2.50
-3.00
Ln(Y/Yo)
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
Time (sec.)
Data used for linear regression calculation


LENZ OIL SITE
MW07S 5 FT RISING HEAD DATA
0.50
0.00
-0.50
-1.00
-1.50
-2.00
-2.50
Ln(Y/Yo)
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
Time (sec.)
Data used in linear regression calculation


LENZ OIL SITE
MW07D RISING HEAD SLUG TEST DATA
0.00
-0.50
-1.00
-1.50
-2.00
-2.50
-3.00
-3.50
Ln(h/ho)
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
50.00
Time (sec.)
Data used for linear regression calculation

APPENDIX E

GROUND WATER ELEVATION MEASUREMENT RESULTS

APPENDIX E

GROUND WATER ELEVATION MEASUREMENT RESULTS

Per the approved Lenz Oil Site RI/FS Work Plan, ERM-North Central collected water level measurements on a monthly basis from the monitoring wells installed at the site. The first round of water level measurements was collected on January 21, 1991, and measurements have been taken every month since then. Because most of the monitoring wells were installed since February 1991, only a few monitoring well clusters (i.e., G101, G102, and G104) have water level data for the entire period. Since the monitoring well network at the site was expanded, the number of measurement points increased from the original 7 monitoring wells to 23 monitoring wells. Measurements of surface water elevation were taken at two points along a ditch on the northwest part of the site and at one point on the Des Plaines River (Figure 2-1). The water level elevations for each monitoring point and each round of measurements are summarized on Table 2-3.

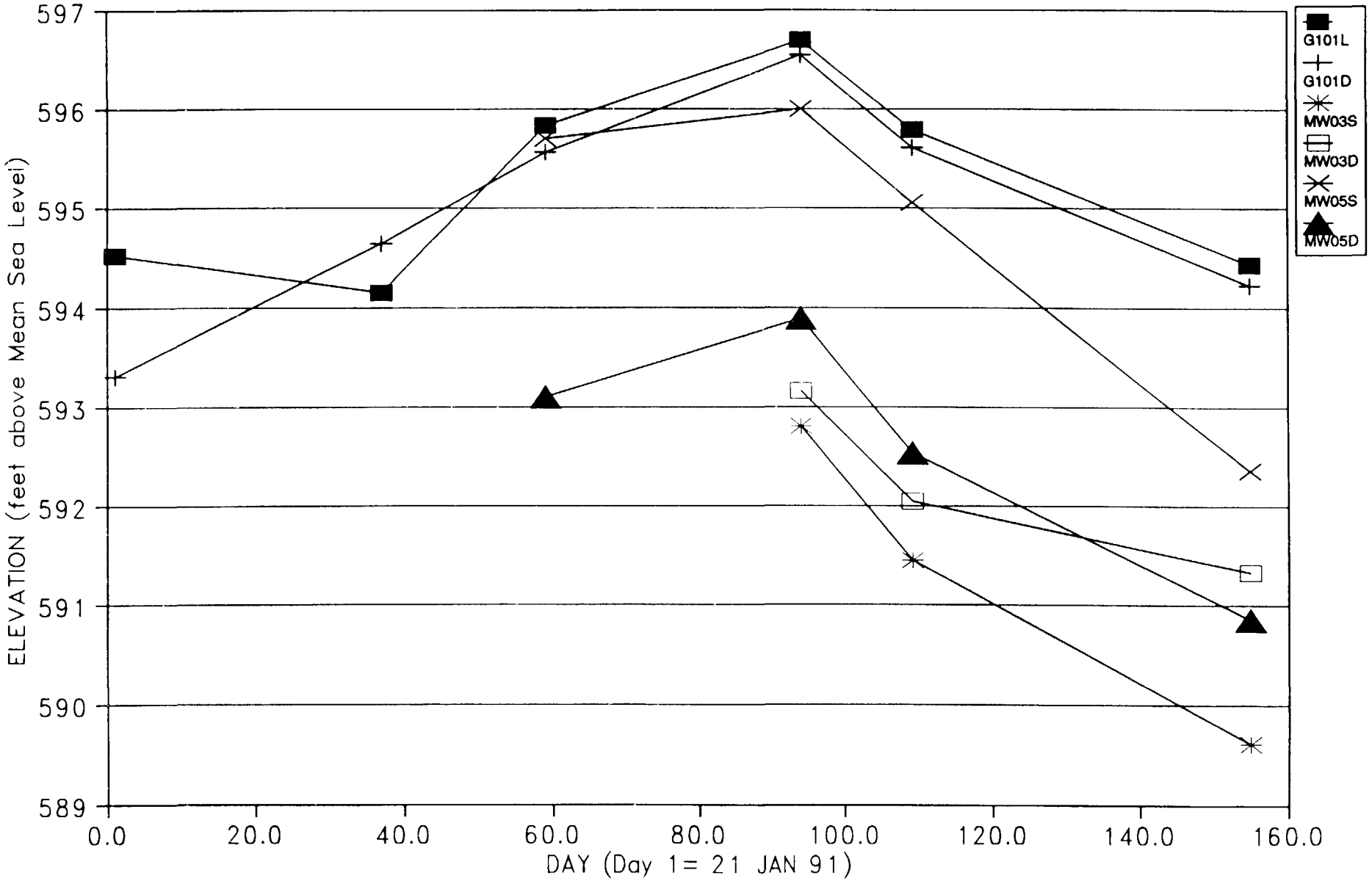
Seasonal fluctuations in the water levels were monitored by plotting the monthly water level elevations for selected wells through time (Figure E-1). The data from only a few wells were plotted because all of the wells showed the same general trend. In general, the water levels in the wells rose approximately 3 feet between January 21, 1991 and April 24, 1991, and then declined approximately 2 feet between April 24, 1991 and June 24, 1991. This water level increase during early spring agrees with the expected seasonal trend of snow melt and increased precipitation during this time.

