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GROUND WATER/HAZARDOUS WASTE
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A Report Prepared for:

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HYDROGEOLOGIC CHARACTERIZATION AND REMEDIAL INVESTIGATION
SPARTON TECHNOLOGY, INC.
9261 COORS ROAD, NORTHWEST
ALBUQUERQUE, NEW MEXICO

HLA Job No. 6310,013.12

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I INTRODUCTION

This report presents the work performed by Harding Lawson Associates (HLA) for the SPARTON Technology, Inc. manufacturing facility located at Coors Boulevard, Albuquerque, New Mexico. In this report, we have incorporated data from previous work phases conducted by HLA at the site.

The purpose of this report is to provide SPARTON with additional understanding of the hydrogeologic conditions at the plant site, to categorize the extent and rate of migration of dissolved volatile organics and metals in the ground water, and to determine the concentration of organics and metals in soil near a suspected contamination source.

HLA performed a review of existing data, reports, and files relevant to the above purpose. Field work for this phase of the project included drilling and installation of six monitoring wells and one production well, collecting soil and water samples for organic and metal analyses, water level monitoring, and conducting both a pump test and an infiltration test to evaluate the hydrogeologic framework.

This report includes appendices which describe in detail the operating procedures and methods used during the field work and for data analyses. The main text therefore contains only data and interpretation obtained during this work phase. The reader is referred to these appendices to obtain specific methodology.

II FIELD WORK

A. Drilling, Well Construction and Development

Six monitor wells (MW-12 through MW-17) and one production well (PW-1) were installed during this phase of work. Wells were installed using both rotary wash (mud-rotary) and hollow-stem auger drilling methods. Appendices A and B detail the methodologies used for the drilling program. The locations of all existing and new wells are shown on Figure 1.

B. Well MW-12

Well MW-12 was drilled approximately 50 feet northeast of MW-9. The well site was selected to collect formation samples for the design of the production well, to obtain a water sample representative of the ground water in the vicinity of the planned production well, and to monitor water level response during the pumping test.

A hollow-stem auger drilling rig was used to drill to a depth of 70 feet below grade. Continuous sampling with the 5-foot core barrel was conducted from 50 to 70 feet. Flowing sand conditions and large gravels in the borehole slowed the drilling rate and the remainder of the boring was completed with a mud-rotary drilling rig. Soils were classified from split-spoon samples taken at selected depths in conjunction with a description of the drill cuttings. Figures 2A and 2B are a log of the materials penetrated and the well construction details for MW-12.

The boring encountered fine to medium grain sand from 0 to 39 feet. A dense fine layer was present from 39 to 40 feet which overlaid a 5-foot section of coarse gravel and cobbles. The coarse material appeared to be a terrace-type deposit consisting of sub-rounded, flat granite cobbles 2 inches in diameter.

Drive samples from 50 to 70 feet indicated a well graded sand with small percentages of gravel and silt. The soils increased in moisture content at 60 feet and the auger rig encountered flowing (saturated) sand conditions below 65 feet.

Split-spoon samples obtained by the mud-rotary rig showed that a 4-foot thick layer of dense brown, fine silty sand is present from 74 to 78 feet. A sample obtained from the 75- to 77-foot depth was submitted to HLA's soil laboratory for sieve analysis. Figure 3 is a grain size distribution graph showing the material as a very fine sand with about 25 percent fines.

The materials from 80 to 135 feet are a well-graded sand with little or no fines. Figure 3 also includes the grain size analyses conducted by Rodgers & Company of samples taken from 60 to 70 and from 80 to 135 feet for the design of the well screen. The sand has a median grain size of greater than 0.6 millimeters, which is about three times larger than the median grain size of the silty sand layer of 74 to 78 feet. The silty sand layer had over 25 percent silt and clay size particles while the sand had no appreciable quantity of fine materials.

A layer of fine-grained material was encountered at a depth of 138 feet. A split-spoon sample collected from 139 to 140 foot interval contained 4 inches of silty clay above a dense brown silt having a small percentage of clay.

A 4-inch-diameter PVC threaded and flush-jointed well was constructed in the borehole with 69 feet of well screen. The screen with a slot size of 0.020 inches was installed at a depth of 64 to 133 feet. Centralizers were placed around the screen to keep the well in the center of the boring. Solid 4-inch-diameter casing extended from the top of the screen to ground surface. Specially-graded sand (Grade No. 10 x 20; see Appendix A) was placed in the annular space to 60 feet. A 2-foot bentonite pellet layer was placed above the sand and the remainder of the annular space was pressure grouted with a neat grout and bentonite mixture. The well was finished below grade with a drive over box and locking cap. The elevation of the top of casing was surveyed into mean sea level datum. The information is listed at the end of this chapter in Section J.

The well was developed for two hours with an air compressor. The flow rate at the end of development was estimated at 30 to 40 gallons per minute (gpm). Following development, a 1/2 horsepower submersible pump was lowered 100 feet below top of casing and the well was pumped for 60 minutes at 5 gpm. The flow rate was then reduced to 1 gpm and samples were obtained for organic and metal analyses using the sampling protocol in Appendix C. All water from development and sampling was discharged to the municipal sanitary sewer. The volatile organic samples were placed in 40 milliliter teflon-sealed vials with no head space and a two liter sample was taken for metal analyses. All samples were immediately iced and delivered to Rocky Mountain Analytical Laboratory (RMA), Arvada, Colorado by overnight delivery. Section III C. discusses the results of the analytical work.

C. Well MW-13

This monitoring well is located next to the south property line, about 200 feet west of MW-8 (Figure 1). The purpose of this boring was to determine the stratigraphy of the subsurface between wells MW-8 and MW-9 and for use as an observation well and a sampling location during later portions of this field work. An 8-inch diameter boring was drilled using mud-rotary techniques. The geologic log and well construction details are shown in Figures 4A and 4B.

The upper 66 feet of the boring consisted of sands and gravels, with two layers of fine-grained material from 30 to 44 feet and from 54 to 56 feet. A dense, silty clay layer with a small quantity of fine sand was noted from 66 to 71. A split-spoon sample was pushed into this material, but no recovery of the soil was obtained. Beneath this layer, a fine sandy silt layer was present from 70 to 80 feet.

Sand was noted from 80 to 86 feet, which changed to silty sand from 86 to 90 feet. A sandy silt was penetrated from 90 to 105 feet and a coarse gravelly sand was present from 105 to 135 feet. This gravelly sand material had similar drilling and textural properties as was noted during the drilling from 80 to 138 feet in MW-12.

A fine-grained layer was present in the bottom of MW-13, and a split-spoon sample of the material was taken at 140 feet. The soil was a fine sandy silt with a trace of clay. The sample was very dense.

A 2-inch diameter threaded and flush-jointed PVC well was constructed in the boring with 79.5 feet of 0.020-inch slot screen placed from 60 to 139.5 feet. The annular space around the well screen was packed with 10 x 20 sand up to 58 feet. Two feet of bentonite pellets were placed above the sand pack and the remainder of the annular space was filled with a neat grout and bentonite slurry. The well construction was completed by cementing a 6-inch diameter steel protector pipe with a locking cap around the PVC well.

The well was developed with air for two hours. The average withdrawal rate of water was 6 gpm. All water was discharged to the municipal sanitary sewer.

D. Well MW-14

This well, located in the southwestern corner of the SPARTON property (Figure 1), was used as an observation point for water level measurements, water sample collection, and to obtain subsurface information from that portion of the site. An 8-inch boring was drilled using rotary wash techniques. Figures 5A and 5B shows the log of subsurface material and well construction.

A coarse sand and gravel layer was present from 40 to 127 feet separated by a 2-foot layer of fine silty sand from 69 to 71 feet. A dense, silty clay layer was encountered at 127 to 130 feet. Split-spoon samples show that the material from both layers was very dense and nonplastic.

A 2-inch-diameter threaded and flush-jointed PVC monitoring well was constructed with 66 feet of 0.020 slot well screen from 61 to 127 feet. Graded 10 x 20 sand was placed in the annular space from 58 to 130 feet. The remainder at the annular space was sealed with a 2-foot layer of bentonite pellets, followed by neat grout with bentonite. The well was finished by cementing a 6-inch diameter steel protector pipe with a locking cap.

The well was developed with air for a period of two hours with a yield of 5 gpm. All water was discharged to the municipal sanitary sewer.

E. MW-15

An 8-inch boring was drilled by rotary wash technique at the western border of the plant property (Figure 1). Data obtained from this boring, along with the information derived from MW-14, were used to develop a better understanding of the hydrogeology on the western site of the property. Figures 6A and 6B are a log of the sub-surface materials and well construction details.

The top 39 feet of the boring consisted of a fine silty sand with a small percentage of clay. Beneath this material was a coarse gravel layer to 70 feet. A fine-grained layer was encountered from 70 to 77 feet. A soil sample from 70 to 71.5 feet showed a fine silty sand with a small percentage of clay. A 3-foot gravel layer was present from 77 to 80 feet. Beneath the gravel layer the formation alternated from coarse sand and gravel to fine-grained soils in approximately 10-foot layers. A dense clay was encountered at 125 feet. Drilling was continued to 130 feet where a split-spoon sample was to have been taken. However, the formation changed to sand and gravel, and the sample was not obtained. Drilling continued to a total depth of 140 feet.

The clay layer breached from 125 to 130 feet may separate a lower aquifer. To assure that ground-water flow would not occur through the boring, the bottom was filled with sand to 130 feet, and a 2-foot layer of bentonite pellets were placed in the boring opposite the clay layer prior to well construction.

MW-15 was constructed using 2-inch-threaded and flush-jointed PVC with 64.5 feet of 0.020-slot well screen from 60 to 124.5 feet. The sand pack extended from 55 to 128 feet and consisted of 10 x 20 sand. The remainder of the annular space was sealed with a 2-foot layer of bentonite followed by a neat grout with bentonite. A 6-inch steel protector pipe with locking cap was cemented into place.

The well was developed with air for two hours. The average yield of the well was 6 gpm. All water from the development was discharged to the municipal sanitary sewer.

F. MW-16

This boring is located in the fenced area adjacent to the two lined lagoons and is about 5 feet east from MW-1 (Figure 1). The boring was drilled using hollow-stem auger methods. Sampling with a 5-foot internal core barrel was used to a total depth of 73 feet.

The purpose of this boring was to obtain a series of soil samples for analytical analyses of total metals. Soil samples were also screened for organic vapor concentration using a photo-ionization detector (PID) meter manufactured by HNU Corporation (Model 101 with 11.7 eV lamp). The PID was calibrated to benzene vapors and was also used to continuously monitor the ambient atmosphere in the work area for health and safety purposes. Figure 7 is a log of the subsurface material encountered and the well construction details.

The boring penetrated brown, well-graded sand to 30 feet, where a 5-foot dense layer of clay was encountered. Beneath the clay layer coarse sand was present to 70 feet with a stiff clay layer located at 53 to 55 feet. Flowing sand conditions were encountered below 70 feet, causing sand to enter the augers after the core barrel was removed. Data regarding organic vapor concentration and metal concentration are included in Section III D.

A monitoring well was installed in the boring using 2-inch-diameter threaded and flush-jointed PVC casing and screen. Five feet of 0.020-inch slot well screen was installed from 68 to 73 feet. The annular space surrounding the well screen was allowed to collapse from 58 to 73 feet. Thick bentonite slurry was placed from 14 to 58 feet, and a neat cement grout was set from 0 to 14 feet. The well was finished with a 6-inch steel protector pipe with a locking cap.

The well was developed by bailing sand and water from the well for approximately two hours. The well yield was less than 0.5 gpm. All water was placed into the lined lagoons.

G. MW-17

Boring MW-17 is located approximately 55 feet north of the eastern lined lagoon (Figure 1). This boring was originally located adjacent to MW-3, but was moved when New Mexico Environmental Improvement Division (NMEID) personnel expressed reservations about conducting an infiltration test adjacent to the lined lagoons. The purpose of this well was to monitor water level fluctuation during the infiltration test. The boring was drilled similarly to MW-16, using a hollow-stem auger with a 5-foot internal core barrel. Figure 8 shows the well construction and subsurface materials encountered during drilling.

The top 40 feet of the boring encountered well-graded sand with a few thin fine-grained layers. Fine-grained clayey sand was noted from 40 to 45 feet, with clayey sandy silt from 45 to 50 feet, and coarse sand was penetrated from 50 to 55 feet. A dense clay layer was present from 55 to 60 feet. Coarse sand and gravelly sand was found to 72 feet where flowing sand conditions were encountered.

A 2-inch-diameter threaded and flush-jointed monitoring well was installed with a 5-foot well screen (0.020-slot) from 67 to 72 feet. The borehole was allowed to collapse from 63 to 72 feet. The annular space was filled with a thick bentonite slurry from 20 to 63 feet, with neat grout from 0 to 20 feet. A steel protector pipe was then cemented over the PVC well casing.

The well was developed by bailing for approximately two hours. The yield during development was less then 0.5 gpm. Water was discharged to the lined ponds.

H. PW-1

A production well was drilled approximately 8 feet east of MW-9 (Figure 1). The immediate purpose of this well was to conduct a pump test to evaluate the hydrogeologic properties of the aquifer beneath the site. The well was drilled with a 16-inch drill bit and with 47 feet of stabilizers, using rotary wash techniques. The well depth and screen design were based upon the samples obtained from MW-12. Figures 9A and 9B shows the materials encountered during drilling and the well construction.

The materials encountered during the drilling were similar in texture and stratigraphy as was noted in MW-12. A fine-grained layer was present in the boring from about 70 to 80 feet which corresponds to the upper silty sand layer present from 74 to 78 feet in MW-12. A second fine-grained layer was encountered at about 135 feet. The drill cuttings continued to increase in silt and clay content to the bottom of the boring at 145 feet. Original plans were to drill to 140 feet, but the boring was extended an additional 5 feet to allow an ample sump for any cuttings which may not have been removed from the boring. This allowed the driller to use a much thinner drilling fluid which aided in well development.

A 10-inch diameter threaded and flush-jointed PVC well casing and screen was installed in the boring to a total depth of 138 feet. Two intervals are screened: from 60 to 70 feet to collect ground water from above the upper silty sand layer; and from 80 to 138 feet to allow the well to be open opposite the coarse sand and gravel below the upper fine-grained layer. The well screen has slot openings of 0.045 inches, based on the grain size analyses from MW-12.

Three sets of centralizers were used to allow the uniform placement of 66 - 100 pounds bags of 8 x 16 gravel around the well screen from the bottom of the boring to 55 feet. Bentonite pellets were placed from 53 to 55 feet and a neat grout with bentonite was pumped into the annular space from 53 feet to grade. The well was completed by cementing a 14-inch steel protector pipe with locking cap over the PVC well casing.

Well development was conducted with the drill rig's air compressor. The initial withdrawal rate was 60 gpm, but after about 90 minutes, the rate was 100 gpm. Development continued for a total of 4 hours 15 minutes until the well produced water with little to no sediment or turbidity. All water was discharged to the municipal sanitary sewer.

I. Infiltration Gallery

An 8-foot-long by 0.88 foot by 4-foot-deep infiltration gallery was installed with a backhoe 4 feet south of MW-17 (Figure 1). The open area of the bottom of the gallery was 7 $feet^2$. The gallery consisted of a wooden box with an open bottom filled with 3 feet of 1.5-inch gravel to ensure integrity and stop erosion during the test. As mentioned earlier, the intended location of the gallery was originally adjacent to MW-16, but was relocated because of concerns expressed by NMEID.

The purpose of the gallery was to conduct a pilot scale infiltration test to determine the capability of the subsurface to receive infiltration. A test of this scale (as opposed to a small test with an infiltrometer) was used to give a much more accurate depiction of the infiltration characteristics of the subsurface.

J. Well Data Summary

Table 1 lists the top of casing elevation and screened interval below grade for the seven wells. The elevation data were obtained from Denny-Gross & Associates, Inc., registered surveyors from Alburquerque, New Mexico. The top of casing data listed are actually the elevation of the top of a flat 3/8-inch-thick bar laid across the top of the steel protector pipe. All water level measurements were obtained using the top of the bar as the reference point.

TABLE 1

WELL COMPLETION SUMMARY

SPARTON TECHNOLOGY, INC.

ALBUQUERQUE, NEW MEXICO

Well	Top of Casing Feet MSL	Screened Interval Feet Below Grade
MW-12	5041.81	64-133
MW-13	5043.35	60-139.5
MW-14	5041.94	61-127
MW-15	5047.51	60-124.5
MW-16	5047.53	68-73
MW-17	5049.30	67-72
PW-1	5043.89	60-70; 80-138

III HYDROGEOLOGIC FRAMEWORK

A. Geologic Conditions

Based upon the results of previous field investigation and the data obtained from these borings, a conceptual three-dimensional hydrogeologic framework has been developed for the SPARTON site. In general, the plant is located on unconsolidated sand and gravel deposits with occasional fine-grained layers of silt and clay located at specific depths. The stratigraphy of these deposits is characteristic of valley-fill alluvium and colluvium of the unconsolidated aquifer in the Rio Grande Valley. The flat, subrounded gravels are indicative of a meandering stream, which deposited sand and gravel in the main channel, and fine-grained sediments on a relatively broad flood plain. Some of these fine-grained layers appear to be found almost continuously beneath the site; the impact of these layers are discussed in this section.

The subsurface conditions can be most easily understood by constructing cross-sections using the geologic information gathered during this and the previous phases of site work. These crosssections are necessarily interpretive, and are therefore subject to change based upon future data acquisition and analysis.

Figure 10 is cross-section A-A' (shown in Figure 1) which shows the interpreted geologic conditions beneath the center of the plant site in a northeast-southwest direction. The boring information from MW-1, 2, 3, 4, 9, 10, 11, 12, 16, 17 and PW-1 is projected onto this cross-section.

The unsaturated zone consists mainly of sand, silty sand, and sandy gravel, with an occasional silt and clay lenses. No data are available to suggest that any of these fine-grained layers are continuous in the unsaturated zone.

Two fine-grained layers are suspected to be present almost continuously beneath the site in this cross-section. A layer, alternately described as silty sand or clayey silt, is present between elevation 4965 to 4975 feet in boring MW-9, 10, 11, 12 and PW-1. MW-16 and 17 were not drilled to this depth. MW-2, 3, and 4 were not logged as having encountered this material, however split-spoon samples were not obtained during drilling of these wells.

The second fine-grained layer is present at about elevation 4900 feet and consists of dense fine sands, silts and clays. The thickness and areal extent of this layer is presently unknown, but the log of MW-10 showed a 1-foot thick clay layer at that depth. Wells MW-9, 16, and 17 are screened above the upper fine-grained layer, while MW-1, 2, 3, 4, 12 and PW-1 are screened above and below that layer. MW-10 and 11 are screened at or below the lower fine-grained layer.

Figure 11 shows the interpretive cross-section B-B' along the southern property boundary of the plant (Figure 1) and contains data projected from MW-8, 9, 12, 13, 14 and PW-1. This view shows that both of the fine-grained units are probably continuous at this location and gives added indications that these units may be continuous beneath the plant site. Wells MW-8 and 9 are screened above the upper fine-grained layer, while the remainder of the wells are screened above and below.