Although the amount of data is limited, the apparent drop in water level for the shallow well in cluster G101 and the apparent rise in the water level in the deep well at the same cluster between January and February, 1991 suggest that a downward flow had occurred from the unconsolidated zone to the Silurian dolomite. This is supported by the steeper decline of water levels in the shallow wells compared to the deep wells between April and June, 1991. These observations

suggest that the unconsolidated soil portion of the aquifer is hydraulically connected to the fractured dolomite portion of the aquifer, but there is probably a lower permeability layer near the dolomite surface.

On April 24, 1991, ERM installed two steam gages (SG1 and SG2) at the site and a single gage in the Des Plaines River. ERM used these gages to measure the water level elevation of the ditch, located northwest of the site and the Des Plaines River. These surface water elevation points provided additional data points for the shallow piezometric surface maps.

FIGURE E-1
MONITORING WELL WATER LEVELS



APPENDIX F

GROUND WATER SAMPLING FORMS

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: LO-1MW07S-GW DATE: 7 May 1991 TIME: 13:15

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
RLL	ERM		
BBM	ERM		

WELL NUMBER: MW07S TOTAL DEPTH: 32.5 (ft) I.D.: 2 (in)

MATERIAL: Stain. Steel SCREENED INTERVAL: ____-____ (ft)

WATER LEVEL TO TOP OF CASING (ft)

PRE-PURGE: 15.72 POST-PURGE: _____ SAMPLING: _____

THICKNESS OF WATER COLUMN: 16.78 (ft) CASING VOLUME: 2.7 (gal) 3 Vol. = 8.1 Gal.

PURGING METHOD: Teflon Bailer SAMPLING METHOD: Teflon Bailer

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F)	Cumulative Volume (gal)
13:00	7.18	1730	13.5°C	0 Gal.
13:05	7.10	1750	12.2°C	2.7 Gal.
13:10	7.05	1780	12.0°C	5.4 Gal.
13:15	7.06	1780	12.0°C	8.1 Gal.

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM
(Continued)

SAMPLE CONTAINER	VOLUME	PRESERVATIVE/PREP.
(2) VOA, Clear, Glass	40 ML	No
(3) SVOA, Amber, Glass	1 Liter	No
(2) Pest./PCBs, Amber, Glass	1 Liter	No
(2) Metals, Plastic	1 Liter	HNO_3
(1) CN, Clear Glass	1 Liter	NaOH

METALS SAMPLE FILTERED IN FIELD? YES ✓ NO ____

OBSERVATIONS:

Cloudy pale gray.

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

LO-1MW07D-FB

SAMPLE I.D.: LO-1MW07D-GW DATE: 7 May 1991 TIME: 12:20

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
BLL	ERM	H.W.L	EBASCO
BBM	ERM		

WELL NUMBER: 4W7D TOTAL DEPTH: 54.5 (ft) I.D.: 2 (in)

MATERIAL: Stain Steel SCREENED INTERVAL: ____-____ (ft)

WATER LEVEL TO TOP OF CASING (ft)

PRE-PURGE: 15.05 POST-PURGE: _____ SAMPLING: _____

THICKNESS OF WATER COLUMN: 39.45 (ft) CASING VOLUME: 6.3 (gal)

PURGING METHOD: Teflon Bailer SAMPLING METHOD: Teflon Bailer

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F)	Cumulative Volume (gal)
11:55	8.14	600	13°C	0 Gal.
12:00	7.45	725	12.5°C	6 Gal.
12:10	7.13	775	12.2°C	12 Gal
12:15	7.04	780	12.2°C	18 Gal.