Boring MW-13 encountered additional fine-grained layers both above and below the water table. The 20-foot thickness of this material below the water table could reduce the transmissivity of the aquifer between the two fine-grained layers which appear to be continuous beneath the site.

Figure 12 shows geologic cross-section C-C' which includes data projected from MW-5, 14, 15, and P-1 (Figure 1). The upper fine-grained layer is present in all boring logs except for P-1 from which split-spoon samples were not collected. Boring MW-15 apparently drilled through the lower fine-grained layer from 4915 to 4920 feet.

That layer consisted of a dense clay which abruptly changed to gravelly sand at 4915 feet. The boring was sealed with a bentonite plug in this interval to assure that no possible migration pathway remained into the sediments beneath the lower fine-grain layer.

The log of MW-15 is similar to MW-13 in that the aquifer between the fine-grained layers contains units of clays and silty sands which may reduce the transmissivity in this area.

In summary, the subsurface at the SPARTON site can be divided into a series of sand and gravel units separated by fine-grained layers. The upper unit extends from the land surface to approximately 70 feet below grade where the upper fine-grained layer was found to be present in all of the borings during this phase of drilling and was noticed in most of the logs from previous field investigations which did not have as vigorous a sampling plan. Ground water is present above this upper fine-grained layer, causing a 5- to 10- foot thickness of saturated sands and gravels above that layer.

A second sand and gravel unit is generally found at elevation 4910 to 4970 feet. This layer generally consists of coarse sand and gravel beneath the water table, although MW-13 and 15 intersected a series of silts and clays between the two fine-grained layers. A second fine-grained layer appears to be present beneath the site at elevation 4910 to 4900 feet, which may act to separate the lower aquifer from deeper sand and gravel units.

B. Ground-Water Conditions

Ground water was encountered in all of the borings at about 60 to 70 feet below grade. Wells were screened at different intervals throughout the phases of field work at this site, so all water level data must be carefully interpreted in order to develop the most representative concept of the ground-water flow regime of the site.

The upper fine-grained layer appears to divide the sediments into two aquifers: a relatively thin unconfined aquifer at about elevation 4970 to 4980 feet; and a lower aquifer that is present from 4910 to 4970 feet. The integrity of the upper fine-grained layer is not totally known, but based upon this last phase of field work, it appears to be sufficiently continous beneath the site to cause a head difference between the aquifers. Also, chemistry data and results of the aquifer test suggest that the upper unit acts as a semi-confining unit, restricting vertical ground-water flow. These last two topics are discussed in more detail in subsequent sections.

Figure 13 is a cross-section of the ground-water conditions at the SPARTON site. The section was taken through A-A' which is shown on Figure 1. The contour map was constructed using the head data in all wells. The mid-point of the screen was used as the reference elevation corresponding to head measurements for the wells in which large thicknesses of the aquifer were monitored. The contours on the crosssection show an apparent downward vertical gradient with up to 4.0 feet of head difference present between adjacent wells MW-16 and MW-11. The downward vertical gradient present on-site complicates the determination of the horizontal flow gradients since the monitoring wells were completed at different elevations and in both aquifers. We interpolated and extrapolated water-level measurements taken for this study, adjusting the levels to what the piezometric elevation is anticipated to be in the upper and lower aquifers, allowing for the vertical gradient.

Figure 14 is a contour map of the water-table elevations of the upper aquifer. The direction of flow is towards the southwest. An anomoly on this map is the apparent low gradient from MW-6 to MW-8. The gradient beneath the plant site of 0.006 is roughly four times as steep as the gradient along the eastern property boundary. The reason for this difference is presently unknown.

Figure 15 shows the piezometric head data for the lower aquifer on the SPARTON site. As mentioned earlier, construction of this map required the interpretation of the water levels taken throughout the plant site. The horizontal gradient in the lower aquifer is about 0.005 toward the west. The gradient of the lower aquifer's piezometric head is less than the gradient of the overlying water table aquifer. The difference in gradients may be due to leakage or changes in the thickness of the upper aquifer.

C. Ground Water Chemistry

This section includes the analyses of water samples taken during this phase of field work. Water samples have been taken from all monitoring wells and PW-1. All analytical work for this phase has been conducted by Rocky Mountain Analytical Laboratory (RMA), Arvada, Colorado. Water samples collected during this phase of work were obtained according to the Ground-Water Sampling and Analytical Protocol attached as Appendix C. All water obtained during well purging was discharged to the sanitary sewer, which was arranged and authorized through SPARTON personnel.

Water samples were taken in MW-12 in order to obtain preliminary chemical data of the anticipated water quality for discharge into the sanitary sewer. PW-1 was sampled four times during the pumping test to determine if any chemical trends could be identified. Water samples were taken before and after the infiltration test from MW-16 and MW-17 to determine the effects of the vadose zone flushing on ground water chemical constituents. The remainder of the new monitoring wells were sampled to augment and update our information about the areal chemical character of the ground water.

Previous ground-water sampling at the SPARTON site has shown the presence of high concentrations of volatile organic chemicals (VOC) in wells MW-1, 3, and 9 with some VOC constituents found in all of the monitoring well samples. The concentrations of VOCs are greatest from the samples from the wells that are screened above the upper fine-grained layer, as evidenced by the chemical results from MW-9, which is about 500 feet from the suspected contamination source. Wells MW-10 and 11, which are screened at or below the lower fine-grained layer, have shown much lower concentrations. These two wells were not sealed below the water table to prevent downward leakage from the water table to the screened area, so the results from these two wells may not be indicative of ground-water quality at that depth.

Previous sampling of MW-1 through 11 showed high concentrations of boron, chromium, manganese, and nickel. Wells with the highest concentrations were in MW-1, 3, and 9, although manganese was the only one of these metals analyzed in MW-9.

Table 2 lists all of the chemical analyses compiled from the new wells installed during this phase of work. Results of the subs quent sampling in November 1984 are in Appendix C. The concentrations of metals and VOCs were greatest in MW-16, which obtained ground water from above the upper fine-grained layer in the area immediately adjacent to the suspected contamination source. High concentrations of VOCs and metals were also found in MW-14, and 15, on the west side of the plant site. The lowest levels of contaminants were found in the samples from MW-12 and PW-1. Samples for metals analysis were not filtered in the field rior to acidification during this phase of work. Therefore the chemical results re resent total metals instead of dissolved metals.

A comparison of the trichloroethylene, Total Organic Carbon, and Specific Conductance re ults from this work phase and subsequent sampling during November 1984 is shown in Table 3. Trichloroethylene was selected because it is a volatile organic constituent which as been detected in all wells. The highest concentration of trichloroethylene is found in MW-3, with 59,000 ug/l of the organic constituent. The lowest trichloroethylene concentrations are found in MW-5, 6, 8, 10, 12, and PW-1. Trichloroethylene was not detected in MW-11. TOC concentration is highest in MW-3. The highest specific conductance value was found in MW-16, with MW-1, 3, and 9 also exhibiting elevated results. The lowest values were found in MW-2, 5, 7, 8, 10, 11, and 17. A comparison of results in MW-9, 12,

TABLE 2
SPARTON TECHNOLOGY, INC.
ALBUQUERQUE, NEW MEXICO
ANALYTICAL RESULTS OF GROUNDWATER SAMPLES

PARAMETERS	UNITS	DETECTION LIMITS	MW-12 8/29/84	MW-13 10/4/84	MW-14 10/4/84	MW-15 10/4/84	MW-16 10/5/84	MW-16 10/10/84	MW-17 10/5/84	MW 17 10/10/84	PW-1 10/7/84	PW-1 10/8/84	PW-1 10/8/84	PW-1 10/8/84
pH	units	0.01	7.65	7.43	7.61	7.68	7.17	7.30	7.90	7.94	8.03	7.86	7.85	7.82
Specific Conductance	umhos/cm	1	769	1090	1290	885	5300	5960	695	748	801	791	789	798
Fluoride	mg/l	0.1	0.3	1.1	0.8	0.8	7.9	6.9	1.5	1.4	0.8			0.7
Nitrate as N	mg/l	0.1	1.3	0.6	1.0	4.4	ND	ND	ND	0.2	0.7			0.8
Sulfate	mg/l	5	136	148	192	146	2180	2320	98	102	130			130
Total Organic Carbon	mg/l	0.1	1.7	5.2	5.9	2.7	54	71	5.1	4.8	3.8	5.8	3.5	6.0
Total Organic Halogen	ugCl-/l	5	74	3600	3700	1100	15000	25000	3100	2500	380	240	210	210
Total Kjeldahl Nitrogen	N mg/l	0.1		3.1	1.0	0.5	310	380	1.5	1.0	0.6			0.3
Hexavalent Chromium	mg/l	0.01	ND	ND	0.60	ND	ND	0.01	ND	ND	ND			0.01
Phenolics	mg/l	0.01	ND	0.01	ND	ND	0.04	0.04	ND	ND	ND			ND
Total Boron	mg/l	0.004	0.12	2.6	2.0	0.16	14	20	0.19	0.18	0.18			0.16
Total Cadmium	mg/l	0.002	0.005	0.003	ND	ND	0.003	0.012	0.013	0.006	ND			ND
Total Chromium	mg/l	0.005	ND	0.038	0.58	ND	0.75	2.3	0.27	0.092	ND			ND
Total Manganese	mg/l	0.005	0.98	2.0	0.76	0.060	17	25	4.1	2.7	1.1			1.1
Total Nickel	mg/l	0.01	ND	0.04	0.04	ND	0.40	0.68	0.11	0.05	ND			ND
Total Sodium	mg/l	0.5	54	79	77	54	200	266	69	56	56			54
Benzene	ug/l	5	ND	ND	9	ND	58	56	ND	6	ND			ND
Chlorobenzene	ug/l	5	ND	ND	ND	ND	16	17	ND	ND	ND			ND
Chloroethane	ug/l	10	ND	ND	ND	ND	45	27	ND	ND	ND			ND
Chloroform	ug/l	5	ND	15	34	ND	25	33	ND	ND	ND			ND
1,1-Dichloroethane	ug/l	5	ND	13	17	ND	3200	2700	1900	2100	ND			ND
1,2-Dichloroethane	ug/l	5	ND	ND	ND	ND	ND	ND	ND	ND	ND			ND
1,1-Dichloroethylene	ug/l	5	ND	820	1000	85	3100	3700	260	460	13	16	12	9
Ethylbenzene	ug/l	5	ND	ND	ND	ND	63	53	ND	ND	ND			ND
Methylchoride	ug/l	10	20	ND	ND	ND	70	23	ND	ND	ND			ND
Methylene chloride	ug/l	10	ND	1700	3600	11	49000	51000	17	66	330			170
Tetrachloroethylene	ug/l	5	ND	17	25	34	140	140	53	77	ND			ND
Toluene	ug/l	5	ND	45	6	ND	1600	1400	50	32	ND			ND
1,2-trans-Dichloroethylene	ug/l	5	ND	ND	ND	ND	200	140	19	21	ND			ND
1,1,1-Trichloroethane	ug/l	5	ND	4600	4100	2200	5500	6700	2300	2900	31			21
Trichloroethylene	ug/l	5	61	6900	12000	4400	37000	38000	4300	6200	200	150	110	130
Acetone	ug/l	10	ND	ND	ND	17000	22000	28	53	ND	ND			ND
Meta-xylene	ug/l	5	ND	ND	ND	ND	42	32	ND	ND	ND			ND
Ortho, Para-xylene	ug/l	5	ND	ND	ND	ND	84	67	ND	ND	ND			ND
Trichlorotrifluoroethane	ug/l	5	ND	24	9	48	73	90	35	67	ND			ND

ND = Not Detected

TABLE 3

TRICHLOROETHYLENE, TOC,

AND SPECIFIC CONDUCTANCE VALUES

SPARTON TECHNOLOGY, INC.

ALBUQUERQUE, NEW MEXICO

Well	Sample Date	Sample Method*	Aquifer Sampled**	Trichloroethylene (ug/l)	TOC (mg/l)	Specific Conductance (uho/cm)
MW-1	11/29/84	G	U	23,000	48	3,420
MW-2	11/29/84	G	U	2,100	1.0	713
MW-3	11/29/84	G	U	59,000	86	4,250
MW-4	11/29/84	G	U	7,400	1.8	983
MW-5	11/28/84	G	U	140	3.8	721
MW-6	11/28/84	G	U	310	6.1	866
MW-7	11/27/84	G	U	530	3.6	692
MW-8	11/27/84	G	U	250	5.5	763
MW-9	11/29/84	G	U	9,600	14	2,350
MW-10	11/20/84	G	L	120	3.0	702
MW-11	11/20/84	G	L	ND*	2.2	699
MW-12	08/29/84	P	L	61	1.7	769
MW-13	10/04/84	B	U	6,900	5.2	1,090
MW-14	10/04/84	B	U	12,000	5.9	1,290
MW-15	10/04/84	B	U	4,400	2.7	885
MW-16	10/05/84	B	U	37,000	54	5,300
MW-17	10/05/84	B	U	4,300	5.1	695
PW-1	10/07/84	P	L	200	3.8	801

* G-Gas Squeeze B adder Pump
P-Submersible Centrifugal Pump
B-Teflon Bailer
ND-Not Detected

** U-Upper Aquifer
L-Lower Aquifer

and PW-1, which were obtained by different methods, suggests that the ground water above the upper fine-grained layer is much more contaminated than the ground water beneath the layer. This is explained below.

The samples in MW-13, 14, 15, 16, and 17 were obtained with a Teflon bailer. Sampling methodology for all wells during this phase of work is included in Appendix C. Samples taken with the bailer from MW-13, 14, and 15 should have been representative of conditions in the upper aquifer. Based on this premise, the data indicate that the ground water above the upper fine-grained layer is contaminated at these locations. Samples from MW-12 and PW-1, taken with a submersible pump set near the bottom of the screen, probably were a mixture of water from the two aquifers. However, because of the coarseness of the lower aquifer, most of the water in these samples was from the lower aquifer.

Figure 16 is a contour map of the specific conductance data obtained from all wells except MW-10, 11, 12 and PW-1. The contoured data, which were taken over a period of time listed on Table 3, are more representative of the ground-water chemistry of the upper aquifer. The high conductivity plume extends from the suspected contamination source as measured by MW-1, 3, and 16 towards the southwest. Background conductance values range from about 690 to 760 umhos/cm.

A similar contour pattern is shown in Figure 17, which is a contour map of trichloroethylene data listed in Table 3. Results of MW-10, 11, 12, and PW-1 are not included on this map.

Both contour maps show that the upper aquifer contains relatively high concentrations of the contaminants present at the suspected contamination source. The direction of contaminant migration is towards the southwest. Additional sampling from the upper and lower aquifer in the existing wells MW-12, 13, 14, and 15 would aid in defining the degree of contamination above and below the fine-grained layer.

Four water samples were obtained from the submersible pump line discharge during the pumping test on PW-1 (Table 2). Concentrations of TOX decreased somewhat as pumping continued; the initial TOX concentration was 380 ugCl$^-$/l and after 12 hours of pumping the concentration was down to 240 ugCl$^-$/l. The third sample, at the end of the 1500-minute pumping test, had a TOX concentration of 210 ugCl$^-$/l. A fourth sample taken at the end of the 120-minute pumping test also had a TOX concentration of 210 ugCl$^-$/l. Based upon the results of these tests, the long-term TOX concentration of pumped water from PW-1 should be about 200 ugCl$^-$/l; the major organic constituents should be methylene chloride and trichlorethylene.

Samples were taken from MW-16 and 17 before and after the infiltration test. Chemical results show that volatile organic constituents increased in both wells (Table 2), with sharp increases in acetone, 1,1 dichloroethane, methylene chloride, 1,1,1 trichloroethane, and trichloroethylene in MW-16. Metal concentrations increased in MW-16 but decreased in MW-17.

In summary, the ground-water sampling and analytical results show that VOCs and some metals are elevated across the entire plant site in the upper aquifer. The highest concentrations were found in MW-16, which is adjacent to the suspected contamination source. Differences in results between wells screened in the upper and lower aquifer indicate the upper aquifer is more contaminated than the ground water in the lower aquifer. Ground water pumped from MW-12 and PW-1 is more representative of the chemical condition in the lower aquifer, while bailed samples from MW-13, 14, and 15 are more indicative of the chemical condition in the upper aquifer.

Samples taken in MW-16 and 17 before and after the infiltration test suggest that some flushing of organic constituents from the vadose zone were taking place due to the infiltration gallery test. Data are less conclusive about metal flushing; MW-16 showed an increase, while MW-17 metal concentrations decreased in the sample taken after the test. Increases would be expected to be greatest in the ground water adjacent to the suspected contamination source, as was the case.

D. Unsaturated Zone Studies

Continuous soil samples were obtained in boring MW-16 for metals and organics analyses and to determine the geologic conditions adjacent the suspected contamination source. Samples were obtained with a 5 foot long internal core barrel in the hollow-stem auger as described in Appendix B. Samples from each interval were collected from the barrel, scanned by the PID (see Section II F.) for organic vapor emissions and split into representative samples for laboratory analysis of total metals, extraction procedure (EP) soluble metals and selected TOX analyses. Approximately 20 ml of soil was placed into a 40 ml vial, tightly-capped and placed in the sun for two hours to determine the organic vapor emissions with the PID after the soil was allowed to heat up in a sealed vial.

Table 4 shows the initial and capped PID readings which had been calibrated to benzene vapors. Also shown are RMA lab analyses for TOX on the soil.

The greatest decrease in vapor concentration from the initial sampling was seen at 45 feet which is the top of a 5 foot layer of dense clay. The vapor concentration decreased with depth; at 70 feet the initial vapor levels were less than 10 ppm. The difference in vapor concentration between the initial and capped samples showed the following phenomena: the upper 25 feet of soil had roughly the same concentration with the two methods; from 25 to 45 feet the capped samples had a lower concentration; samples below 45 feet had a higher capped concentration. The mechanism that causes these relationships is unknown.

As mentioned above, soil samples from MW-16 were collected and sent to RMA for analysis. These samples and EP-extracts were analyzed for total concentrations of cadmium, chromium, lead, nickel, and silver. The EP-extracts were also tested for hexavalent chromium. The soil samples were also analyzed for cyanide.

Table 5 lists the total metal and cyanide concentrations for the soil samples. Nickel concentrations are highest in samples from 30 to 45 feet, corresponding to the depth above where organic vapor concentration decreased at 45-50 feet. These metal concentrations are much higher than would be expected in the subsurface away from the suspected contamination source. A subsequent work phase to attempt to determine the "background" metal concentration is discussed in the Recommendation Section of this report.

TABLE 4

MW - 16

ORGANIC VAPOR EMISSIONS

FROM SOIL

Concentration in PPM BENZENE

SPARTON TECHNOLOGY, INC.

ALBUQUERQUE, NEW MEXICO

DEPTH INTERVAL	INITIAL SAMPLE	WARMED & CAPPED SAMPLE	Lab TOX Concentration *
0-5	-	-	
5-10	100	150	
10-15	200	200	
15-20	200	240	ND
20-25	200	150	
25-30	200	80	
30-35	175	50	ND
35-40	175	50	
40-45	150	40	
45-50	40	70	
50-55	30	70	
55-60	20	50	ND
60-65	15	20	
65-70	5	70	
70-73	5	20	

* TOX mg Cl^-/Kg (ppm). Detection limit = 100 ppm
ND = Not Detected

Table 6 lists the metal concentrations found in EP-extracts of the soil samples. The results of these tests follow a similar pattern as the total metal analyses; chromium and nickel concentrations are greatest in the 30 to 45 foot interval. Most of the extracted chromium measured is in the hexavalent form as would be expected.

HLA conducted these tests to show the marked differences between the total and the water-extracted metal concentrations. While the concentrations listed in Tables 5 and 6 are not directly comparable, the data can be used to generally show the expected concentrations of water infiltrating through these soils.

TABLE 5

TOTAL METALS AND CYANIDE CONCENTRATIONS

IN SOIL MW-16

SPARTON TECHNOLOGY, INC.

ALBUQUERQUE, NEW MEXICO

Concentrations in mg/Kg (ppm)

Depth Feet	Cadmium [0.1]*	Chromium [0.3]	Lead [1.3]	Nickel [0.5]	Silver [0.2]	Cyanide [0.25]
5-10	0.8	3.2	3.4	3.3	ND	ND
10-15	0.7	7.7	3.4	4.3	ND	ND
15-20	0.8	6.7	3.6	4.4	ND	ND
20-25	0.9	8.4	3.2	4.0	ND	ND
25-30	0.9	8.6	3.0	4.6	ND	ND
30-35	1.0	350	ND	30	ND	ND
35-40	1.1	500	2.1	41	ND	ND
40-45	2.6	480	2.7	38	ND	ND
45-50	1.1	80	4.2	14	ND	ND
50-55	0.5	130	2.7	13	ND	ND
55-60	0.6	9.8	3.6	5.6	ND	ND
60-65	0.4	24	2.3	4.8	ND	ND
65-70	1.0	52	3.6	9.8	ND	ND
70-73	1.2	69	3.5	7.5	ND	ND

* = Detection Limit   ND = Not Detected

TABLE 6
EP METAL CONCENTRATIONS
IN SOIL EXTRACTS FROM MW-16
SPARTON TECHNOLOGY, INC.
ALBUQUERQUE, NEW MEXICO

All Concentrations in mg/l (ppm) of Extract

Depth Feet	Cadmium [0.002]*	Chromium [0.005]	Hex Chromium [0.01]	Lead [0.025]	Nickel [0.01]	Silver [0.003]
5-10	ND	ND	ND	ND	0.01	ND
10-15	ND	0.027	ND	ND	0.02	ND
15-20	0.003	0.060	0.02	ND	0.027	ND
20-25	ND	0.048	0.02	ND	0.01	ND
25-30	ND	0.083	ND	ND	0.027	ND
30-35	0.003	4.1	3.6	ND	0.13	ND
35-40	0.006	8.6	8.0	ND	0.19	ND
40-45	0.028	2.1	1.6	ND	0.12	ND
45-50	0.013	0.70	0.5	ND	0.11	ND
50-55	0.005	1.1	0.81	ND	0.11	ND
55-60	ND	ND	ND	ND	0.045	ND
60-65	ND	ND	ND	ND	0.026	ND
65-70	ND	0.011	ND	ND	0.050	ND
70-75	ND	0.007	ND	ND	0.045	ND

* = Detection Limit ND = Not Detected

IV AQUIFER TESTS

Tests were conducted on PW-1 and the infiltration gallery in order to determine the hydrogeologic characteristics of the aquifers and the unsaturated zone beneath the plant site. Water samples were collected from the pumping well in order to determine the degree of contamination for design purposes of an on-site treatment facility. The methodologies for these tests are described in Appendix D.

A 6-hour step-drawdown test, and 25-hour and 2-hour constant rate pumping test were conducted on PW-1 during the period of October 5 through 8, 1984. An infiltration test was conducted on the infiltration gallery adjacent to MW-17 on October 9 through 10, 1984. The results of the tests are discussed in the next section.

A. Step-Drawdown Test

The step-drawdown test was conducted on PW-1 on October 5, 1984. The pumping schedule was set to nominally withdraw water at 50 gpm increments at 60-minute intervals. The actual rates are as follows:

Elapsed Time Minute	Withdrawal GPM
0 - 60	50
60 - 130	100
130 - 180	150
180 - 360	200

At the 200 gpm step, the hydraulics of the well changed drastically in conjunction with an influx of fine sands and silts into the well. The change is due to the increased development of the formation surrounding the well. The development process increases the available yield of the well by increasing the hydraulic capabilities of the formation adjacent to the well screen. This increase is most easily seen by comparing specific capacities of the well at each pumping rate. Specific capacity is defined as the pumping rate divided by the amount of drawdown; the units used here are gallons per minute per foot of drawdown (gpm/ft):

	Pumping Rate GPM	Drawdown Feet	Specific Capacity GPM/Ft
	50	13.0	3.85
	100	23.8	4.20
	150	36.3	4.13
initial	200	51.8	3.86
ending	200	36.1	5.54

The increase in specific capacity during the 200 gpm rate showed that the well had not been sufficiently developed during construction with the drilling rig's air compressor. While this was anticipated, the degree of fine sand inflow necessitated additional development prior to running the constant-rate test.

The additional development was conducted on October 6, 1984, by pumping and surging the well at rates up to 300 gpm. The development was continued for a total of 5-hours, at the end of which the well was producing relatively clear water with a low sand content. Following the development, the specific capacity of the well was increased to 7.5 gpm/ft at 200 gpm, which is an approximately 100 percent increase over the initial specific capacity at that pumping rate.

Based on the results of the step-drawdown test and the development program, a rate of 200 gpm was chosen for the constant-rate portion of the aquifer test.

B. Constant-Rate Test

A 48-hour constant-rate test of PW-1 at 200 gpm was proposed to start on October 7, 1984. The test was started at 1015 hours and the rate was set to approximately 200 gpm. Unfortunately, sand apparently blocked the flow meter a few minutes into the test and the pumping rate fluctuated for the first 60 minutes. Data from the early portion of the test is important in aquifer analysis, and it was decided to repeat the early portion after this test was ended.

The test was continued at a constant-rate of 180 gpm for a total of 1500 minutes. Water levels were measured with the transducer system in MW-12, 13, 14 and PW-1 as described in Appendices D and E.

Periodic hand-level measurements as discussed in Appendix D were taken in all other wells to determine the extent of pumping influence. Measurable drawdown was observed in all wells equipped with transducers as well as in MW-4, 9, 10, 11, and 15.

Following pump shut-down, water level recovery was monitored in all wells which had shown discernable drawdown. These results are also discussed in the next section.

Following recovery of water levels, a 120-minute constant-rate test was conducted at 189 gpm. Drawdown was measured by transducer in MW-12, 13, 14, and PW-1. This test allowed for much better data to be collected for methods used to analyze early test data.

Water levels were obtained from all monitoring wells at the end of the first constant-rate test. These data were contoured to estimate the ground-water flow directions which were developed due to pumping. Figure 18 is a contour map of cross-section A-A', showing the differences in piezometric head with depth.

Figure 19 is a contour map of the water table in the upper aquifer at the end of the first test. Ground-water flow is still towards the south and the relative thinness of the upper aquifer limits the extent of drawdown away from the well.

Figure 20 shows the piezometric head of the lower aquifer at the end of the test. The ground-water flow direction has been altered, and the direction of flow is towards the south.

C. Aquifer Test Analysis

Appendix E contains the printout and graphical data from the well-tests on PW-1 and the infiltration test. The quantity of data recovered from these tests precludes the individual discussion of drawdown analysis by each method for each portion of the test; rather, this section will summarize the hydrogeologic parameters.

Table 7 lists the mean transmissivity (T), hydraulic conductivity (K), storage coefficient, and leakage coefficients (K'/b') found in the observation wells during the PW-1 tests. The table is divided into groups which are indicative of the upper and lower aquifer.

Well MW-9 was the only point which had measurable drawdown in the upper aquifer; the other wells were screened either in both aquifers or only in the lower aquifer. Transmissivity and Storage Coefficient information on the upper aquifer was obtained during the 50 gpm pumping period of the step drawdown test. The T and K values listed for the upper aquifer take into account the fact that pumping caused withdrawals from both aquifers and the analytical method assumed that all water was removed from a single aquifer. Based on our experience and judgement the actual K of the aquifer should be about 1000 gpd/ft.

TABLE 7

PW-1 Pump Test Summary

SPARTON TECHNOLOGY, INC.

ALBUQUERQUE, NEW MEXICO

Upper Aquifer

Well	T gpd/ft	K gpd/ft^2	S
MW-9	5,000 - 1,000	1,000	0.10

Lower/Both Aquifers

Well	T gpd/ft	K gpd/ft^2	S	K'/b' 1/day
PW-1	25,000	420	-	-
MW-12	13,200	190	0.00047	0.030
MW-13	26,700	360	0.00020	0.018
MW-14	66,200	880	0.00024	0.0018
MW-15	69,000	920	0.00015	-
MW-4	193,400	2,580	0.00028	-
MW-10	63,000	840	0.00024	-
MW-11	67,000	890	0.00026	-

The storage coefficient of 0.10 in MW-9 indicates that the upper aquifer is unconfined. This correlates with the boring log data which does not show any confining layers at the water table elevation.

Examination of the data from wells set in the lower aquifer shows that some of the data are anomolous and probably not representative. For example, the T value from MW-4 appears to be too great, considering the placement of the well screen through what is believed to be the lower-permeable layer which separates the upper and lower aquifer. The screen extends below this layer, and it is possible that a thin sand or gravel layer exists which gives the high transmissivity indication. In fine-grained sediments adjacent to a more transmissive aquifer, pump test data can often produce misleadingly high T values due to the limited drawdown and by delayed leakage from the fine sediments.

MW-12, 13, and PW-1 produced results of a lower T than the other wells which were monitored in the lower aquifer. Boring MW-13 showed silt and clay lenses present in the middle of the lower aquifer, which may reduce transmissivity. However, similar layers were present in boring MW-15 and the transmissivity of the aquifer in that location is similar to the values obtained from MW-10, 11, and 14, which suggests that MW-10 and 11 are in direct hydrologic contact with the lower aquifer. Based upon the results from these tests, the transmissivity of the lower aquifer is between 60,000 to 70,000 gpd/ft. The hydraulic conductivity of the lower aquifer is estimated at 1,000 gpd/ft^2, using an average thickness of the lower aquifer of about 65 feet.

The storage coefficient of the wells in the lower aquifer is approximately 0.0002, which is indicative of a confined or semiconfined aquifer. This information, along with the boring logs from this phase of work, strongly supports the differentiation of the subsurface into the two different aquifers.

Leakage rates of the semi-confining layer were obtained from the time-drawdown graphs of MW-12, 13, and 14. The data, also listed in Table 7, show that the leakage coefficient ranges between 0.002 to 0.03/day. The further the observation point is from the pumping well, the lower the apparent leakage coefficient. Data from the closer wells are more representative since the drawdowns were slightly greater and the leakage across the layer would have been established for a longer time period during the test. Using an average leakage coefficient of 0.02/day and assuming a thickness of 5 feet, the hydraulic conductivity of the semi-confining unit is 0.75 gpd/ft^2 (3.5×10^{-5} cm/sec) which is approximately 3 orders of magnitude less than the hydraulic conductivity of either the upper or lower aquifer. This lower leakage coefficient restricts the flow of ground water between the two aquifers, causing the observed head differences and the chemical concentration patterns present beneath the SPARTON site.

In summary, the results of the pumping test indicate the presence of two aquifers beneath the SPARTON site, separated by a less-permeable layer that appears to be sufficiently continuous to cause the semi-confined aquifer responses of the lower aquifer. The hydraulic conductivity of both aquifers is approximately 1000 gpd/ft^2; the transmissivity of each aquifer is dependent upon the saturated thickness throughout the site. In general, the upper aquifer, being 5- to 10-feet-thick, has a T ranging from 5000 to 10,000 gpd/ft. The lower aquifer, which is about 60- to 70-feet-thick, has a T of 60,000 to 70,000 gpd/ft. MW-10 and 11 exhibited water-level responses during the pumping test which suggests that these two wells are in direct hydrologic contact with the lower aquifer.

The storage coefficient of the upper aquifer is 0.10, indicative of an unconfined aquifer. The S of the lower aquifer is approximately 0.0002, indicative of a semi-confined aquifer.

The semi-confining layer between the two aquifers has an estimated hydraulic conductivity of 0.75 gpd/ft^2, which is about three orders of magnitude less than the K found in both the upper and lower aquifers.

D. Infiltration Test

An infiltration test was conducted on the infiltration gallery from October 8-9, 1984. It was hoped to conduct this test at a sufficient rate to impact the water table, causing a mound beneath the gallery. However, the gallery would accept only 6,100 gallons of water over the 1240 minute test (4.9 gpm) which was insufficient to cause a pronounced mound. Slight water table increases were noticed in MW-16 and 17 but the change could be due to natural fluctuations.

The results of the test show that the gallery could infiltrate water at 4.9 gpm. Using the open area at the bottom of the gallery of 7.0 ft^2, a vertical unsaturated hydraulic conductivity of about 1000 gpd/ft^2 is estimated. This value is the same as the saturated hydraulic conductivity of the two aquifers.

V CONCLUSIONS

Based upon the results of field work and interpretations of pumping, water level, and chemical data, the following conclusions have been made about the SPARTON site:

The SPARTON site is underlain by at least two distinctly different aquifers. The upper aquifer is a relatively thin unconfined system which is present above a fine-grained unit occurring at elevation 4960 to 4970 feet msl. Another aquifer is present beneath this unit which exhibits semi-confined characteristics. The estimated hydrogeologic properties of both aquifers are:

Upper Aquifer	Lower Aquifer
T = 5,000 - 10,000 gpd/ft	60,000 - 70,000 gpd/ft
K = 1,000 gpd/ft	K = 1,000 gpd/ft
S = 0.10	S = 0.0002

An initial estimate of the Leakage Coefficient of the semi-confining layer between the two aquifers is 0.02/day, and the hydraulic conductivity is estimated to be approximately 0.75 gpd/ft^2.

A second fine-grained unit is found at about elevation 4900 feet. The hydrogeologic importance and areal extent of this layer are not fully known at this time.

The ground-water flow direction in the upper aquifer is towards the south-southwest, generally in a direction from MW-16 towards MW-9. The direction of flow in the lower aquifer is apparently towards the west south-west. Extrapolating the piezometric gradient towards the east suggests that the lower aquifer may be in hydrologic contact with the shallow water table upgradient in the area surrounding the Rio Grande.

A significant vertical hydraulic gradient is present beneath the SPARTON site, resulting in the upper aquifer having a hydraulic head more than 4.0 feet above the piezometer level of the lower aquifer in an adjacent monitoring well.

Chemical analyses of ground-water samples show that volatile organic constituents are present in the upper aquifer across the site. Concentrations of metals in ground water also appear to be elevated; however, all samples in this study have been acidified prior to filtering, which takes metals adsorbed onto the sediment into solution. The actual dissolved metal concentration of the ground water has not been determined, but is probably lower.

Infiltration of water through the vadose zone appears to be feasible. Based upon the pilot-scale test, the infiltration rate of the unsaturated zone is 0.70 gpm/ft^2, which is approximately 1,000 gpd/ft^2. Infiltration flushed some of the contaminants from the soil, based upon water samples taken in MW-16 after the test which showed an increase in VOC and metal concentrations.

The unsaturated zone sampled by boring MW-16 showed high concentrations of metals. VOC were not determined from the samples, however, VOCs concentrations were reflected by the PID readings of the vapor emissions. Both metals and VOCs appear to the concentrated in the upper 55 feet near the suspected contamination source.

VI RECOMMENDATIONS

Additional work is required to define the extent of metal and VOC concentrations in the vadose zone and to determine the chemical and hydrostatic head differences in the two aquifers at the southern and western portion of the plant site.

Vadose Zone Contamination

Seven soil borings are recommended to be located around the suspected spill location (concrete sump) as shown in Figure 21. These borings will be drilled using the Hollow Stem Auger and sampling techniques described in Appendix B. The borings will extend to approximately 75 feet below grade.

Soil samples will be taken from each 5-foot soil interval and will be analyzed for total cadmium, chromium, lead, and nickel. VOCs will be determined by solvent extraction followed by purge and trap gas chromatography and mass spectroscopy following U.S. EPA procedure 624. Metal concentrations may be determined from EP-extracts of some of the samples.

An eighth boring will be drilled in order to obtain 'background' metal concentrations of the soil. The location of this boring is shown in Figure 21. Monitoring wells, similar in construction as MW-17, may be installed in some of the borings.

Comparisons of the metallic and organic concentrations between the borings will be used to estimate the extent of vadose zone contamination.

Ground Water Investigation

A series of tests should be conducted on selected wells in order to determine the chemical and hydrostatic profile at the site. These tests will be conducted by inserting inflatable packers in the monitoring well with a pump. A low volume pump, such as a gas squeeze pump, will be used to collect ground-water samples between the two packers. A sufficient quantity of water will be removed prior to sampling to assure that the water samples are representative at each profile. Samples will be analyzed for selected VOC constituents and dissolved metals found during previous sampling. Static water levels will be measured with transducers and a recorder prior to pumping with the packers in place. Vertical communication along the well annulus may affect the water level measurements, but the results should show a vertical profile.

The results of this ground-water investigation will allow us to further evaluate the vertical extent of contamination and the direction of ground-water flow in both aquifers. This information, in conjunction with the results of previous studies, will allow us to design a remedial plan for ground-water contamination abatement. For example, if the ground-water sampling profile shows no significant contamination in the lower aquifer the remedial design will include only pumpage and treatment of ground-water flow from the water table aquifer. If significant concentrations of contaminants are found in the lower aquifer, a withdrawal system will be designed for both aquifers. Disposal of treated water will probably include infiltration through the vadose zone at the areas found to contain increased concentration of VOCs and metals at the suspected contamination source.

DISTRIBUTION

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QUALITY CONTROL REVIEW:

FOR

Eric G. Lappala
Principal Hydrogeologist

LIST OF APPENDICES

APPENDIX A

ROTARY DRILLING AND WELL CONSTRUCTION PROCEDURES

APPENDIX A

Rotary Drilling and Well Construction Procedures

Borings MW-13, 14, 15, and PW-1 were drilled using rotary wash (mud rotary) techniques. MW-12, drilled from 0 to 70 feet using a hollow-stem auger, was completed using a rotary rig. The following general drilling and construction procedures were used on all rotary drilling wells.

Equipment Set-up

Prior to the set-up of the drilling rig on the prospective well site, all underground utilities were located to help assure that the borings will not encounter any buried power, gas, or telephone lines. Overhead electrical power lines were shrouded with rubber by the electrical utility to protect the workers from electrical hazards. Additionally, all drilling equipment were cleaned with a high pressure steam cleaning machine in order to remove any material which could possibly cause any cross-contamination between boreholes.