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM
(Continued)

SAMPLE CONTAINER	VOLUME	PRESERVATIVE/PREP.
(2) VOA, clear glass	40 ml	no
(3) SVOA, Amber glass	1 Liter	no
(2) Pest, PCB, Amber glass	1 Liter	no
(2) Metals, Plastic	1 Liter	HNO3
(1) CN, Glass, clear	1 Liter	NaOH

METALS SAMPLE FILTERED IN FIELD? YES ✓ NO ____

OBSERVATIONS: Cloudy, yel. gray. after 3 Gal

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: ~~9292~~ 0252

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: LO-1G01M-GW DATE: 5-6-91 TIME: [illegible]

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
TBT	ERM-NC	KM	Ebasco
BBM	ERM-NC		

WELL NUMBER: G-101M TOTAL DEPTH: 23.65 (ft) I.D.: 2 (in)

MATERIAL: Steel SCREENED INTERVAL: ____-____ (ft)

WATER LEVEL TO TOP OF CASING (ft)

PRE-PURGE: 4/24 15.31 ~~POST~~-PURGE: 5/6 [illegible] SAMPLING: _____

THICKNESS OF WATER COLUMN: _____(ft) CASING VOLUME: 1.4 (gal)

PURGING METHOD: _____ SAMPLING METHOD: Teflon bailer

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F)	Cumulative Volume (gal)
[illegible]	[illegible]	[illegible]	5/6 [illegible]	0
[illegible]	[illegible]	[illegible]	[illegible]	1.5
[illegible]	[illegible]	[illegible]	[illegible]	3.5
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	7.34	[illegible]	[illegible]	[illegible]

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM
(Continued)

SAMPLE CONTAINER	VOLUME	PRESERVATIVE/PREP.

METALS SAMPLE FILTERED IN FIELD? YES _____ NO _____

OBSERVATIONS: _____

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: ~~9292~~ 0252

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: LO-1G101L-SW DATE: 5-6-91 TIME: _____

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
JBT	EKU-NC	KM	Ebasco
BBM	ERM-NC		

WELL NUMBER: 5-101L TOTAL DEPTH: 34.35 (ft) I.D.: 2 (in)

MATERIAL: Steel SCREENED INTERVAL: ____-____ (ft)

WATER LEVEL TO TOP OF CASING (ft)

PRE-PURGE: 14.56 (5/21) ~~POST~~ PRE-PURGE: 15.53 (5/16) SAMPLING: _____

THICKNESS OF WATER COLUMN: _____(ft) CASING VOLUME: 3.2 (gal)

PURGING METHOD: _____ SAMPLING METHOD: Teflon

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg ~~F~~ C)	Cumulative Volume (gal)
[illegible]	8.12	[illegible]	[illegible] 29	[illegible]
[illegible]	7.65	[illegible]	9.3 [illegible]	3.5
[illegible]	7.54	[illegible]	9.5 [illegible]	[illegible]
[illegible]	[illegible]	[illegible]	9.0 [illegible]	—
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM
(Continued)

SAMPLE CONTAINER	VOLUME	PRESERVATIVE/PREP.
VOC vials - 2	40 mL	none
Semi volatiles - 3	1L amber	none
Pest [illegible] - 2	1L amber	none
Metals [illegible]	1/2 [illegible]	HNO_3 [illegible] → [illegible]
Cyanide	[illegible]	NaOH [illegible]
[illegible]	500 mL [illegible]	None

METALS SAMPLE FILTERED IN FIELD? YES _____ NO ✓

OBSERVATIONS: [illegible]

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: LO-1G101D-GW DATE: 5-6-91 TIME: [illegible]

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
JR	[illegible]	KM	[illegible]
KAH	[illegible]		

WELL NUMBER: [illegible] TOTAL DEPTH: 41.02 (ft) I.D.: 2 (in)

MATERIAL: Stee SCREENED INTERVAL: ___-___ (ft)

WATER LEVEL TO TOP OF CASING (ft)

4/24/91 5/6 [illegible]

PRE-PURGE: 14.44 ~~POST~~-PURGE: 15.02 SAMPLING: _____

THICKNESS OF WATER COLUMN: _____(ft) CASING VOLUME: [illegible] (gal)

PURGING METHOD: _____ SAMPLING METHOD: _____

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F)		Cumulative Volume (gal)
[illegible]	7.97	620	9.4	9.2	3 ([illegible])
[illegible]	7.53	[illegible]	[illegible]	[illegible]	4.5
[illegible]	7.21	[illegible]	10.5	10.2	[illegible]
[illegible]	7.03	[illegible]	[illegible]	[illegible]	13.5
[illegible]	7.13	[illegible]	[illegible]	[illegible]	17.[illegible]

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM
(Continued)

SAMPLE CONTAINER	VOLUME	PRESERVATIVE/PREP.