Drilling Procedure

The rotary wash well-drilling process involves the use of drilling fluid, normally a bentonite and water mixture, to suspend drill cuttings obtained by the advancement of a tri-cone drill bit into unconsolidated formations. The drilling fluid is pumped down through the inside of the drill pipe, through the end of the drill bit, and then returns to the surface through the annulus between the drill pipe and the bore hole wall. The fluid cools the drill bit, carries the cuttings to the surface, stops excessive loss of fluid into the formation, and prevents the borehole from collapsing. Upon circulating to the ground surface, the fluid is directed in to mud pits or a portable mud tank in which the cuttings drop out of suspension and are removed.

Soil Sampling

Samples of the formation encountered during drilling were obtained by two different methods: cuttings suspended in the drilling mud and 2-inch split-spoon pushed ahead of the drill bit. Additional data was obtained by noting the rate and ease of drilling penetration.

Formation cuttings were collected at the top of the boring in a strainer. The samples were classified according to the Unified Soil Classification System (USCS) into gravel, sand, silt, and clay mixtures to allow for an understanding of the geologic characteristics of the subsurface. Figure A-1 shows the classification system. This method of sampling has a tendency to miss portions of both the coarse and fine-grain materials, but are satisfactory to delineate the textural changes which occur in the borehole and to determine the depth for split-spoon samples.

MAJOR DIVISIONS				TYPICAL NAMES
COARSE GRAINED SOILS (MORE THAN HALF IS LARGER THAN #200 SIEVE)	GRAVELS (MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE)	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW	WELL GRADED GRAVELS, GRAVEL - SAND MIXTURES
			GP	POORLY GRADED GRAVELS, GRAVEL - SAND MIXTURES
		GRAVELS WITH OVER 12% FINES	GM	SILTY GRAVELS, POORLY GRADED GRAVEL - SAND - SILT MIXTURES
			GC	CLAYEY GRAVELS, POORLY GRADED GRAVEL - SAND - CLAY MIXTURES
	SANDS (MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE)	CLEAN SANDS WITH LITTLE OR NO FINES	SW	WELL GRADED SANDS, GRAVELLY SANDS
			SP	POORLY GRADED SANDS, GRAVELLY SANDS
		SANDS WITH OVER 12% FINES	SM	SILTY SANDS, POORLY GRADED SAND - SILT MIXTURES
			SC	CLAYEY SANDS, POORLY GRADED SAND - CLAY MIXTURES
FINE GRAINED SOILS (MORE THAN HALF IS SMALLER THAN #200 SIEVE)	SILTS AND CLAYS (LIQUID LIMIT LESS THAN 50)		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS (LIQUID LIMIT GREATER THAN 50)		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACIOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS

UNIFIED SOIL CLASSIFICATION SYSTEM

Consol	—	Consolidation
LL	—	Liquid Limit (in %)
PL	—	Plastic Limit (in %)
G_s	—	Specific Gravity
SA	—	Sieve Analysis
■		"Undisturbed" Sample
⊠		Bulk Sample

	Shear Strength, psf	Confining Pressure, psf	
*Tx	320	(2600)	Unconsolidated Undrained Triaxial
TxCU	320	(2600)	Consolidated Undrained Triaxial
DS	2750	(2000)	Consolidated Drained Direct Shear
FVS	470		Field Vane Shear
*UC	2000		Unconfined Compression
LVS	700		Laboratory Vane Shear

Notes: (1) All strength tests on 2.8" or 2.4" diameter samples unless otherwise indicated.

(2) * Indicates 1.4" diameter sample.

KEY TO TEST DATA

Harding Lawson Associates
Engineers, Geologists
& Geophysicists

SOIL CLASSIFICATION CHART
AND KEY TO TEST DATA
Sparton Technology, Inc.
Albuquerque, New Mexico

PLATE A1

DRAWN: JM | JOB NUMBER: 6310,013.12 | APPROVED | DATE | REVISED | DATE

02470

Split-spoon samples were obtained with the following methodology. Upon reaching a desired sampling interval (as noted by the drill cuttings), the drill pipe and bit were raised one foot off the bottom of the borehole and the remaining cuttings in the boring were cleaned by increasing the velocity of the drilling fluid. On occasion, this process would not remove coarse gravel from the borehole and the drilling fluid would have to be thickened in order to help float this coarse material out of the borehole. Upon cleaning out the hole, the drill bit was removed and a 2-foot long, 2-inch outside diameter split-spoon sampler was screwed onto the drill pipe. The sampler was seated into the bottom of the borehole and was pushed into the formation using the hydraulic system of the drill rig. The sampler was pushed a maximum of 24-inches, or until refusal, which was defined as the point where the rig was about to be lifted off its jacks by the pressure on the drill pipe.

The sample was then retrieved and classified according to the USCS standards. Select samples were bagged and kept for future reference. The sampler was then thoroughly cleaned with the high pressure steam cleaning machine.

Well Construction

Upon drilling the boring to its total depth, the hole was cleaned out by a process similar to the one used during the split-spoon sampling process. After the boring is clean, a 1-inch diameter tremie pipe is lowered to near the bottom of the hole. The well screen and casing are then lowered into the boring. All screen and casing used in this project were threaded and flush-jointed PVC manufactured by Timco, Inc. Couplings between portions of solid casing were made leak-proof by wrapping the threads with Teflon tape. The diameter and lengths of casing and slot size of screen varied in the wells installed; refer to the main text for a discussion of the design of each individual well.

After the well had been placed at its correct position in the boring, lower weight drilling fluid (i.e. less mud content) was added at the bottom of the boring through the tremie pipe. This process helped remove some of the mud which is attached to the side of the boring and reduced the weight of the mud, allowing the pack material to fall through the fluid.

Specially-graded sand was used to pack the annular space from the bottom of the boring to above the top of the well screen. The sand was graded and sold by Fountain Sand and Gravel, Denver, Colorado. Grade numbers listed in the main text refer to the 10 and 99 percentage retained on standard U.S. Sieves. Sand was poured into the annular space around the well, and the tremie pipe was used to sense the level of sand in the well and to assure that this material did not bridge on upper portions of the boring. The level of sand was brought up at least 2-feet above the top of the screen.

Following the placement of the sand pack, the tremie pipe was raised about 4 feet off the top of the sand and sufficient bentonite pellets were placed uniformally into the annular space to give a 2-foot thickness in the boring. The bentonite acts as an excellent seal, retarding vertical flow of ground water in the annular space and acting to stop the grout, which is added next, from invading the sand pack.

A neat grout mixture of approximately one 94 pound sack of cement, 15 pounds of bentonite powder and 7 gallons of water were mixed together and pumped through the tremie pipe down to the top of the bentonite seal. The grout displaced the remaining drilling fluid in the annular space, assuring a competent seal to stop infiltration of any surface water down the bore hole.

Each well was finished by installing either a steel protector pipe or drive-over box depending upon whether the well was finished above or below grade. Each well is secured by a locking cap and the elevation of the top of the protector pipe were surveyed into mean sea level datum by a registered surveyor.

Well Development

Each well was developed shortly after construction by lowering a 1-inch diameter pipe down to near the bottom of the well and forcing air into the well, which blows water, fine sand, and drilling fluid out of the well. The development process was continued until the water is relatively free of mud and sand. The rate at which water was removed from each wall is listed in the main report. All fluids obtained during development were discharged into the sewer line, under an agreement which was arranged between SPARTON personnel and New Mexico Utilities, Inc.

APPENDIX B

HOLLOW-STEM AUGER DRILLING

AND

WELL CONSTRUCTION PROCEDURES

APPENDIX B

Auger Drilling and Well Construction Procedures

Borings MW-16 and 17 were drilled using a hollow-stem auger. MW-12 was drilled from 0 to 70 feet with a hollow stem auger and completed using a rotary rig. The following general drilling and construction procedures were used on all augered wells.

Equipment Set-up

Prior to the set-up of the auger rig on the prospective well site, all underground utilities are located to help assure that the boring will not hit the utilities. All equipment and materials are cleaned with a portable high-pressure steam cleaning machine to remove any material which could possibly cause any cross-contamination between bore holes.

Drilling Procedure

The hollow stem auger drilling procedure involves rotating a hollow auger into the soil. As the auger is rotated into the soil, cuttings are brought to the surface on the continuous flights surrounding the hollow stem. Samples of the formation were obtained by a 5-foot long core barrel in the hollow stem extended out past the bottom of the drill bit. No drilling fluid is used in this method which enables a more representative sample to be obtained.

Each soil sample was removed from the core barrel and classified according to the Unified Soil Classification System (USCS) into gravel, sand, silt, and clay mixtures to allow for an understanding of the three-dimensions geologic characteristic of the subsurface. The sampler was thoroughly cleaned with the steam cleaner between samples.

Well Construction

Upon augering the boring to its total depth, the coring mechanism is removed from the hollow stem augers and a 2-inch-diameter PVC well screen and casing was lowered through the hollow stem. The screen was manufactured by Timco, Inc. and consisted of 10- and 20-foot lengths of threaded and flush-jointed sections; the threads of the joints connecting the solid casing were wrapped with Teflon tape to make them leak-proof. The lengths and depths of casing and screen varied between each well; refer to main text for a discussion of the design of each individual well.

After the well had been placed at its correct position in the hollow stem, the augers were pulled up in the borehole to allow the natural formation to surround the screen. A thick bentonite slurry (approximately 3 pounds of bentonite per gallon of water) was pumped down the annular space to fill up the space above the natural sand pack. The auger was then removed in phases, filling the annulus space with mud as the flights were removed.

A neat grout with about 15 percent bentonite was added the next day to the top of the bentonite after slurry has settled.

Each well was finished by cementing a steel protector pipe with a locking cap over the PVC well. The elevation of both the top of the protector pipe and PVC well were surveyed into mean sea level datum by a registered surveyor.

Well Development

Each well was developed shortly after construction by bailing water, fine sand, and mud from the well. The development process was continued until the water was relatively free of mud and sand. All fluids obtained during bailing were discharged into a lined lagoon.

APPENDIX C

GROUND-WATER SAMPLING AND ANALYTICAL PROTOCOL

APPENDIX C

Ground-Water Sampling and Analytical Protocol

Introduction

This sampling and analysis protocol has been compiled for use at locations which require ground-water monitoring and sampling for volatile organic constituents (VOCs). The methods described are equivalent to other HLA sampling plans, such as the document used for sampling MW-1 through 4. This protocol includes procedures and techniques for:

1. Sample collection
2. Sample preservation and shipment
3. Chain of custody control
4. Analytical procedures

Before sample collection can begin, the water sampled from the well casing must be fresh aquifer water. Well purging replaces stagnant well water with representative aquifer water each time a set of samples is taken from the well.

There are no mandated procedures for sample collection, and shipment, only guidelines as contained in two Environmental Protection Agency

(EPA) recommended publications. The sample collection and preservation protocol maintains sample integrity while reducing collection time. It is adaptable to most ground-water monitoring wells and meets both state and federally-recommended guidelines.

Shipping and handling of samples will route the samples to Rocky Mountain Analytical, Arvada, Colorado for the analyses. The chain of custody control program lists all sample handlers, and provides for maximum protection against sample contamination. The recommended procedures for chain of custody control and holding time are followed in this protocol.

Sampling Equipment Water Depth

A battery-operated water-level indicator, such as Model DR-760A as manufactured by Soiltest, Inc., is used to measure water level within the well. This information, along with well construction data, will be used to calculate the volume of water standing in the well casing.

Field Measurements

Portable instruments are used if field measurements are to be obtained. Temperature and conductivity are measured using equipment such as a Yellow Springs Model 33 SCT Meter and an Orion Research Model 399 A/F meter to measure pH.

Well Evacuation

All 2-inch diameter monitoring wells will be purged with a gas squeeze pump or a PVC or Teflon bailer. Wells 4 inches in diameter and larger will be purged by bailing or with an electrical submersible pump. The well will be considered properly purged after four standing water volumes have been removed. In low-yielding wells, the standing water will be removed until the well is essentially dry. The water level in the well will be allowed to recover until a sufficient volume of water is present to obtain the samples.

Sample Collection

All samples for VOCs will be placed in 30 ml septum-seal vials with no headspace. Duplicate VOC samples will be obtained from all wells. Following collection and labeling, all samples will be stored in an ice-filled cooler.

After the well has been properly purged, a water sample will be obtained with a Teflon bailer or a gas squeeze pump.

Equipment Cleaning Procedures

Cleaning and sterilization of the bailer is accomplished by using either a 5 percent household bleach and water or with a dilute methanol solution. Following the cleaning, the bailer is thoroughly rinsed with deionized water. The submersible pump and tubing, if transferred between wells, are rinsed with deionized water. Dedicated gas-squeeze pumps do not need to be cleaned.

Rocky Mountain Analytical laboratories provided all sample bottles which have been cleaned following EPA-recommended procedures.

Sample Shipment

All samples will be transported to the lab directly from the field. If necessary, insulated cartons and cold packs are available to maintain the temperature (4°C) required for the preservation of samples. At the lab, the samples are routed for analysis with priorities based on sample holding times.

Chain of Custody Control

Sample identification numbers and sample name are recorded on a label affixed to each sample. Sample transfer is accomplished in groups with a chain of custody record. When a portion of the samples identified on the record form is to be transferred, the individual samples are noted in the column with the signature of the person relinquishing them. The sample collector is responsible for packaging and dispatching the samples, properly filling out, dating, and signing the chain of custody record form.

VOC Analytical Methodology

The method employed for the analysis of the volatile organic compounds was EPA Method 624 (Federal Register, December 3, 1979, page 69532). The method can be summarized as follows: helium is bubbled through a 5 ml. water sample contained in a specially designed purging chamber at ambient temperature. The purgeable volatile organic compounds are efficiently transferred from an aqueous phase to the vapor phase.

Vapor is swept through a sorbent column where the purgeables are trapped. After purging is completed, the sorbent column is heated and back flushed with helium to desorb the purgeables onto a gas chromtographic column. The gas chromatograph is temperature programmed to separate the purgeables which are then detected with a mass spectrometer.

Other Parameters

Information about analytical methods and sample containers is contained in documents prepared by Rocky Mountain Analytical Laboratory, and incorporated with this Appendix.

Quality Assurance Protocol

The quality assurance protocol followed in all sample analyses is based on the "Handbook for Analytical Control in Water and Wastewater Laboratories," EPA 600/4-79-019, March 1979; National Enforcement Investigation Center Policies and Procedures manual; EPA-330/9/79/001-R, October 1979; and the recommended guidelines to EPA Method 624 and 625.

SAMPLE DESCRIPTION INFORMATION

for

Sparton Technology, Inc.

RMA Sample No.	Sample Description	Sample Type	Date Sampled	Date Received
4333-01	MW-13	Water	10/4/84	10/6/84
4333-02	MW-14	Water	10/4/84	10/6/84
4333-03	MW-15	Water	10/4/84	10/6/84
4333-04	MW-16	Water	10/5/84	10/6/84
4333-05	MW-17	Water	10/5/84	10/6/84
4333-06	PW-1-1	Water	10/7/84	10/11/84
4333-07	PW-1-4	Water	10/8/84	10/11/84
4333-08	MW-16	Water	10/10/84	10/11/84
4333-09	MW-17	Water	10/10/84	10/11/84

October 31, 1984

ANALYTICAL RESULTS

for

Sparton Technology, Inc.

INORGANIC PARAMETERS

Parameter	Units	Detection Limit	4333-01	4333-02	4333-03	4333-04	4333-05	4333-06	4333-07	4333-08	4333-09
pH	units	0.01	7.43	7.61	7.68	7.17	7.90	8.03	7.82	7.30	7.94
Specific Conductance at 25°C	umhos/cm	1	1090	1290	885	5300	695	801	798	5960	748
Fluoride	mg/l	0.1	1.1	0.8	0.8	7.9	1.5	0.8	0.7	6.9	1.4
Nitrate as N	mg/l	0.1	0.6	1.0	4.4	ND	ND	0.7	0.8	ND	0.2
Sulfate	mg/l	5	148	192	146	2180	98	130	130	2320	102
Total Organic Carbon	mg/l	0.1	5.2	5.9	2.7	54	5.1	3.8	6.0	71	4.8
Total Organic Halogen	$ugCl^-/l$	5	3600	3700	1100	15000	3100	380	210	25000	2500
Total Kjeldahl Nitrogen as N	mg/l	0.1	3.1	1.0	0.5	310	1.5	0.6	0.3	380	1.0
Hexavalent Chromium	mg/l	0.01	ND	0.60	ND	ND	ND	ND	0.01	0.01	ND
Phenolics	mg/l	0.01	0.01	ND	ND	0.04	ND	ND	ND	0.04	ND

TOTAL TRACE METALS

Parameter	Units	Detection Limit	4333-01	4333-02	4333-03	4333-04	4333-05	4333-06	4333-07	4333-08	4333-09
Boron	mg/l	0.004	2.6	2.0	0.16	14	0.19	0.18	0.16	20	0.18
Cadmium	mg/l	0.002	0.003	ND	ND	0.003	0.013	ND	ND	0.012	0.006
Chromium	mg/l	0.005	0.038	0.58	ND	0.75	0.27	ND	ND	2.3	0.092
Manganese	mg/l	0.005	2.0	0.76	0.060	17	4.1	1.1	1.1	25	2.7
Nickel	mg/l	0.01	0.04	0.04	ND	0.40	0.11	ND	ND	0.68	0.05
Sodium	mg/l	0.5	79	77	54	200	69	56	54	266	56

ND = Not detected. NR = Not requested.

ANALYTICAL RESULTS

for

Sparton Technology, Inc.

VOLATILE ORGANICS - PRIORITY POLLUTANTS

	Parameter	Units	Detection Limit	4333-01	4333-02	4333-03	4333-04	4333-05	4333-06	4333-07	4333-08	4333-09
1V	Acrolein	ug/l	100	ND	ND	ND	ND	ND	ND	ND	ND	ND
2V	Acrylonitrile	ug/l	100	ND	ND	ND	ND	ND	ND	ND	ND	ND
3V	Benzene	ug/l	5	ND	9	ND	58	ND	ND	ND	56	6
4V	Bis(chloromethyl)ether	ug/l	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
5V	Bromoform	ug/l	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
6V	Carbon tetrachloride	ug/l	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
7V	Chlorobenzene	ug/l	5	ND	ND	ND	16	ND	ND	ND	17	ND
8V	Chlorodibromomethane	ug/l	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
9V	Chloroethane	ug/l	10	ND	ND	ND	45	ND	ND	ND	27	ND
10V	2-Chloroethylvinyl ether	ug/l	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
11V	Chloroform	ug/l	5	15	34	ND	25	ND	ND	ND	33	ND
12V	Dichlorobromomethane	ug/l	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
13V	Dichlorodifluoromethane	ug/l	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
14V	1,1-Dichloroethane	ug/l	5	13	17	ND	3200	1900	ND	ND	2700	2100
15V	1,2-Dichloroethane	ug/l	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
16V	1,1-Dichloroethylene	ug/l	5	820	1000	85	3100	260	13	9	3700	460
17V	1,2-Dichloropropane	ug/l	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
18V	1,3-Dichloropropylene	ug/l	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
19V	Ethylbenzene	ug/l	5	ND	ND	ND	63	ND	ND	ND	53	ND
20V	Methylbromide	ug/l	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
21V	Methylchloride	ug/l	10	ND	ND	ND	70	ND	ND	ND	23	ND
22V	Methylene chloride	ug/l	10	1700	3600	11	49000	17	330	170	51000	66
23V	1,1,2,2-Tetrachloroethane	ug/l	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
24V	Tetrachloroethylene	ug/l	5	17	25	34	140	53	ND	ND	140	77
25V	Toluene	ug/l	5	45	6	ND	1600	50	ND	ND	1400	32
26V	1,2-trans-Dichloroethylene	ug/l	5	ND	ND	ND	200	19	ND	ND	140	21
27V	1,1,1-Trichloroethane	ug/l	5	4600	4100	2200	5500	2300	31	21	6700	2900
28V	1,1,2-Trichloroethane	ug/l	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
29V	Trichloroethylene	ug/l	5	6900	12000	4400	37000	4300	200	130	38000	6200
30V	Trichlorofluoromethane	ug/l	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
31V	Vinyl chloride	ug/l	10	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = Not detected. NR = Not requested.