METALS SAMPLE FILTERED IN FIELD? YES _____ NO _____

OBSERVATIONS: [illegible]

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: LO-1G102L-GW DATE: 5/6/91 TIME: 12:05 RLL

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
RLL	ERM-N.C.		
VAH	ERM-N C		
BBM	ERM-NC		

WELL NUMBER: G102L TOTAL DEPTH: 6.35 (ft) I.D.: 2 (in)

MATERIAL: Stain Steel SCREENED INTERVAL: ___-___ (ft)

WATER LEVEL TO TOP OF CASING (ft)

PRE-PURGE: 7.77 POST-PURGE: _____ SAMPLING: _____

THICKNESS OF WATER COLUMN: 8.58 (ft) CASING VOLUME: 1.4 (gal)

PURGING METHOD: Teflon Bailer SAMPLING METHOD: Teflon Bailer

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F)	Cumulative Volume (gal)
12:00	6.70	1050	11°C	0
12:05	6.78	1100	9.8°C	1.5
12:08	6.95	1100	9.0°C	3.0
12:10	6.95	1100	9.0°C	4.5

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM
(Continued)

SAMPLE CONTAINER	VOLUME	PRESERVATIVE/PREP.
(2) Glass VOA	40 ML	No
(3) Amber Glass ~~Plastic~~ SVOA	1 L.	No
(1) Clear Glass CN	1 L.	No
(2) Plastic Metals	1 L.	~~NO~~ HNO_3
(2) Pest./PCB Amber Glass	1 L.	NO

METALS SAMPLE FILTERED IN FIELD? YES ✓ NO ___

OBSERVATIONS:

Rusty

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: LO-1G102D-G1 DATE: 6 May 1991 TIME: 12:55

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
BLL	ERM	K. Mc.	Ebasco
IAH	ERM		
BBM	ERM		

WELL NUMBER: G-102-D TOTAL DEPTH: 21.17 (ft) I.D.: 2 (in)

MATERIAL: Stain. Steel SCREENED INTERVAL: ___-___ (ft)

WATER LEVEL TO TOP OF CASING (ft)

PRE-PURGE: 8.73 POST-PURGE: _____ SAMPLING: _____

THICKNESS OF WATER COLUMN: 12.5 (ft) CASING VOLUME: 2.0 (gal)

PURGING METHOD: Teflon Bailer SAMPLING METHOD: Teflon Bailer

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F)	Cumulative Volume (gal)
12:35	7.30	1150	10°C	0
12:40	7.26	1190	9.2°C	2 Gal
12:45	7.16	1150	9.0°C	4 Gal
12:50	7.29	1150	9.0°C	5 Gal

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM
(Continued)

SAMPLE CONTAINER	VOLUME	PRESERVATIVE/PREP.
(2) VOA Glass	40 ML	No
(3) Amber Glass SVOA	1 Liter	No.
(2) Pest./PCB, Amb. Glass	1 Liter	No
(1) CN. clear Glass	1 Liter	NaOH ph 12+
(2) Plastic Metals	1 Liter	HNO_3

METALS SAMPLE FILTERED IN FIELD? YES ✓ NO ____

OBSERVATIONS: Bailed dry in 4 Gal., W.C. recovery to obtain sample

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: LO-1G104L-GW DATE: 5/7/91 TIME: Start 2:00 Finished 14:15

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
JRT	FRM-[illegible]		
PAH	FRM-[illegible]		

WELL NUMBER: G104L TOTAL DEPTH: 10.58 (ft) I.D.: 2 (in)

MATERIAL: STEEL SCREENED INTERVAL: ___-___ (ft)

WATER LEVEL TO TOP OF CASING (ft)

PRE-PURGE: 4/24 3.12 ~~POST~~ 5/7 PRE-PURGE: 3.45 SAMPLING: ___

THICKNESS OF WATER COLUMN: ___ (ft) CASING VOLUME: 1.2 (gal)

PURGING METHOD: ___ SAMPLING METHOD: Test [illegible]

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg ~~F~~ °C) SPC METER	pH METER	Cumulative Volume (gal)
11:09	6.96	3300	13.0	11.8	0
11:12	6.96	320	12.1	11.3	1.5
11:17	7.11	300	11.9	11.0	3.0 [illegible]

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM
(Continued)

[illegible] 12:00 - 12:30
[illegible] 14:15

SAMPLE CONTAINER	VOLUME	PRESERVATIVE/PREP.

METALS SAMPLE FILTERED IN FIELD? YES ____ NO /

OBSERVATIONS: [illegible]

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: LO-1G1040-SN DATE: 5/7/91 TIME: 11:45

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
JR	ERM-NC		
JAH	ERM-NC		

WELL NUMBER: G1040 TOTAL DEPTH: 16.40 (ft) I.D.: 2 (in)

MATERIAL: Steel SCREENED INTERVAL: ____-____ (ft)

WATER LEVEL TO TOP OF CASING (ft)

PRE-PURGE: 6.22 (4/24) ~~POST~~-PURGE: 6.92 (5/7 pre) SAMPLING: _____

THICKNESS OF WATER COLUMN: _____(ft) CASING VOLUME: 1.2 (gal)

PURGING METHOD: _____ SAMPLING METHOD: [illegible]

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F) SPC METER	Temperature (deg F) pH METER	Cumulative Volume (gal)
11:21	8.97	1020	12.0	10.6	0
11:24	9.52	980	10.8	10.1	2.0
11:27	8.39	1100	10.0	9.8	4.0
11:31	7.73	1190	10.0	10.1	6.0
11:35	7.54	1190	10.0	9.8	8.0
11:39	7.41	1220	10.8	9.7	9.0
11:42	7.41	1220	10.0	9.7	10.0

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM
(Continued)

SAMPLE CONTAINER	VOLUME	PRESERVATIVE/PREP.

METALS SAMPLE FILTERED IN FIELD? YES _____ NO ✓

OBSERVATIONS: RUSTY/RUSTY BROWN, [illegible]

_____

_____

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: [illegible] DATE: 5-7-91 TIME: _____

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		

WELL NUMBER: [illegible] TOTAL DEPTH: [illegible] (ft) I.D.: [illegible] (in)

MATERIAL: [illegible] SCREENED INTERVAL: ____-_____ (ft)

WATER LEVEL TO TOP OF CASING (ft)

_____

PRE-PURGE: 4/24 10:30 ~~POST~~-PURGE: 5/7 PRE- 11:41 SAMPLING: _____

THICKNESS OF WATER COLUMN: _____(ft) CASING VOLUME: [illegible] (gal)

PURGING METHOD: _____ SAMPLING METHOD: [illegible]

STABILIZATION TEST

_____

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F)	Cumulative Volume (gal)

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM
(Continued)

SAMPLE CONTAINER	VOLUME	PRESERVATIVE/PREP.
_____	_____	_____
_____	_____	_____
_____	_____	_____

METALS SAMPLE FILTERED IN FIELD? YES _____ NO ____

OBSERVATIONS: _____

_____

_____

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: G106S-WO DATE: 5/9/91 TIME: 9:50

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
[illegible]	ERM	Hang Wei Wang	Ebasco
Vic Hamer	↓		

WELL NUMBER: G106S TOTAL DEPTH: _____(ft) I.D.: 2" (in)

MATERIAL: #316 STAINLESS STEEL SCREENED INTERVAL: ____-_____ (ft)

WATER LEVEL TO TOP OF CASING (ft)

_____

PRE-PURGE: DRY 1/2 gal on 5/8/91 POST-PURGE: _____ SAMPLING: _____

THICKNESS OF WATER COLUMN: _____(ft) CASING VOLUME: _____(gal)

PURGING METHOD: BAILING SAMPLING METHOD: _____

STABILIZATION TEST

NONE

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F)	Cumulative Volume (gal)

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM
(Continued)

SAMPLE CONTAINER	VOLUME	PRESERVATIVE/PREP.
(2) 40ml VOA		
(1) 1l A/B/N, PEST/PCB		
(1) 1l METALS, CN-		

METALS SAMPLE FILTERED IN FIELD? YES ____ NO X

OBSERVATIONS: SHIPPED UNPRESERVED AS HIGH CONC. SAMPLE. SAMPLE IS OF WASTE OIL

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

LO-1G106 DR-MS/MSC

SAMPLE I.D.: LO-1G106DR-GW DATE: 5-7-91 TIME: 1[illegible]5

~~LO-1G106DR [illegible]~~

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
JBT	ERM-NC	HL	Ebasco
VAH	ERM-NC		

WELL NUMBER: [illegible] TOTAL DEPTH: [illegible] (ft) I.D.: 2 (in)

MATERIAL: Steel SCREENED INTERVAL: ___-___ (ft)

WATER LEVEL TO TOP OF CASING (ft)

PRE-PURGE: 9.71 (4/24) POST-PURGE: 10.28 (5/7) SAMPLING: ___

THICKNESS OF WATER COLUMN: ___ (ft) CASING VOLUME: 6.2 (gal)

PURGING METHOD: ___ SAMPLING METHOD: Dedicated Teflon Bailer

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg ~~F~~ °C) Spc Meter	PH Meter	Cumulative Volume (gal)
0945	7.41	1390	11.1	10.5	0 (initial)
0955	7.30	1380	10.9	10.5	6.5
[illegible]	[illegible]	1380	10.9	[illegible]	13.0
[illegible]	7.16	1350	[illegible]	[illegible]	19.5

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM
(Continued)

SAMPLE CONTAINER	VOLUME	PRESERVATIVE/PREP.
VOCs – [illegible]	40 mL – 2	None
[illegible] – Amber	1 L – 2	None
[illegible] – Amber	1 L – 2	None
[illegible] – Plastic	1/2 [illegible]	[illegible]
[illegible] – UVE [illegible]	1 L	[illegible]
[illegible] – Plastic	L	NaOH [illegible]

METALS SAMPLE FILTERED IN FIELD? YES _____ NO ✓ [illegible]

OBSERVATIONS: [illegible] + slightly brown

[illegible]

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

LO-1MW025-MS/MSD

SAMPLE I.D.: LO-1MW025-GW1 DATE: 8 May 1991 TIME: 10:45

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
RLL	ERM	K. HS	EBASCO
BBM	ERM		

WELL NUMBER: MW25 TOTAL DEPTH: 18.0 (ft) I.D.: 2 (in)

MATERIAL: Stain. Steel SCREENED INTERVAL: ___-___ (ft)

WATER LEVEL TO TOP OF CASING (ft)

PRE-PURGE: 7.80 POST-PURGE: _____ SAMPLING: _____

3V = 4.8 Gal.