ANALYTICAL RESULTS

for

Sparton Technology, Inc.

VOLATILE ORGANICS - ADDITIONAL COMPONENTS

Parameter	Units	Detection Limit	4333-01	4333-02	4333-03	4333-04	4333-05	4333-06	4333-07	4333-08	4333-09
Acetone	ug/l	10	ND	ND	ND	17000	28	ND	ND	22000	53
Ethanol	ug/l	400	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Hexanone	ug/l	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Meta-xylene*	ug/l	5	ND	ND	ND	42	ND	ND	ND	32	ND
Ortho, Para-xylene*	ug/l	5	ND	ND	ND	84	ND	ND	ND	67	ND
Trichlorotrifluoroethane	ug/l	5	24	9	48	73	35	ND	ND	90	67

ND = Not detected.   NR = Not requested.

*Please note that xylene = dimethylbenzene. The ortho and para isomers are not resolved chromatographically and are therefore reported together. Adding the ortho,para and meta results together gives the total xylene (dimethylbenzene) results.

SAMPLE DESCRIPTION INFORMATION

for

Sparton Technology, Inc., Inc.

RMA Sample No.	Sample Description	Sample Type	Date Sampled	Date Received
4346-01	PW-1-2	Water	10/8/84	10/11/84
4346-02	PW-1-3	Water	10/8/84	10/11/84

October 31, 1984

ANALYTICAL RESULTS

for

Sparton Technology, Inc.

INORGANIC PARAMETERS

Parameter	Units	Detection Limit	4346-01	4346-02
pH	units	0.01	7.86	7.85
Specific Conductance at 25°C	umhos/cm	1	791	789
Total Organic Carbon	mg/l	0.1	5.8	3.5
Total Organic Halogen	ugCl⁻/l	5	240	210

VOLATILE ORGANICS

Parameter	Units	Detection Limit	4346-01	4346-02
16V 1,1-Dichloroethylene	ug/l	5	16	12
29V Trichloroethylene	ug/l	5	150	110

ND = Not detected. NR = Not requested.

SAMPLE DESCRIPTION INFORMATION

for

Sparton Technology, Inc.

RMA Sample No.	Sample Description	Sample Type	Date Sampled	Date Received
4216-01	MW-12	Water	8/29/84	8/30/84

September 28, 1984

ANALYTICAL RESULTS

for

Sparton Technology

INORGANIC PARAMETERS

Parameter	Units	Detection Limit	4216-01
pH	units	0.01	7.65
Specific Conductance at 25^{o}C	umhos/cm	1	769
Fluoride	mg/l	0.1	0.3
Chloride	mg/l	3	23
Nitrite as N	mg/l	0.01	0.02
Nitrate as N	mg/l	0.01	1.3
Ortho-Phosphate as P	mg/l	0.01	ND
Sulfate	mg/l	5	136
Total Organic Carbon	mg/l	0.1	1.7
Total Organic Halogen	mg/l	5	74
Ammonia as N	mg/l	0.1	ND
Phenolics	mg/l	0.01	ND
Chromium +3	mg/l	0.005	ND
Hexvalent Chromium	mg/l	0.005	ND

ND = Not detected. NR = Not requested.

ANALYTICAL RESULTS

for

Sparton Technology

TRACE METALS

Parameter	Units	Detection Limit	4216-01
Arsenic	mg/l	0.002	0.006
Barium	mg/l	0.005	0.21
Boron	mg/l	0.004	0.12
Cadmium	mg/l	0.002	0.005
Chromium	mg/l	0.005	ND
Copper	mg/l	0.002	0.005
Iron	mg/l	0.05	0.09
Lead	mg/l	0.025	ND
Manganese	mg/l	0.005	0.98
Mercury	mg/l	0.0002	ND
Molybdenum	mg/l	0.005	0.012
Nickel	mg/l	0.01	ND
Selenium	mg/l	0.002	ND
Silver	mg/l	0.003	ND
Sodium	mg/l	0.5	54
Tin	mg/l	0.03	ND
Zinc	mg/l	0.004	0.055

ND = Not detected. NR = Not requested.

ANALYTICAL RESULTS

for

Sparton Technology

/OLATILE ORGANICS

'arameter		Units	Detection Limit	4216-01
V	Acrolein	ug/l	100	ND
:V	Acrylonitrile	ug/l	100	ND
;V	Benzene	ug/l	5	ND
ꞁV	Bis(chloromethyl)ether	ug/l	5	ND
;V	Bromoform	ug/l	5	ND
;V	Carbon tetrachloride	ug/l	5	ND
'V	Chlorobenzene	ug/l	5	ND
ꞁV	Chlorodibromomethane	ug/l	5	ND
)V	Chloroethane	ug/l	10	ND
:0V	2-Chloroethylvinyl ether	ug/l	5	ND
.1V	Chloroform	ug/l	5	ND
12V	Dichlorobromomethane	ug/l	5	ND
'3V	Dichlorodifluoromethane	ug/l	10	ND
14V	1,1-Dichloroethane	ug/l	5	ND
15V	1,2-Dichloroethane	ug/l	5	ND
16V	1,1-Dichloroethylene	ug/l	5	ND
17V	1,2-Dichloropropane	ug/l	5	ND
18V	1,3-Dichloropropylene	ug/l	5	ND
19V	Ethylbenzene	ug/l	5	ND
20V	Methylbromide	ug/l	10	ND
21V	Methylchloride	ug/l	10	20
22V	Methylene chloride	ug/l	10	ND
23V	1,1,2,2-Tetrachloroethane	ug/l	5	ND
24V	Tetrachloroethylene	ug/l	5	ND
25V	Toluene	ug/l	5	ND
26V	1,2-trans-Dichloroethylene	ug/l	5	ND
27V	1,1,1-Trichloroethane	ug/l	5	ND
28V	1,1,2-Trochloroethane	ug/l	5	ND
29V	Trichloroethylene	ug/l	5	61
30V	Trichlorofluoromethane	ug/l	10	ND
31V	Vinyl chloride	ug/l	10	ND

ND = Not detected.   NR = Not requested.

Rocky Mountain Analytical Laboratory

ANALYTICAL RESULTS

for

Sparton Technology

/OLATILE ORGANICS

'arameter	Units	Detection Limit	4216-01
Acetone	ug/l	10	ND
Ethanol	ug/l	10	ND
Freon	ug/l	5	ND
2-Hexanone	ug/l	10	ND
Xylene (Dimethyl benzene)	ug/l	5	ND
O-Xylene (Dimethyl benzene)	ug/l	5	ND

ID = Not detected. NR = Not requested.

SAMPLE DESCRIPTION INFORMATION

for

Sparton Technology

RMA Sample No.	Sample Description	Sample Type	Date Sampled	Date Received
4208-01	Boring MW-16 5-10'	Soil	8/16/84	8/25/84
4208-02	Boring MW-16 10-15'	Soil	8/16/84	8/25/84
4208-03	Boring MW-16 15-20'	Soil	8/16/84	8/25/84
4208-04	Boring MW-16 20-25'	Soil	8/16/84	8/25/84
4208-05	Boring MW-16 25-30'	Soil	8/16/84	8/25/84
4208-06	Boring MW-16 30-35'	Soil	8/16/84	8/25/84
4208-07	Boring MW-16 35-40'	Soil	8/16/84	8/25/84
4208-08	Boring MW-16 40-45'	Soil	8/16/84	8/25/84
4208-09	Boring MW-16 45-50'	Soil	8/16/84	8/25/84
4208-10	Boring MW-16 50-55'	Soil	8/20/84	8/25/84
4208-11	Boring MW-16 55-60'	Soil	8/20/84	8/25/84
4208-12	Boring MW-16 60-65'	Soil	8/20/84	8/25/84
4208-13	Boring MW-16 65-70'	Soil	8/20/84	8/25/84
4208-14	Boring MW-16 70-73'	Soil	8/20/84	8/25/84

October 3, 1984

ANALYTICAL RESULTS

for

Sparton Technology

INORGANIC PARAMETERS

Parameter	Units	Detection Limit	4208-01	4208-02	4208-03	4208-04	4208-05	4208-06	4208-07	4208-08	4208-09	4208-10
pH	units	0.01	7.76	8.25	8.55	8.22	8.27	7.60	8.00	7.52	7.79	7.71
Total Organic Halogen	$mgCl^-/kg$	100	NR	NR	ND	NR	NR	NR	ND	NR	NR	NR
Total Cyanide	mg/kg	0.25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexavalent Chromium, EP TOX	mg/l	0.01	ND	ND	0.02	0.02	ND	3.6	8.0	1.6	0.5	0.81
% Solids	%	0.1	94.0	97.0	97.5	95.6	92.6	95.4	94.2	91.3	94.0	93.5

Parameter	Units	Detection Limit	4208-11	4208-12	4208-13	4208-14
pH	units	0.01	8.27	8.20	8.17	8.08
Total Organic Halogen	$mgCl^-/kg$	100	ND	NR	NR	NR
Total Cyanide	mg/kg	0.25	ND	ND	ND	ND
Hexavalent Chromium, EP TOX	mg/l	0.01	ND	ND	ND	ND
% Solids	%	0.1	87.2	87.2	91.9	86.6

ND = Not detected. NR = Not requested.

Rocky Mountain Analytical Laboratory

ANALYTICAL RESULTS

for

Sparton Technology

:P TOXICITY METALS

'arameter	Units	Detection Limit	4208-01	4208-02	4208-03	4208-04	4208-05	4208-06	4208-07	4208-08	4208-09	4208-10
:admium	mg/l	0.002	ND	ND	0.003	ND	ND	0.003	0.006	0.028	0.013	0.005
:hromium	mg/l	0.005	ND	0.027	0.060	0.048	0.083	4.1	8.6	2.1	0.70	1.1
,ead	mg/l	0.025	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
lickel	mg/l	0.01	0.01	0.02	0.027	0.01	0.027	0.13	0.19	0.12	0.11	0.11
ilver	mg/l	0.003	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

'arameter	Units	Detection Limit	4208-11	4208-12	4208-13	4208-14
:admium	mg/l	0.002	ND	ND	ND	ND
:hromium	mg/l	0.005	ND	ND	0.011	0.007
,ead	mg/l	0.025	ND	ND	ND	ND
lickel	mg/l	0.01	0.045	0.026	0.050	0.045
ilver	mg/l	0.003	ND	ND	ND	ND

ID = Not detected. NR = Not requested.

ANALYTICAL RESULTS

for

Sparton Technology

OTAL TRACE METALS

arameter	Units	Detection Limit	4208-01	4208-02	4208-03	4208-04	4208-05	4208-06	4208-07	4208-08	4208-09	4208-10
admium	mg/kg	0.1	0.8	0.7	0.8	0.9	0.9	1.0	1.1	2.6	1.1	0.5
hromium	mg/kg	0.3	3.2	7.7	6.7	8.4	8.6	350	500	480	80	130
ead	mg/kg	1.3	3.4	3.4	3.6	3.2	3.0	ND	2.1	2.7	4.2	2.7
ickel	mg/kg	0.5	3.3	4.3	4.4	4.0	4.6	30	41	38	14	13
ilver	mg/kg	0.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

arameter	Units	Detection Limit	4208-11	4208-12	4208-13	4208-14
admium	mg/kg	0.1	0.6	0.4	1.0	1.2
hromium	mg/kg	0.3	9.8	24	52	69
ead	mg/kg	1.3	3.6	2.3	3.6	3.5
ickel	mg/kg	0.5	5.6	4.8	9.8	7.5
ilver	mg/kg	0.2	ND	ND	ND	ND

D = Not detected.   NR = Not requested.

Results given on a dry weight basis.

SUMMARY OF ANALYTICAL RESULTS AND METHODOLOGY

for

Sparton Technology, Inc. - November 1984 Sampling

As shown on the Sample Description Information sheet, RMAL received eleven samples in late November, 1984.

Results

Analytical results are presented in the enclosed tables. In general, all results are reported in mg/l (ppm). This represents a change over previous reports. This change was made to better permit cross comparison of the GC/MS results to results from other determinations.

These data are consistent with previous reports with one exception, volatile organic compound concentration, for sample MW-11. Previously (RMA #3339), volatile organics were detected in this sample in concentrations varying from .09 to .8 mg/l. The data reported for this sample in this report shows the compounds to be not detected. A review of both reports has not revealed any obvious errors. The current values appear to be correct based on the TOX value of only 0.006 ug/l. In general, the sum of the volatile organics and the TOX values correlate very well for this set of data.

Note that the results for MW-1 are consistent with the previous data in that the 1,1-dichloroethane is substantially less than the 1,1-dichloroethylene. The previous results for MW-16 still cannot be explained.

Analytical Methods

In general, all analyses were in accordance with standard EPA methodology as promulgated in 40 CFR 136. The enclosed table of Inorganic Analytical Methodology summarizes the methods for all parameters except organics.

The volatile organic species were determined by a combination of both GC and GC/MS. All of the priority pollutant organics listed in Table 4 were determined by GC/MS using EPA Method 624. Furthermore, with the exception of ethanol, all of the additional organics listed in Table 5 were also determined by GC/MS. These six organics (including ethanol) were also determined by direct aqueous injection GC/FID using a variation of EPA Method 603. This technique was also used to quantify high concentrations of volatile priority pollutants.

SAMPLE DESCRIPTION INFORMATION

for

Sparton Technology, Inc.

RMA Sample No.	Sample Description	Sample Type	Date Sampled	Date Received
4466-01	MW-10	Water	11/20/84	11/21/84
4466-02	MW-11	Water	11/20/84	11/21/84
4466-03	MW-5	Water	11/28/84	11/29/84
4466-04	MW-6	Water	11/28/84	11/29/84
4466-05	MW-7	Water	11/27/84	11/29/84
4466-06	MW-8	Water	11/27/84	11/29/84
4466-07	MW-9	Water	11/27/84	11/29/84
4466-08	MW-1	Water	11/29/84	11/30/84
4466-09	MW-2	Water	11/29/84	11/30/84
4466-10	MW-3	Water	11/29/84	11/30/84
4466-11	MW-4	Water	11/29/84	11/30/84

December 31, 1984

TABLE 1. ANALYTICAL RESULTS FOR INORGANIC PARAMETERS, WELLS 5-11

Parameter	Units	Detection Limit	MW-10	MW-11	MW-5	MW-6	MW-7	MW-8	MW-9
Sparton #			MW-10	MW-11	MW-5	MW-6	MW-7	MW-8	MW-9
RMA #			4466-01	4466-02	4466-03	4466-04	4466-05	4466-06	4466-07
pH	units	0.01	7.74	7.76	7.64	7.50	7.43	7.50	6.70
Specific Conductance at 25°C	umhos/cm	1	702	699	721	866	692	763	2350
Fluoride	mg/l	0.1	0.2	0.2	0.4	0.3	0.3	0.3	0.3
Nitrate as N	mg/l	0.01	0.2	0.5	1.8	16	3.3	7.4	ND
Sulfate	mg/l	5	119	118	112	120	85	80	372
Total Organic Carbon	mg/l	0.1	3.0	2.2	3.8	6.1	3.6	5.5	14
Total Organic Halogen	$mgCl^-/l$	5	0.040	0.006	0.22	0.45	0.85	0.18	21
Total Kjeldahl Nitrogen as N	mg/l	0.1	0.4	0.6	0.6	0.1	0.2	0.4	1.7
Phenolics	mg/l	0.01	ND	ND	ND	ND	ND	ND	0.02
Hexavalent Chromium	mg/l	0.01	ND	ND	ND	ND	0.02	ND	ND
Trivalent Chromium	mg/l	0.01	ND	ND	ND	ND	ND	ND	ND

ND = Not detected.

TABLE 2. ANALYTICAL RESULTS FOR INORGANIC PARAMETERS, WELLS 1-4

Parameter	Units	Detection Limit	MW-1	MW-2	MW-3	MW-4
Sparton #			MW-1	MW-2	MW-3	MW-4
RMA #			4466-08	4466-09	4466-10	4466-11
pH Value 1	units	0.01	7.73	7.50	7.48	8.17
pH Value 2	units	0.01	7.75	7.60	7.48	8.18
pH Value 3	units	0.01	7.72	7.57	7.47	8.17
pH Value 4	units	0.01	7.71	7.59	4.48	8.17
Specific Conductance at 25°C	umhos/cm	1	3450	714	4250	996
Specific Conductance at 25°C	umhos/cm	1	3420	711	4250	981
Specific Conductance at 25°C	umhos/cm	1	3410	716	4260	979
Specific Conductance at 25°C	umhos/cm	1	3410	710	4250	978
Fluoride	mg/l	0.1	0.4	0.3	0.8	0.4
Nitrate as N	mg/l	0.01	0.9	3.7	1.5	2.3
Sulfate	mg/l	5	285	112	810	150
Total Organic Carbon Value 1	mg/l	0.1	47	1.1	86	1.8
Total Organic Carbon Value 2	mg/l	0.1	49	1.0	86	1.8
Total Organic Carbon Value 3	mg/l	0.1	48	1.0	85	1.8
Total Organic Carbon Value 4	mg/l	0.1	47	1.0	85	1.8
Total Organic Halogen Value 1	mg/Cl⁻/l	0.005	45	2.8	86	14
Total Organic Halogen Value 2	mg/Cl⁻/l	0.005	45	2.3	68	14
Total Organic Halogen Value 3	mg/Cl⁻/l	0.005	42	2.7	74	14
Total Organic Halogen Value 4	mg/Cl⁻/l	0.005	39	2.5	80	12
Total Kjeldahl Nitrogen as N	mg/l	0.1	17	0.5	34	0.7
Phenolics	mg/l	0.01	ND	0.01	0.03	ND
Hexavalent Chromium	mg/l	0.01	24	ND	1.0	ND
Trivalent Chromium	mg/l	0.01	ND	ND	ND	ND

ND = Not detected.

TABLE 3. ANALYTICAL RESULTS FOR TRACE METALS

Parameter	Units	Detection Limit	MW-10	MW-11	MW-5	MW-6	MW-7	MW-8	MW-9	MW-1	MW-2	MW-3	MW-4
	Sparton #		MW-10	MW-11	MW-5	MW-6	MW-7	MW-8	MW-9	MW-1	MW-2	MW-3	MW-4
	RMA #		4466-01	4466-02	4466-03	4466-04	4466-05	4466-06	4466-07	4466-08	4466-09	4466-10	4466-11
Boron	mg/l	0.05	ND	ND	0.12	0.25	0.11	0.37	13	4.4	0.06	32	1.6
Cadmium	mg/l	0.009	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	mg/l	0.01	0.01	0.01	ND	ND	0.021	ND	ND	22	0.022	0.64	ND
Manganese	mg/l	0.006	0.93	0.78	0.68	0.34	0.03	ND	1.9	1.4	0.009	4.2	0.14
Nickel	mg/l	0.006	0.02	0.006	ND	0.005	ND	ND	0.19	0.042	ND	0.73	0.034
Sodium	mg/l	0.5	39	38	71	71	45	75	149	120	49	210	55

ND = Not detected.

TABLE 4. ANALYTICAL RESULTS FOR VOLATILE PRIORITY POLLUTANT ORGANICS

		Concentration, mg/l										
Sparton #		MW-10	MW-11	MW-5	MW-6	MW-7	MW-8	MW-9	MW-1	MW-2[2]	MW-3[2]	MW-4[3]
RMA #		4466-01	4466-02	4466-03	4466-04	4466-05	4466-06	4466-07	4466-08	4466-09	4466-10	4466-11
Parameter	Detection Limit											
1V Acrolein	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2V Acrylonitrile	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3V Benzene	0.005	ND	ND	ND	ND	ND	ND	0.016	0.050	ND	0.083	ND
4V Bis(chloromethyl)ether	0.005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
5V Bromoform	0.005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
6V Carbon tetrachloride	0.005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
7V Chlorobenzene	0.005	ND	ND	ND	ND	ND	ND	ND	0.006	ND	0.060	ND
8V Chlorodibromomethane	0.005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
9V Chloroethane	0.010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10V 2-Chloroethylvinyl ether	0.005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
11V Chloroform	0.005	ND	ND	ND	ND	ND	ND	0.057	0.16	ND	0.15	ND
12V Dichlorobromomethane	0.005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
13V Dichlorodifluoromethane	0.010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
14V 1,1-Dichloroethane	0.005	ND	ND	ND	ND	ND	ND	0.12	0.015	ND	0.061	ND
15V 1,2-Dichloroethane	0.005	ND	ND	ND	ND	ND	ND	ND	0.020	ND	0.050	ND
16V 1,1-Dichloroethylene	0.005	ND	ND	0.007	0.028	0.11	22	1.2	1.4	0.16	4.8	1.0
17V 1,2-Dichloropropane	0.005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
18V 1,3-Dichloropropylene	0.005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
19V Ethylbenzene	0.005	ND	ND	ND	ND	ND	ND	0.013	0.086	ND	ND	ND
20V Methylbromide	0.010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
21V Methylchloride	0.010	16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
22V Methylene chloride	0.010	ND	ND	ND	ND	ND	ND	5.2	17	0.035	57	2.3
23V 1,1,2,2-Tetrachloroethane	0.005	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.086	ND
24V Tetrachloroethylene	0.005	ND	ND	ND	ND	ND	ND	0.060	0.12	ND	0.50	ND
25V Toluene	0.005	ND	ND	ND	ND	ND	ND	0.29	1.4	0.042	3.2	ND
26V 1,2-trans-Dichloroethylene	0.005	ND	ND	ND	ND	ND	ND	0.011	ND	ND	ND	ND
27V 1,1,1-Trichloroethane	0.005	0.005	ND	0.070	0.081	0.18	0.082	6.9	2.8	0.86	27	4.4
28V 1,1,2-Trichloroethane	0.005	ND	ND	ND	ND	ND	ND	0.11	0.16	ND	0.42	ND
29V Trichloroethylene	0.005	0.012	ND	0.14	0.31	0.53	0.25	9.6	23	2.1	59	7.4
30V Trichlorofluoromethane	0.010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
31V Vinyl chloride	0.010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes

1. ND = Not detected.
2. Detection limit 10x those listed.
3. Detection limit 100x those listed.

TABLE 5. ANALYTICAL RESULTS FOR NON-PRIORITY POLLUTANT VOLATILE ORGANICS

		Concentration, mg/l										
Sparton #		MW-10	MW-11	MW-5	MW-6	MW-7	MW-8	MW-9	MW-1	MW-2[2]	MW-3[1]	MW-4[2]
RMA #		4466-01	4466-02	4466-03	4466-04	4466-05	4466-06	4466-07	4466-08	4466-09	4466-10	4466-11
Parameter	Detection Limit											
Acetone	0.010	ND[3]	ND	ND	ND	ND	ND	0.033	6.0	0.069	56	ND
Ethanol	0.50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Hexanone	0.010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichorotrifluoroethane	0.005	ND	ND	ND	0.061	0.073	ND	0.20	0.16	0.11	0.47	0.17
m-Xylene	0.005	ND	ND	ND	ND	ND	ND	0.007	0.033	ND	0.020	ND
o,p-Xylene[4]	0.005	ND	ND	ND	ND	ND	ND	0.015	0.036	ND	0.042	ND

Notes

1. Detection limit 10 x those listed.
2. Detection limit 100 x those listed.
3. ND = Not detected.
4. o-Xylene & p=Xylene reported together.

ROCKY MOUNTAIN ANALYTICAL LABORATORY

Organic Analytical Methodology

Parameter	Units	Nominal Detection Limit[a]	Methodology	Reference[1]	Preservation Bottle No.	Maximum Holding Time[b]
Purgeables	ug/l	1	Purge & Trap GC/MS	624	11	14 days
Base/Neutrals	ug/l	10	Extraction/GC/MS	625	12	7 days/40 days
Acids	ug/l	10	Extraction/GC/MS	625	12	7 days/40 days
Organochlorine Pesticides/PCB's	ug/l	0.01	Extraction/GC/ECD	608	13	7 days/40 days
		10	Extraction/GC/MS	625	12	7 days/40 days
Phenoxy Herbicides	ug/l	0.01	Extraction/GC/ECD	(2)	14	7 days/40 days
Total Organic Halogen (TOX)	ug/l	5	Adsorbtion/Coulometric	450.1(3)	15	-
Trihalomethanes (THM)	ug/l	1	Extraction/GC/ECD	(4)	11	14 days
		1	Purge & Trap GC/MS	(4)	11	14 days
Dioxin	ug/l	0.005	Extraction/GC/MS/ECD	613	16	7 days/40 days
Purgeable Halocarbons	ug/l	0.01	Purge & Trap/GC/Hall	601	11	14 days
Purgeable Aromatics	ug/l	1	Purge & Trap/GC/FID	602	17	14 days
Acrolein & Acrylonitrile	ug/l	100	Purge & Trap/GC/FID	603	18	14 days
Phenols by GC	ug/l	10	Extraction/GC/FID	604	16	7 days/40 days
Benzidines	ug/l	0.1	Extraction/HPLC	605	19	7 days/40 days
Phthalate Esters	ug/l	10	Extraction/GC/FID	606	12	7 days/40 days
Nitrosamines	ug/l	1	Extraction/GC/NPD	607	20	7 days/40 days
Nitroaromatics/isophorone	ug/l	1	Extraction/GC/FID & GC/ECD	609	12	7 days/40 days
Polynuclear Aromatics	ug/l	0.5	Extraction/HPLC	610	20	7 days/40 days
Haloethers	ug/l	1	Extraction/GC/Hall	611	17	7 days/40 days
Chlorinated Hydrocarbons	ug/l	0.02	Extraction/GC/ECD	612	12	7 days/40 days
Organophosphorus Pesticides	ug/l	0.1	Extraction/GC/NPD	622(5)	12	7 days/40 days
Triazine Pesticides	ug/l	0.1	Extraction/GC/NPD	(6)	12	7 days/40 days

References

(1) Federal Register, Vol. 44, No. 233, Monday, December 3, 1979.
(2) "Method for Chlorinated Phenoxy Acid Herbicides in Industrial Effluents," Federal Register, Vol. 38, No. 75, Part II.
(3) "Total Organic Halide," US EPA-EMSL, Cincinnati, November, 1980.
(4) Federal Register, Vol. 44, No. 231, Thursday, November 29, 1979, Appendix, Part I.
(5) "Method 622- Organophosphorus Pesticides," Proposed EPA Method, 304 (h) Committee.
(6) Federal Register, Vol. 38, No. 75, 1973.

Notes

[a] Nominal values are the best achievable with the listed analytical method for a typical component. Interferrences in specific samples may result in a higher detection limit.

[b] Applicable to NPDES Wastes as updated by Robert C. Booth, Director, EMSL-Cincinnati, September 22, 1981. Where two times are given, the first refers to the time to extraction, the second to the time of instrumental analysis.

ROCKY MOUNTAIN ANALYTICAL LABORATORY

Organic Analytical Methodology (continued)

Preservation Bottle No.	Parameter Group	Bottle	Preservation
11	Purgeables	40 ml glass with teflon lined silicone septum cap	4°C (thiosulfate if Cl_2 present)
17	Purgeables	40 ml glass with teflon lined silicone septum cap	4°C, HCl to pH less than 2 (thiosulfate if Cl_2 present)
18	Purgeables	40 ml glass with teflon lined silicone septum cap	4°C, adjust pH to 4 - 5 (thiosulfate if Cl_2 present)
16	Extractables	1 liter glass with teflon lined cap	4°C (thiosulfate if Cl_2 present)
19	Extractables	1 liter glass with teflon lined cap	4°C, adjust pH to 2 - 7 (thiosulfate if Cl_2 present)
12, 13, 14	Extractables	1 liter glass with teflon lined cap	4°C
20	Extractables	1 liter glass with teflon lined cap	4°C, store in dark (thiosulfate is Cl_2 present)
15	TOX	250 ml glass with teflon lined cap, single 1 liter glass with teflon lined cap, quad.	4°C, store in dark (thiosulfate if Cl_2 present)

ROCKY MOUNTAIN ANALYTICAL LABORATORY

Inorganic Analytical Methodology

Parameter	Units	Nominal Detection Limit[a]	Methodology	Reference	Preservation Bottle No.	Maximum Holding Time[b]
MAJOR IONS						
Sodium	mg/l	0.5	ICP Emission Spectroscopy	3	4	6 months
Potassium	mg/l	0.3	ICP Emission Spectroscopy	3	4	6 months
Calcium	mg/l	0.1	ICP Emission Spectroscopy	3	4	6 months
Magnesium	mg/l	0.1	ICP Emission Spectroscopy	3	4	6 months
Chloride	mg/l	3	Manual Titrimetric, $Hg(NO_3)_2$	1-325.3/2-407B	1	28 days
			Automated Colorimetric Ferricyanide	1-325.2	1	28 days
Fluoride	mg/l	0.1	Electrode	1-340.2/2-413B	1	28 days
Sulfate	mg/l	5	Manual Turbidimetric	1-375.4/2-426C	1	28 days
			Automated Colorimetric MTB	1-375.2	1	28 days
Total Alkalinity as $CaCO_3$ at pH 4.5	mg/l	5	Titrimetric	1-310.1/2-403	1	14 days
Carbonate Alkalinity as $CaCO_3$ at pH 8.3	mg/l	5	Titrimetric	1-310.1/2-403	1	14 days
Bicarbonate Alkalinity as $CaCO_3$ at pH 4.5	mg/l	5	Titrimetric	1-310.1/2-403	1	14 days
Hydroxide Alkalinity as $CaCO_3$	mg/l	5	Calculation	2-403	-	-
Nitrate+Nitrite as N	mg/l	0.1	Manual Cd Reduction - Colorimetric	1-353.3/2-418C	2	28 days
		0.1	Automated Cd Reduction - Colorimetric	1-353.2	2	28 days
Total Cations	meq/l	0.1	Calculation	2-104C	-	-
Total Anions	meq/l	0.1	Calculation	2-104C	-	-
Difference	%	0.1	Calculation	2-104C	-	-
RADIOCHEMISTRY						
Gross Alpha	pCi/l	0.1	Proportional Counter	2-703	5	6 months
Gross Beta	pCi/l	0.1	Proportional Counter	2-703	5	6 months
Radium 226	pCi/l	0.1	Separation - Counter	2-705	5	6 months
Radium 228	pCi/l	0.1	Separation - Counter	2-707	5	6 months
Uranium	mg/l	0.005	Fluorimetric	4-D2907-75	5	6 months

ROCKY MOUNTAIN ANALYTICAL LABORATORY

Inorganic Analytical Methodology (Continued)

Parameter	Units	Nominal Detection Limit[a]	Methodology	Reference	Preservation Bottle No.	Maximum Holding Time[b]
TRACE METALS[c]						
Aluminum	mg/l	0.05	ICP Emission Spectroscopy	3	4	6 months
Antimony	mg/l	0.002	Furnace Atomic Absorption	1-204.2	4	6 months
Arsenic	mg/l	0.002	Furnace Atomic Absorption	1-206.2	4	6 months
Barium	mg/l	0.005	ICP Emission Spectroscopy	3	4	6 months
Beryllium	mg/l	0.001	ICP Emission Spectroscopy	3	4	6 months
Boron	mg/l	0.004	ICP Emission Spectroscopy	3	4	6 months
Cadmium	mg/l	0.002	ICP Emission Spectroscopy	3	4	6 months
Chromium	mg/l	0.005	ICP Emission Spectroscopy	3	4	6 months
Cobalt	mg/l	0.003	ICP Emission Spectroscopy	3	4	6 months
Copper	mg/l	0.002	ICP Emission Spectroscopy	3	4	6 months
Iron	mg/l	0.05	ICP Emission Spectroscopy	3	4	6 months
Lead	mg/l	0.025	ICP Emission Spectroscopy	3	4	6 months
		0.001	Furnace Atomic Absorption	1-239.2	4	6 months
Manganese	mg/l	0.005	ICP Emission Spectroscopy	3	4	6 months
Mercury	mg/l	0.0002	Cold Vapor Atomic Absorption	1-245.1	4	6 months
Molybdenum	mg/l	0.005	ICP Emission Spectroscopy	3	4	6 months
Nickel	mg/l	0.01	ICP Emission Spectroscopy	3	4	6 months
Selenium	mg/l	0.002	Furnace Atomic Absorption	1-270.2	4	6 months
Silver	mg/l	0.003	ICP Emission Spectroscopy	3	4	6 months
Strontium	mg/l	0.005	ICP Emission Spectroscopy	3	4	6 months
Thallium	mg/l	0.002	Furnace Atomic Absorption	1-279.2	4	6 months
Tin	mg/l	0.03	ICP Emission Spectroscopy	3	4	6 months
Titanium	mg/l	0.002	ICP Emission Spectroscopy	3	4	6 months
Vanadium	mg/l	0.002	ICP Emission Spectroscopy	3	4	6 months
Zinc	mg/l	0.004	ICP Emission Spectroscopy	3	4	6 months
INORGANIC PARAMETERS						
pH	units	0.01	Meter	1-150.1; 2-423	1	ASAP
Specific Conductance at 25°C	umhos/cm	1	Bridge	1-120.1; 2-205	1	28 days
Total Dissolved Solids	mg/l	10	Gravimetric, 180°C	1-160.1; 2-209B	1	7 days
Total Suspended Solids	mg/l	2	Gravimetric, 105°C	1-160.2	1	7 days
Total Solids	mg/l	10	Gravimetric, 105°C	1-160.3	1	7 days
Total Volatile Solids	mg/l	10	Gravimetric, 550°C	1-160.4	1	7 days
Ortho-Phosphate as P	mg/l	0.01	Single Reagent Colorimetric	1-365.2; 2-424F	1	48 hours

ROCKY MOUNTAIN ANALYTICAL LABORATORY

Inorganic Analytical Methodology (Continued)

Parameter	Units	Nominal Detection Limit[a]	Methodology	Reference	Preservation Bottle No.	Maximum Holding Time[b]
INORGANIC PARAMETERS (Continued)						
Total Phosphorus as P	mg/l	0.06	Digestion; ICP Emission Spectroscopy	1-4.1.4; 3	4	28 days
		0.01	Digestion - Colorimetric	1-365.2; 1-424C,F	2	28 days
Silica as SiO_2	mg/l	0.1	ICP Emission Spectroscopy	3	4	28 days
	mg/l	1	Colorimetric	1-370.1; 2-425C	1	28 days
Biological Oxygen Demand	mg/l	2	Dilution Bottle - D.O. Probe	1-405.1; 2-507	1	48 hours
Chemical Oxygen Demand	mg/l	5	Micro Colorimetric	1-410.4; 2-508A	2	28 days
Total Organic Carbon	mg/l	0.1	Oxidation-Infrared Absorption	1-415.1; 2-505	2	28 days
Ammonia as N	mg/l	0.1	Electrode	1-350.3; 2-417E	2	28 days
		0.1	Automated Colorimetric	1-350.1	2	28 days
Total Kjeldahl Nitrogen as N	mg/l	0.1	Digestion - Electrode	1-351.4; 2-420B	2	28 days
		0.1	Digestion - Colorimetric	1-351.2	2	28 days
Total Organic Nitrogen as N	mg/l	0.1	Calculation (TKN - NH_3)	-	-	-
Oil and Grease	mg/l	1	Freon Extraction-Gravimetric	1-413.1; 2-503A	3	28 days
Free Cyanide	mg/l	0.01	Chlorination-Distillation-Colorimetric	1-335.1; 2-412F,D	6	14 days
Total Cyanide	mg/l	0.01	Distillation - Colorimetric	1-335.2; 2-412B,D	6	14 days
Phenolics	mg/l	0.01	Distillation - Colorimetric	1-420.1; 2-510A,B	2	28 days
Fecal Coliform	Colonies/100 ml	1	Membrane Filter	2-909C	8	ASAP
Total Coliform	Colonies/100 ml	1	Membrane Filter	2-909A	8	ASAP
Bromide	mg/l	0.1	Colorimetric	2-405	1	28 days
Residual Chlorine	mg/l	0.05	Amperometric	1-330.2; 2-408C	1	ASAP
Hexavalent Chromium	mg/l	0.01	Colorimetric	1-218.4; 2-312B	1	24 hours
Color	units	5	Pt-Co Colorimetric	1-110.2; 2-204A	1	48 hours
Hardness as $CaCO_3$	mg/l	5	Calculation	2-314A	4	6 months
Nitrite as N	mg/l	0.01	Colorimetric	1-354.1; 2-419	1	48 hours
Sulfide	mg/l	0.05	Titrimetric - Electrode	1-376.1; 2-427B,D	7	7 days
Sulfite	mg/l	2	Titrimetric	1-377.1; 2-428	1	ASAP
MBAS (Surfactants)	mg/l	0.1	Colorimetric	1-425.1; 2-512A	1	48 hours
Turbidity	NTU	0.1	Turbidimeter	1-180.1; 2-214A	1	48 hours

ROCKY MOUNTAIN ANALYTICAL LABORATORY

Inorganic Analytical Methodology (Continued)

References

(1) "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, EMSL, Cincinnati, 1979.