THICKNESS OF WATER COLUMN: 10.20 (ft) CASING VOLUME: 1.6 (gal)

PURGING METHOD: Teflon Bailer SAMPLING METHOD: Teflon Bailer

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F)	Cumulative Volume (gal)
10:20	7.47	1075	12.2°C	0 Gal
10:25	7.27	900	11.0°C	2 Gal
10:30	7.22	950	11.0°C	4 Gal
10:33	7.13	1150	11.0°C	6 Gal
10:35	7.13	1125	11.0°C	8 Gal.

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM
(Continued)

SAMPLE CONTAINER	VOLUME	PRESERVATIVE/PREP.
(4) VOA Glass, Clear	40 ML	NO
(6) SVOA Amber Glass	1 Liter	NO
(2) Pest./PCB	1 Liter	NO
(2) Metals Plastic	1 Liter	HNO_3
(1) CN, Glass, clear	1 Liter	NaOH

METALS SAMPLE FILTERED IN FIELD? YES ✓ NO ____

OBSERVATIONS: Muddy, Vol.-Brown, Silty
Split w/EPA

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: LO-1MW02D-GW DATE: 7 May 1991 TIME: 14:30

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
BBH	ERM		
BBH	ERM		

WELL NUMBER: MW-02D TOTAL DEPTH: 43.5 (ft) I.D.: 2 (in)

MATERIAL: Stain. Steel SCREENED INTERVAL: ____-____ (ft)

WATER LEVEL TO TOP OF CASING (ft)

PRE-PURGE: 9.13 POST-PURGE: _____ SAMPLING: _____

THICKNESS OF WATER COLUMN: 34.37 (ft) CASING VOLUME: 5.5 (gal)

PURGING METHOD: Teflon Bailer SAMPLING METHOD: Teflon Bailer

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F)	Cumulative Volume (gal)
14:10	7.42	750	13.5°C	0 Gal.
14:15	7.13	750	13.0°C	5.5 Gal.
14:20	7.13	750	13.0°C	11.0 Gal.
14:25	7.05	750	12.5°C	16.5 Gal.

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM
(Continued)

SAMPLE CONTAINER	VOLUME	PRESERVATIVE/PREP.
_____	_____	_____
_____	_____	_____
_____	_____	_____

METALS SAMPLE FILTERED IN FIELD? YES _____ NO ____

OBSERVATIONS: _____

_____

_____

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

H(Nu = Ø Uppm

LO-GW1-FB-1500

SAMPLE I.D.: LO-1MW15-GW-1540 DATE: 5/6/91 TIME: 1540

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
JBT	ERM-NC		
VAH	ERM-NC		

WELL NUMBER: MW 15 TOTAL DEPTH: 18.30 (ft) I.D.: 2 (in)

MATERIAL: Steel SCREENED INTERVAL: ___-___ (ft)

WATER LEVEL TO TOP OF CASING (ft)

PRE-PURGE: 4/24 6.21 ~~POST~~ 5/6 pre PURGE: 6.78 SAMPLING: ___

THICKNESS OF WATER COLUMN: ___(ft) CASING VOLUME: 2.0 (gal)

PURGING METHOD: ___ SAMPLING METHOD: ___

STABILIZATION TEST

Time	pH	Conductance. (umhos/sq cm)	Temperature (deg F) Spec	Temperature (deg F) pH meter	Cumulative Volume (gal)
1527	7.04	1780	10.2	10.1	0
1531	7.10	1450	10.0	10.0	2
1534	7.05	1400	10.0	10.0	4
1537	7.02	1370	9.9	9.8	6

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM
(Continued)

SAMPLE CONTAINER	VOLUME	PRESERVATIVE/PREP.

METALS SAMPLE FILTERED IN FIELD? YES ____ NO ✓

OBSERVATIONS: very silty, turbid, lt. grey color

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

HNu 0 ppm

SAMPLE I.D.: LO-1MW1D-GW DATE: 5-6-91 TIME: 1650

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
JBT	ERM-NC		
VAH	ERM-NC		

WELL NUMBER: MW 1D TOTAL DEPTH: 48.14 (ft) I.D.: 2 (in)

MATERIAL: _____ SCREENED INTERVAL: ____-____ (ft)

WATER LEVEL TO TOP OF CASING (ft)

4/24 PRE-PURGE: 6.28 5/6/91 POST-PURGE: 7.84 SAMPLING: _____

THICKNESS OF WATER COLUMN: _____(ft) CASING VOLUME: 6.8 (gal)

PURGING METHOD: _____ SAMPLING METHOD: _____

STABILIZATION TEST

Time	pH	Conductance. (umhos/sq cm)	Temperature (deg F) SpC	Temperature (deg F) pH	Cumulative Volume (gal)
1613	10.84	580	10.0	10.0	0
1622	7.81	930	10.6	10.6	7
1630	7.50	980	10.9	10.8	14
1642	7.06	990	11.0	10.9	21
1646	7.10	990	11.1	11.1	25

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM
(Continued)

SAMPLE CONTAINER	VOLUME	PRESERVATIVE/PREP.