(2) "Standard Methods for the Examination of Water and Wastewater", 15th Edition, APHA, 1980.

(3) Federal Register, 40 CFR 136, December 3, 1979; USEPA EMSL-Cincinnati, OH 45268.

(4) "Annual Book of ASTM Standards", Part 31, Water, 1980.

Notes

[a] Nominal values are the best achievable with the listed analytical method. Interferences in specific samples may result in a higher detection limit.

[b] Applicable to NPDES wastes as updated by Robert C. Booth, Director, EMSL-Cincinnati, September 22, 1981.

[c] Digestion procedure 1-4.1.4 used for elements determined by ICP Emission Spectroscopy when determining total metals. Digestion procedures for graphite furnace elements included with reference listed.

11/10/82

GUIDELINES FOR SAMPLE BOTTLES AND PRESERVATIVES[a]

Bottle No.	Parameters	Container	Preservative	Notes
1	Cl^-, F^-, $SO_4^=$, Tot. Alk., $CO_3^=$ Alk., HCO_3^- Alk., OH^- Alk., pH, spec. cond., TDS, TSS, TS, TVS, o-PO_4 SiO_2, BOD, Br^-, res. Cl_2, Cr^{+6}, color, NO_2^-, $SO_3^=$, MBAS, Turbidity.	1 liter poly	4° C	Provide unfiltered sample for solids and turbidity.
2	Tot. P, COD, TOC, NH_3, TKN, TON, Phenolics $NO_3 + NO_2$.	500 ml poly	2 ml 50% H_2SO_4, 4°C	
3	O & G	1 liter glass	4 ml 50% H_2SO_4, 4°C	Do not filter, collect directly in bottle.
4	Na, K, Ca, Mg, Al, Sb, As, Ba, Be, B, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Mo, Ni, Se, Ag, Sr, Tl, Sn, Ti, V, Zn, ICP, Hardness.	500 ml poly	5 ml 50% HNO_3	Provide separate samples for total and dissolved sample (filter before adding to bottle.)
5	Alpha, Beta, Ra^{226}, Ra^{228}, U	1 liter poly (no Ra^{228}) ½ gallon poly (with Ra^{228})	10 ml 50% HNO_3 20 ml 50% HNO_3	
6	Free CN, Tot. CN	500 ml poly	2 ml 50% NaOH, 4°C	
7	Sulfide	250 ml poly	1 ml 1 N Zn acetate, 1 ml 50% NaOH, 4°C	
8	Fecal coli., total coli.	8 oz. sterile	4° C	Collect directly in sterile bottle
11	VOA, purgeable organics, THM	2 - 40 ml glass vial	4° C	Completely fill bottle, leave no air bubbles.
12	B/NA	1 liter glass	4° C	
13	Pest./PCB	1 liter glass	4° C	
14	Herbicides	1 liter glass	4° C	
15	TOX	1 liter glass	4° C	

[a] Federal Register, 40 CFR 136, December 3, 1979, as updated by EPA, EMSL-Cincinnati, September 22, 1981.

APPENDIX D

AQUIFER TEST PROCEDURES

APPENDIX D

Aquifer Test Procedures

The purpose of an aquifer test is to estimate the hydrogeologic properties of the subsurface. These properties are determined by stressing the aquifer by either the addition or removal of water and monitoring the hydrostatic and chemical changes which occur at monitoring points throughout the system. Prediction of aquifer response can be made under different conditions, if the hydrogeologic framework is correctly understood. These test are also used to determine the hydraulics of wells in order to design pumping systems.

The tests conducted at the SPARTON site included a series of pumping tests on PW-1 and an infiltration test of the infiltration gallery adjacent to MW-17. The methodology employed in each test is discussed in the next section.

PW-1 Aquifer Test

A 25-horsepower submersible pump was installed 126 feet below TOC in PW-1 by Rodgers & Company on October 4, 1984. Discharge from the pump was directed through 4-inch irrigation pipe to the municipal sewer located just off the southeast corner of SPARTON property. SPARTON personnel obtained permission from the Albuquerque Sewer Authority for the discharge.

The pump was powered with a diesel electric generator and flow was controlled with a valve and direct-reading totalizing flow meter.

Water level measurements were taken in all wells with an accurately calibrated water level indicator such as a chalked steel tape or electric conductivity probe. All levels were referenced into the TOC elevation, which was determined by a registered surveyor.

Constant water level measurements were automatically recorded with the use of a computer-operated pressure transducer system manufactured by INSITU-Inc., Laramie, Wyoming. The SE-2000 system collected data from four transducers throughout the tests, reduced and tabulated the data, and printed graphs of water level changes in MW-12, 13, 14, and PW-1. These data were complemented by periodic hand water level measurements in the surrounding wells using a chalked steel tape or a battery-operated water level indicator.

All data from the tests were reduced into a format of elapsed time and drawdown and analyzed by standard hydrogeologic methods such as those discussed in Lohman, 1979. The Theis, Jacob, and Hantush methods of analyses were used to develop aquifer parameters.

The results of these analyses were then used to estimate the flow and storage properties of the subsurface, and to determine the hydraulic characteristics of the upper finer-grain layer.

Infiltration Test

A pilot-scale infiltration test was conducted using the infiltration gallery constructed 5 feet south of MW-17. The gallery consisted of a nominal 8-foot long, 1-foot wide, wooden box 4-feet deep filled with coarse gravel. The actual open area of the bottom of the gallery was 7 feet^2.

Water was added to the gallery from the fire hydrant at the northwest corner of the SPARTON property, keeping the gallery filled to a prescribed elevation. The infiltration rate was monitored with an in-line flow meter and controlled with a valve.

The pressure transducer system was used to monitor water-level changes in MW-11, 16, and 17. The fourth transducer was placed in the gallery.

This pilot-scale test was conducted in order to develop actual infiltration rates rather than a small double-ring infiltrometer which would yield data on the vertical hydraulic conductivity coefficient. The pilot-scale study removed much of the calculation and extrapolation which would be necessary to design a full-scale infiltration gallery.

Aquifer Parameters

The parameters of greatest interest are the aquifer's Transmissivity, Hydraulic Conductivity, Storage and Leakage coefficients. The following is a brief discussion of each parameter.

Transmissivity (T) describes the ability of water to flow through the aquifer. Specifically defined, it is the quantity of ground water which will travel through a vertical unit width of aquifer under a hydraulic gradient of one. It is dependent upon both the aquifer material and thickness. Typical units are gallons per day per foot (gpd/ft) or feet ^{2}/day (ft^2/day).

Hydraulic conductivity (K) of an aquifer is defined as the quantity of ground water that will flow through a unit area of aquifer under a unit gradient. The horizontal K of an aquifer is equal to the Transmissivity divided by the aquifer thickness (b): $K = T/b$. Typical units are gallons per day per square foot (gpd/ft^2) or feet/day (ft/day). Soil hydraulic conductivity is often listed in cm/sec, but these units are generally not applicable to ground water situations.

Storage coefficient (S) describes the quantity of ground water removed from the aquifer per unit decline of either the water table or the potentiometric surface. For water table aquifers, S typically ranges from 0.01 to 0.20 and in confined or semi-confined aquifers, S can range from 0.000001 to 0.001. The parameter is unitless, being the ratio of water yielded to volume of aquifer.

Leakage coefficient (K'/b') is the ratio of the hydraulic conductivity of the semi-confining layer to its thickness. Typical units are in 1/day or gallons per day per cubic feet (gpd/ft^3). The leakier the confining layer, the greater the K'/b'.

REFERENCES

1. Lohman, S.W. 1979. Ground-Water Hydraulics: United States Geological Survey Professional Paper 708.

APPENDIX E

AQUIFER TEST DATA

SPARTON CONSTANT-RATE TEST PW-1
Run 3
10/07/84

SE200B DATA
constant rate test

SPARTON TECHNOLOGY INC
ALBUQUERQUE NEW MEXICO
Constant rate test of PW-1
HARDING LAWSON ASSOCIATES INC
HOUSTON TEXAS
JOB # 6310 013.12
OPERATORS: DAVID BRATBERG &
FRANK DELUCA
Anticipated Q= 150 gpm
Total test time: 48 hrs

TRANSDUCER TABLE

Input 1: PW-1
Transducer s/n: 135
Scale factor: 49.95
Initial level: 67.47 feet

Input 2: MW-12
Transducer s/n: 871/846
Scale factor: 10.02
Initial level: 64.52 feet

Input 3: MW-13
Transducer s/n: 477/830
Scale factor: 10.12
Initial level: 65.18 feet

Input 4: MW-14
Transducer s/n: 034
Scale factor: 10.1
Initial level: 65.47 feet

PUMP SCHEDULE

Drawdown for 2880 min
Pump at 200 GPM
Pump set at 131 feet

Recovery for 1440 min

SAMPLING SCHEDULE

0-1	min	@	5 sec
1-10	min	@	20 sec
10-100	min	@	2 min
100-1000	min	@	20 min
1000-10000	min	@	60 min
10000-9999[illegible]	[illegible]	@	200 min

---------DRAWDOWN REPORT---------

Started at 1015
Lasted 1499.9 min

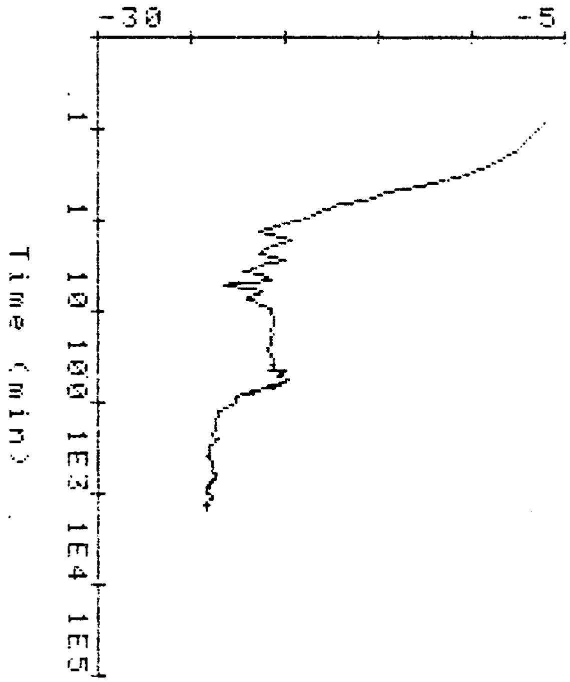
Input 1 (feet):

Time	ET (min)	level	Δlevel
1015	0.000	67.47	0.00
1015	0.084	73.58	-6.11
1015	0.167	74.95	-7.47
1015	0.251	76.47	-9.00
1015	0.334	78.32	-10.85
1015	0.417	80.28	-12.80
1015	0.501	81.95	-14.48
1015	0.584	83.33	-15.86
1015	0.667	84.51	-17.04
1015	0.751	85.24	-17.77
1015	0.834	85.79	-18.32
1015	0.917	86.41	-18.94
1016	1.001	86.97	-19.50
1016	1.377	88.84	-21.37
1016	1.710	87.20	-19.73
1017	2.043	88.57	-21.10
1017	2.377	88.86	-21.39
1017	2.710	87.48	-20.01
1018	3.043	88.44	-20.97
1018	3.377	89.22	-21.75
1018	3.710	89.84	-22.37
1019	4.043	88.64	-21.17
1019	4.377	88.25	-20.78
1019	4.710	89.41	-21.94
1020	5.043	90.21	-22.74
1020	5.377	90.69	-23.22
1020	5.710	89.16	-21.69
1021	6.043	88.74	-21.27
1021	6.377	88.87	-21.40
1021	6.710	89.19	-21.72
1022	7.043	89.52	-22.05
1022	7.377	89.51	-22.04
1022	7.710	89.26	-21.79
1023	8.043	88.9[illegible]	-21.50
1023	8.377	88.7[illegible]	-21.23
1023	8.710	88.5[illegible]	-[illegible].04
1024	9.043	88.33	-20.86
1024	9.377	88.21	-20.74
1024	9.710	88.28	-20.81
1025	10.043	88.24	-20.77
1027	12.312	88.02	-20.55
1029	14.078	88.07	-20.60
1031	16.142	88.20	-20.73
1033	18.142	88.17	-20.70
1035	20	[illegible]1	-20.74
1037	22	[illegible]3	-20.75
1039	24	[illegible]8	-20.81

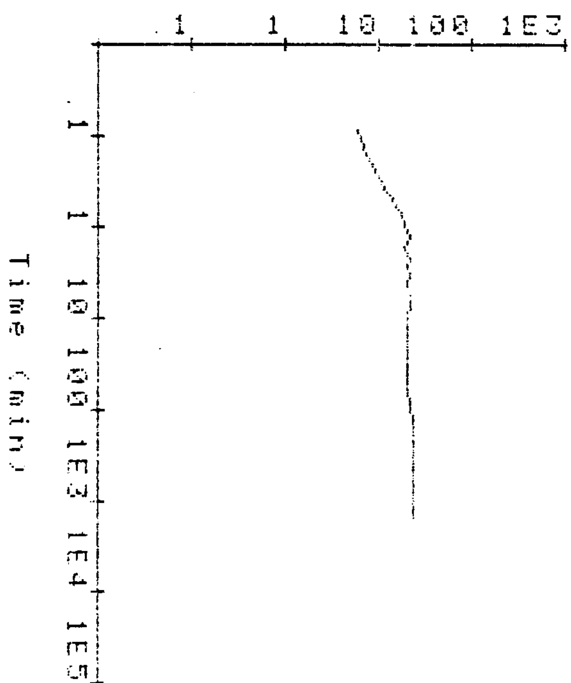
1041	26 [illegible]	[illegible]	-20.91
1043	28 [illegible]	[illegible]	-20.94
1045	30 [illegible]	[illegible]	-20.83
1047	32.068	88.18	-20.71
1049	34.068	88.14	-20.67
1051	36.068	88.10	-20.62
1053	38.068	88.12	-20.65
1055	40.068	88.18	-20.71
1057	42.068	88.17	-20.70
1059	44.068	88.38	-20.91
1101	46.068	87.52	-20.05
1103	48.193	87.79	-20.32
1105	50.193	87.76	-20.29
1107	52.193	87.94	-20.47
1109	54.193	87.61	-20.14
1111	56.193	87.29	-19.82
1113	58.193	87.32	-19.85
1115	60.193	87.51	-20.03
1117	62.193	87.76	-20.29
1119	64.193	87.74	-20.26
1121	66.193	88.34	-20.87
1123	68.193	88.17	-20.70
1125	70.193	88.67	-21.20
1127	72.193	88.64	-21.17
1129	74.193	89.05	-21.58
1131	76.193	89.29	-21.82
1133	78.193	89.15	-21.68
1135	80.193	89.85	-22.38
1137	82.193	89.77	-22.30
1139	84.193	90.08	-22.61
1141	86.193	89.95	-22.48
1143	88.193	90.11	-22.64
1145	90.193	90.17	-22.70
1147	92.193	90.16	-22.68
1149	94.193	90.10	-22.63
1151	96.193	90.08	-22.61
1153	98.193	90.05	-22.58
1215	120.150	91.02	-23.55
1235	140.160	91.08	-23.61
1255	160.160	91.21	-23.74
1315	180.170	91.22	-23.75
1335	200.150	91.15	-23.68
1355	220.150	91.32	-23.85
1415	240.150	91.34	-23.87
1435	260.070	91.11	-23.63
1455	280.070	91.22	-23.75
1515	300.070	91.51	-24.04
1535	320.070	91.54	-24.07
1555	340.070	91.55	-24.08
1615	360.070	91.52	-24.05
1635	380.070	91.64	-24.17
1655	400.070	91.58	-24.11
1715	420.070	91.47	-23.99
1735	440.070	91.44	-23.97
1755	460.030	91.38	-23.91
1815	480.030	91.42	-23.95
1835	500.030	91.42	-23.95
1855	520.030	91.41	-23.94
1915	540.030	91.41	-23.94
1935	560.030	91.39	-23.92
1955	580.030	91.34	-23.87
2015	600.030	91.29	-23.82
2035	620.[illegible]	91.31	-23.84
2055	640.[illegible]	[illegible]	-23.72
2115	660.[illegible]	[illegible]	-23.79
2135	680.[illegible]	[illegible]	-23.75
2155	70[illegible]	[illegible]71	-23.84
2215	72[illegible]	[illegible]8	-23.91
2235	740.100	91.39	-23.92
2255	760.100	91.49	-24.01
2315	780.100	91.47	-23.99
2335	800.100	91.62	-24.15
2355	820.130	91.48	-24.01
0015	840.130	91.51	-24.04
0035	860.130	91.62	-24.15
0055	880.130	91.65	-24.18
0115	900.130	91.68	-24.21
0135	920.130	91.68	-24.21
0155	940.130	91.64	-24.17
0215	960.130	91.70	-24.23
0235	980.130	91.68	-24.21
0255	1000.100	91.58	-24.11
0355	1060.300	91.45	-23.98
0455	1120.300	91.45	-23.98
0555	1180.300	91.51	-24.04
0655	1240.300	91.62	-24.15
0755	1300.300	91.54	-24.07
0855	1360.300	91.81	-24.34
0955	1420.200	91.70	-24.23
1055	1480.200	91.68	-24.21
1114	1499.900	91.68	-24.21

Average [illegible] .29

Input 1 (Δfeet)



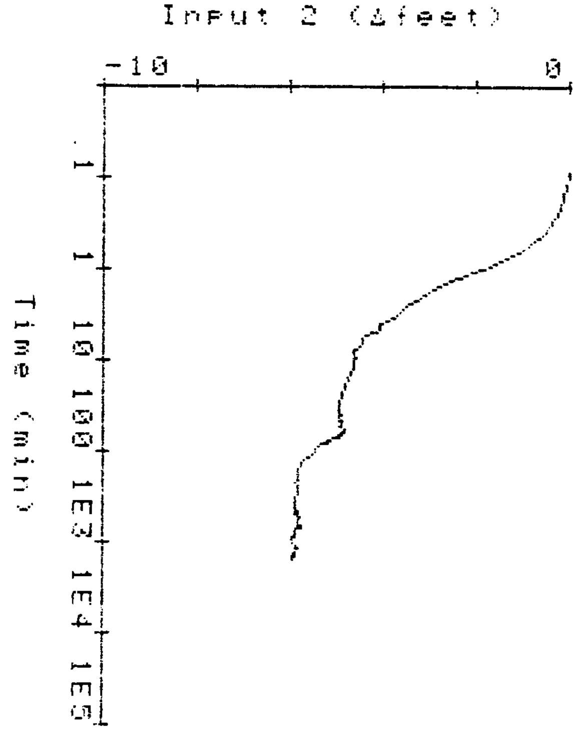
Input 1 (Δfeet)