METALS SAMPLE FILTERED IN FIELD? YES _____ NO ____

OBSERVATIONS: _____

_____

_____

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: LO-1GW1-FB LO-1MW03S-GW DATE: 6 May 91 TIME: 16:45

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
RLL	ERM	K McC	EB&SCO
BBM	ERM		

WELL NUMBER: MW03S TOTAL DEPTH: 21.15 (ft) I.D.: 2" (in)

MATERIAL: Stain Steel SCREENED INTERVAL: ___-___ (ft)

WATER LEVEL TO TOP OF CASING (ft)

PRE-PURGE: 5:13 POST-PURGE: _____ SAMPLING: _____

THICKNESS OF WATER COLUMN: 16.02 (ft) CASING VOLUME: 2.52 (gal)

PURGING METHOD: Teflon Bailer SAMPLING METHOD: Teflon Bailer 7.5

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F)	Cumulative Volume (gal)
16:25	7.66	510	9°	0
16:30	7.53	450	9°	2½ Gal.
16:35	7.34	575	9°	5 Gal.
16:40	7.48	575	9°	7½ Gal.
16:45	7.42	600	9°	10 Gal.

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM
(Continued)

SAMPLE CONTAINER	VOLUME	PRESERVATIVE/PREP.
(4) VOA, glass, clear	40 ml	No
(6) SVOA, Amber, glass	1 Liter	No
(4) Pest/PCB, Amber, glass	1 Liter	No
(4) Metals, plastic	1 Liter	HNO_3 ph -2
(2) CN, glass, clear	1 Liter	NaOH ph 12+

METALS SAMPLE FILTERED IN FIELD? YES ✓ NO ___

OBSERVATIONS: H_2S = 0.0 ppm

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: LO-1MW03D-GW DATE: 6 May 91 TIME: 15:50

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
RLL	ERM	KHE	Elxsco
BBM	ERM		

WELL NUMBER: MW03D TOTAL DEPTH: 47.13 (ft) I.D.: 2 (in)

MATERIAL: Stain. Steel SCREENED INTERVAL: ___-___ (ft)

WATER LEVEL TO TOP OF CASING (ft)

PRE-PURGE: 4.78 POST-PURGE: _____ SAMPLING: _____

THICKNESS OF WATER COLUMN: 42.35 (ft) CASING VOLUME: 6.8 (gal) x 3 = 20

PURGING METHOD: Teflon Bailer SAMPLING METHOD: Teflon Bailer

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F)	Cumulative Volume (gal)
15:25	7.30	1000	9.5°C	0
15:30	7.14	900	10.0°C	7 Gal.
15:35	7.19	900	10.0°C	14 Gal.
15:40	7.10	1110	10.0°C	21 Gal.

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM
(Continued)

SAMPLE CONTAINER	VOLUME	PRESERVATIVE/PREP.
(2) VOAs, Glass	40 mL	No
(3) SVOAs, Amber Glass	1 Liter	No
(1) CN, Glass Clear	1 Liter	~~[illegible]~~ NaOH pH 12+
(2) Pest/PCBs, Amber Glass	1 Liter	HNO_3
(2) Metals, Plastic	2 Liter	

METALS SAMPLE FILTERED IN FIELD? YES ✓ NO ____

OBSERVATIONS: Hmu = 0.2 ppm

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

LO-1MW04S-FD
LO-1GW03-FB

SAMPLE I.D.: LO-1MW04S-GW DATE: 8 May 1991 TIME: 08:15 (GW 03 FB) 09:15 (MW04S) (FD)

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
RLL	ERM	H.W.G.	EBASCO
BBM	ERM	K. McC.	EBASCO

WELL NUMBER: MW04S TOTAL DEPTH: 18.6 (ft) I.D.: 2 (in)

MATERIAL: Stain. Steel SCREENED INTERVAL: ____-____ (ft)

WATER LEVEL TO TOP OF CASING (ft)

PRE-PURGE: 7.86 POST-PURGE: _____ SAMPLING: _____

THICKNESS OF WATER COLUMN: 10.74 (ft) CASING VOLUME: 1.7 (gal) Vol. x 3 = 5.1 Gal.

PURGING METHOD: Teflon Bailer SAMPLING METHOD: Teflon Bailer

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F)	Cumulative Volume (gal)
08:45	7.0	1800	12.0°C	0 Gal.
08:50	7.2	1925	11.0°C	1.75
08:55	7.45	2100	11.0°C	4.0
09:00	7.50	2125	11.0°C	6.0

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM
(Continued)

SAMPLE CONTAINER	VOLUME	PRESERVATIVE/PREP.
(6) VOA Glass Clear	40 ML	NC
(5) SVOA Amber Glass	1 Liter	NO
(6) Pest./PCB Amber Glass	1 Liter	NO
(6) Metals, plastic	1 Liter	HNO_3
(3) CN, Glass Clear	1 Liter	NaOH

METALS SAMPLE FILTERED IN FIELD? YES ✓ NO ____

OBSERVATIONS: 0 Gal - Blk. to Dk. Gry., Slight Fuel Oil Smell
Fuel Oil smell stronger, water darker
the more bailed

Split FB w/EPA
Split MWCAS & F.D. w/EPA

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: LO-1MW04D-GW DATE: 7 May 1991 TIME: 15:30

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
RLL	ERM		
BBM	ERM		

WELL NUMBER: MW04D TOTAL DEPTH: 45.7 (ft) I.D.: _____ (in)

MATERIAL: Stain. Steel SCREENED INTERVAL: ____-_____ (ft)

WATER LEVEL TO TOP OF CASING (ft)

_____

PRE-PURGE: 9.05 POST-PURGE: _____ SAMPLING: _____

THICKNESS OF WATER COLUMN: 36.65 (ft) CASING VOLUME: 5.8 (gal) 3 Vol. = 17.4 Gal.

PURGING METHOD: Teflon Bailer SAMPLING METHOD: Teflon Bailer

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F)	Cumulative Volume (gal)
15:15	7.29	800	14°C	0 Gal.
15:20	7.13	1050	14°C	6 Gal.
15:25	7.14	1050	14°C	12 Gal.
15:30	7.07	1000	13.5°C	18 Gal.

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM
(Continued)

SAMPLE CONTAINER	VOLUME	PRESERVATIVE/PREP.
(2) VOA Glass, Clear	40 ML	No
(3) SVOA Glass, Amber	1 Liter	No
(2) Pest./PCB Glass Amber	1 Liter	No
(2) Metals, plastic	1 Liter	HNO_3
(1) CN, Glass clear	1 Liter	NaOH

METALS SAMPLE FILTERED IN FIELD? YES ✓ NO ____

OBSERVATIONS: _____

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

LO-1MW055-FD

SAMPLE I.D.: LO-1MW055-GW DATE: 7 May 1991 TIME: 09:30

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
RLL	ERM	H.W.H.	EBASCO
BBM	ERM		

WELL NUMBER: MW055 TOTAL DEPTH: 22.2 (ft) I.D.: 2 (in)

MATERIAL: Stain. Steel SCREENED INTERVAL: ___-___ (ft)

WATER LEVEL TO TOP OF CASING (ft)

PRE-PURGE: ±9 Ft. POST-PURGE: _____ SAMPLING: _____

THICKNESS OF WATER COLUMN: 12.2 (ft) CASING VOLUME: 2 (gal)

PURGING METHOD: Teflon Bailer SAMPLING METHOD: Teflon Bailer

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F)	Cumulative Volume (gal)
09:05	6.68	890	12.2°C	0*
09:10	6.81	1000	11.0°C RLL	2 Gal.*
09:15	6.95	1150	11.0°C	4 Gal.*
09:20	6.99	1120	10.8°C	6 Gal.*

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM
(Continued)

SAMPLE CONTAINER	VOLUME	PRESERVATIVE/PREP.
(4) 40 ml clear glass VOA		
(2) SVOA amber glass	40 ml / 1 liter	No / No
(4) Pest. / PCB amber glass	1 liter	
(1) Plastic metals	1 liter	HNO_3
(2) C.N. clear glass	1 liter	NaOH

METALS SAMPLE FILTERED IN FIELD? YES ✓ NO ___

OBSERVATIONS: SWL - ±9 Ft., layer of oil on water surface, cannot get accurate Top

* 0 Gal. - Strong fuel oil smell, free product on water surface, water is murky
* 2 Gal. - As above, not as bad
* 4 Gal. - As above
* 6 Gal. - As above

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM
(Continued)

SAMPLE CONTAINER	VOLUME	PRESERVATIVE/PREP.
(2) VOA, Glass, Clear	40 ML	No
(3) SVOA, Glass Amber	1 Liter	No
(2) Pest./PCB Glass Amber	1 Liter	No
(2) Metals, Plastic	1 Liter	HNO3
(1) CN, Glass, Clear	1 Liter	NaOH

METALS SAMPLE FILTERED IN FIELD? YES ✓ NO ____

OBSERVATIONS: Clear 0-7 Gal., murky pale-gray after

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM
(Continued)

SAMPLE CONTAINER	VOLUME	PRESERVATIVE/PREP.

METALS SAMPLE FILTERED IN FIELD? YES _____ NO ____

OBSERVATIONS: _____