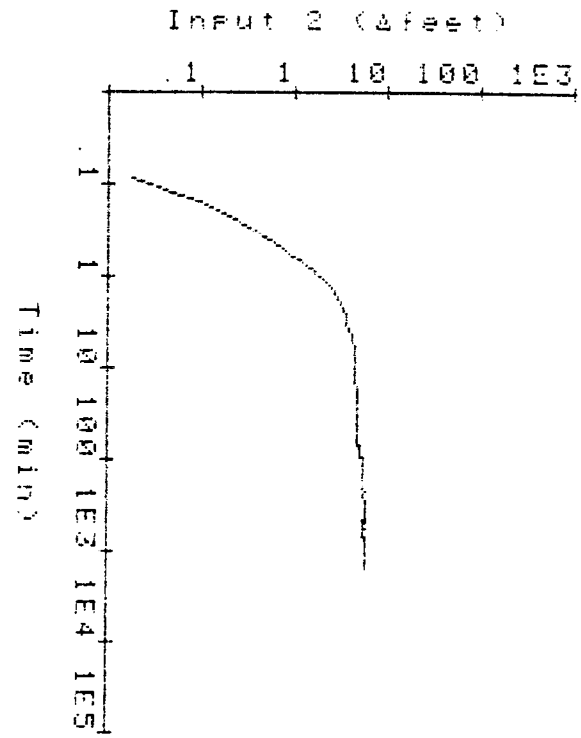


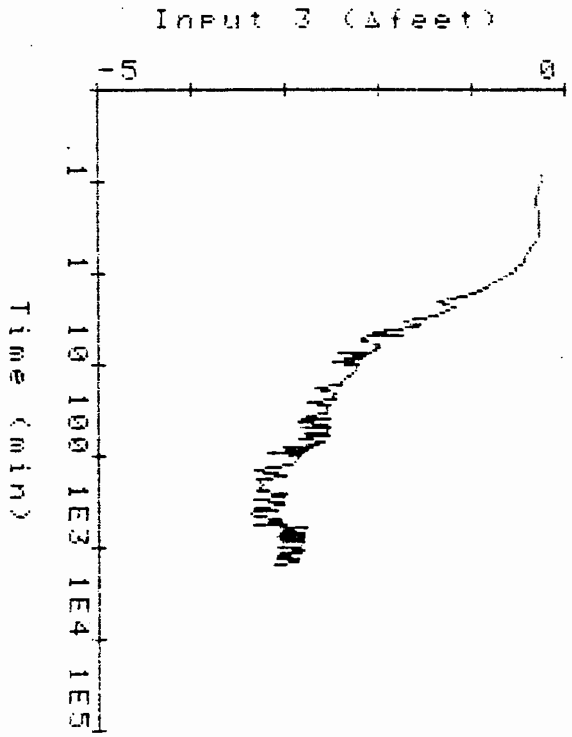
Input 2 (

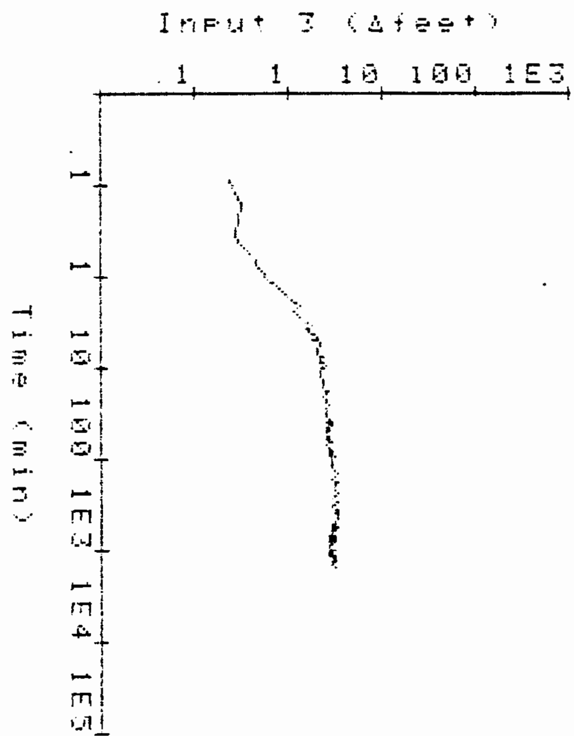
Time	ET [illegible]	[illegible]	Δlevel
1015	0.000	64.52	0.00
1015	0.084	64.54	-0.02
1015	0.167	64.64	-0.12
1015	0.251	64.79	-0.26
1015	0.334	64.94	-0.42
1015	0.417	65.11	-0.59
1015	0.501	65.28	-0.76
1015	0.584	65.47	-0.95
1015	0.667	65.64	-1.12
1015	0.751	65.85	-1.33
1015	0.834	66.04	-1.51
1015	[illegible].917	66.23	-1.70
1016	[illegible].001	66.41	-1.89
1016	1.377	67.05	-2.53
1016	1.710	67.47	-2.95
1017	2.043	67.69	-3.17
1017	2.377	67.93	-3.41
1017	2.710	68.06	-3.54
1018	3.043	68.15	-3.63
1018	3.377	68.28	-3.76
1018	3.710	68.45	-3.93
1019	4.043	68.57	-4.05
1019	4.377	68.60	-4.08
1019	4.710	68.64	-4.11
1020	5.043	68.76	-4.24
1020	5.377	68.88	-4.36
1020	5.710	68.97	-4.45
1021	6.043	68.96	-4.44
1021	6.377	68.94	-4.42
1021	6.710	68.98	-4.46
1022	7.043	69.03	-4.51
1022	7.377	69.07	-4.55
1022	7.710	69.13	-4.61
1023	8.043	69.15	-4.63
1023	8.377	69.16	-4.64
1023	8.710	69.14	-4.62
1024	9.043	69.11	-4.59
1024	9.377	69.13	-4.61
1024	9.710	69.12	-4.60
1025	10.043	69.13	-4.61
1027	12.312	69.17	-4.65
1029	14.078	69.20	-4.67
1031	16.142	69.25	-4.73
1033	18.142	69.31	-4.79
1035	20.472	69.33	-4.81
1037	22.068	69.37	-4.85
1039	24.068	69.38	-4.86
1041	26.068	69.42	-4.89
1043	28.068	69.44	-4.92
1045	30.068	69.45	-4.93
1047	32.068	69.44	-4.92
1049	34.068	69.43	-4.91
1051	36.068	69.44	-4.92
1053	38.068	69.43	-4.91
1055	40.068	69.46	-4.93
1057	42.068	69.45	-4.93
1059	44.068	69.47	-4.95
1101	46.068	69.40	-4.88
1103	48.193	69.37	-4.85
1105	50.193	69.40	-4.88
1107	52.193	69.43	-4.91
1109	54.193	69.38	-4.86
1111	56.[illegible]	[illegible] 34	-4.82
1113	58.[illegible]	[illegible]33	-4.91
1115	60.[illegible]	[illegible]31	-4.79
1117	62.1[illegible]	[illegible]9	-4.87

1119	[illegible]	69.40	-4.88
1121	[illegible]	69.46	-4.94
1123	[illegible]	69.48	-4.96
1125	[illegible]	69.56	-5.04
1127	72.193	69.58	-5.06
1129	74.193	69.61	-5.09
1131	76.193	69.71	-5.19
1133	78.193	69.73	-5.21
1135	80.193	69.79	-5.27
1137	82.193	69.85	-5.33
1139	84.193	69.87	-5.35
1141	86.193	69.90	-5.38
1143	88.193	69.92	-5.40
1145	90.193	69.95	-5.43
1147	92.193	69.97	-5.45
1149	94.193	69.96	-5.43
1151	96.193	69.96	-5.44
1153	98.193	69.95	-5.43
1215	120.150	70.21	-5.69
1235	140.160	70.28	-5.76
1255	160.160	70.32	-5.80
1315	180.170	70.33	-5.81
1335	200.150	70.33	-5.81
1355	220.150	70.38	-5.86
1415	240.150	70.35	-5.82
1435	260.070	70.33	-5.81
1455	280.070	70.36	-5.84
1515	300.070	70.36	-5.84
1535	320.070	70.39	-5.87
1555	340.070	70.39	-5.87
1615	360.070	70.40	-5.88
1635	380.070	70.41	-5.89
1655	400.070	70.39	-5.87
1715	420.070	70.38	-5.86
1735	440.070	70.37	-5.85
1755	460.030	70.34	-5.82
1815	480.030	70.39	-5.87
1835	500.030	70.35	-5.82
1855	520.030	70.31	-5.79
1915	540.030	70.29	-5.77
1935	560.030	70.34	-5.82
1955	580.030	70.36	-5.84
2015	600.030	70.34	-5.82
2035	620.030	70.35	-5.83
2055	640.170	70.28	-5.76
2115	660.050	70.34	-5.82
2135	680.050	70.30	-5.78
2155	700.050	70.36	-5.84
2215	720.050	70.37	-5.85
2235	740.100	70.39	-5.87
2255	760.100	70.38	-5.86
2315	780.100	70.37	-5.85
2335	800.100	70.38	-5.86
2355	820.130	70.42	-5.90
0015	840.130	70.39	-5.87
0035	860.130	70.42	-5.89
0055	880.130	70.43	-5.91
0115	900.130	70.45	-5.93
0135	920.130	70.44	-5.92
0155	940.130	70.44	-5.92
0215	960.130	70.44	-5.92
0235	980.130	70.45	-5.93
0255	1000.100	70.43	-5.91
0355	1060.300	70.41	-5.89
0455	1120.300	70.36	-5.84
0555	1180.300	70.42	-5.89
0655	1240.300	70.42	-5.90
0755	1300.300	70.41	-5.89
0855	1360.300	70.47	-5.95
0955	1420.	.42	-5.90
1055	1480.	44	-5.92
1114	1499.	.47	-5.95







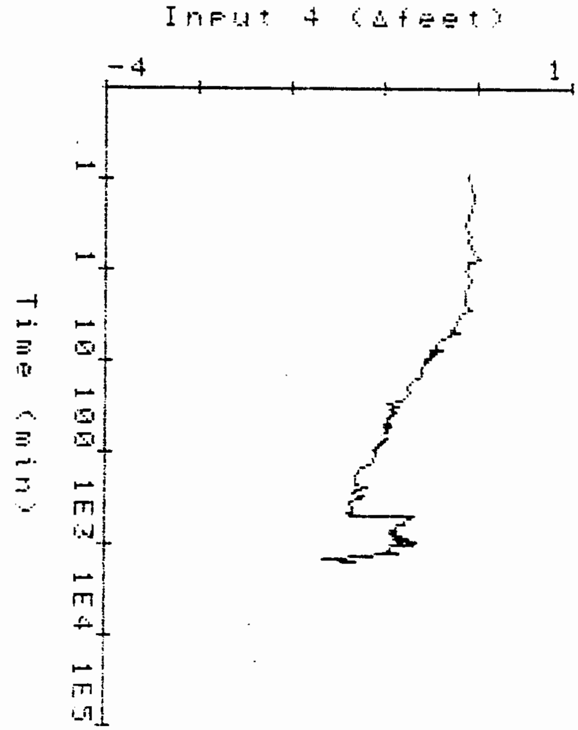


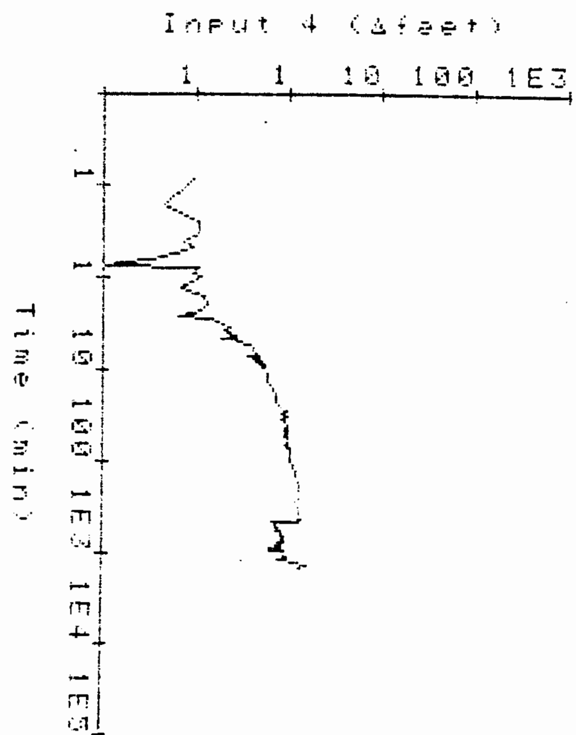
Input 4 (

Time	ET		Δlevel
1015	0.000	65.47	0.00
1015	0.084	65.57	-0.10
1015	0.167	65.52	-0.05
1015	0.251	65.58	-0.11
1015	0.334	65.58	-0.11
1015	0.417	65.55	-0.08
1015	0.501	65.56	-0.09
1015	0.584	65.52	-0.05
1015	0.667	65.50	-0.03
1015	0.751	65.45	0.02
1015	0.834	65.58	-0.10
1015	0.917	65.56	-0.09
1016	1.001	65.59	-0.12
1016	1.377	65.54	-0.07
1016	1.710	65.60	-0.13
1017	2.043	65.61	-0.14
1017	2.377	65.59	-0.12
1017	2.710	65.54	-0.07
1018	3.043	65.63	-0.15
1018	3.377	65.66	-0.19
1018	3.710	65.70	-0.23
1019	4.043	65.68	-0.21
1019	4.377	65.75	-0.28
1019	4.710	65.67	-0.20
1020	5.043	65.75	-0.28
1020	5.377	65.74	-0.27
1020	5.710	65.86	-0.39
1021	6.043	65.89	-0.41
1021	6.377	65.89	-0.42
1021	6.710	65.90	-0.43
1022	7.043	65.92	-0.45
1022	7.377	65.96	-0.49
1022	7.710	65.84	-0.36
1023	8.043	65.97	-0.50
1023	8.377	65.98	-0.51
1023	8.710	65.93	-0.45
1024	9.043	65.99	-0.52
1024	9.377	66.02	-0.55
1024	9.710	65.99	-0.52
1025	10.043	66.03	-0.56
1027	12.312	66.07	-0.59
1029	14.078	66.08	-0.61
1031	16.142	66.15	-0.68
1033	18.142	66.19	-0.71
1035	20.472	66.22	-0.75
1037	22.068	66.21	-0.73
1039	24.068	66.23	-0.76
1041	26.068	66.27	-0.80
1043	28.068	66.33	-0.86
1045	30.068	66.44	-0.97
1047	32.068	66.32	-0.85
1049	34.068	66.45	-0.98
1051	36.068	66.35	-0.88
1053	38.068	66.40	-0.93
1055	40.068	66.39	-0.92
1057	42.068	66.45	-0.98
1059	44.068	66.44	-0.97
1101	46.068	66.43	-0.96
1103	48.193	66.46	-0.99
1105	50.193	66.42	-0.95
1107	52.193	66.42	-0.94
1109	54.193	66.46	-0.99
1111	56.193	66.43	-0.96
1113	58.193	66.46	-0.99
1115	60.193	66.44	-0.97
1117	62.197	66.46	-0.99
1119	64.1[illegible]	[illegible]5.49	-1.02
1121	66.1[illegible]	[illegible]6.49	-1.02

1123	[illegible]	[illegible]	-1.01
1125	[illegible]	[illegible]	-0.99
1127	72.193	[illegible]	-0.96
1129	74.193	66.51	-1.04
1131	76.193	66.49	-1.02
1133	78.193	66.53	-1.06
1135	80.193	66.53	-1.06
1137	82.193	66.51	-1.04
1139	84.193	66.57	-1.10
1141	86.193	66.57	-1.10
1143	88.193	66.57	-1.10
1145	90.193	66.58	-1.10
1147	92.193	66.57	-1.10
1149	94.193	66.58	-1.11
1151	96.193	66.56	-1.09
1153	98.193	66.58	-1.10
1215	120.150	66.60	-1.13
1235	140.160	66.74	-1.26
1255	160.160	66.76	-1.28
1315	180.170	66.78	-1.31
1335	200.150	66.77	-1.30
1355	220.150	66.79	-1.32
1415	240.150	66.67	-1.20
1435	260.070	66.78	-1.30
1455	280.070	66.81	-1.33
1515	300.070	66.68	-1.21
1535	320.070	66.77	-1.30
1555	340.070	66.84	-1.37
1615	360.070	66.85	-1.38
1635	380.070	66.82	-1.35
1655	400.070	66.83	-1.35
1715	420.070	66.83	-1.36
1735	440.070	66.82	-1.35
1755	460.030	66.88	-1.41
1815	480.030	66.83	-1.36
1835	500.030	66.16	-0.68
1855	520.030	66.23	-0.76
1915	540.030	66.21	-0.74
1935	560.030	66.25	-0.77
1955	580.030	66.26	-0.79
2015	600.030	66.24	-0.77
2035	620.030	66.33	-0.86
2055	640.170	66.36	-0.89
2115	660.050	66.35	-0.88
2135	680.050	66.38	-0.91
2155	700.050	66.40	-0.93
2215	720.050	66.36	-0.89
2235	740.100	66.40	-0.93
2255	760.100	66.33	-0.86
2315	780.100	66.32	-0.85
2335	800.100	66.28	-0.81
2355	820.130	66.37	-0.90
0015	840.130	66.36	-0.89
0035	860.130	66.31	-0.84
0055	880.130	66.28	-0.81
0115	900.130	66.13	-0.66
0135	920.130	66.25	-0.78
0155	940.130	66.35	-0.88
0215	960.130	66.26	-0.79
0235	980.130	66.14	-0.67
0255	1000.100	66.41	-0.94
0355	1060.300	66.42	-0.94
0455	1120.300	66.45	-0.98
0555	1180.300	66.44	-0.97
0655	1240.300	66.30	-0.83
0755	1300.300	66.85	-1.37
0855	1360.300	66.83	-1.36
0955	1420.200	66.92	-1.45
1055	1480.200	67.14	-1.67
1114	1499.900	66.78	-1.31

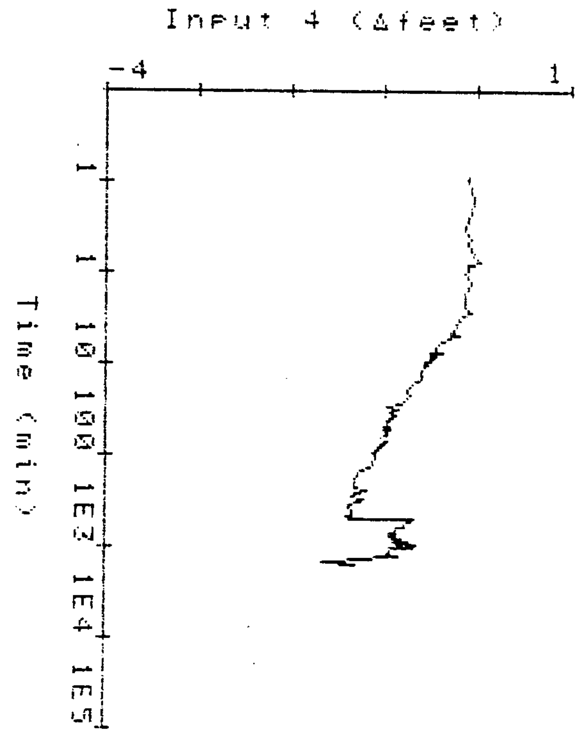
Average leve 55

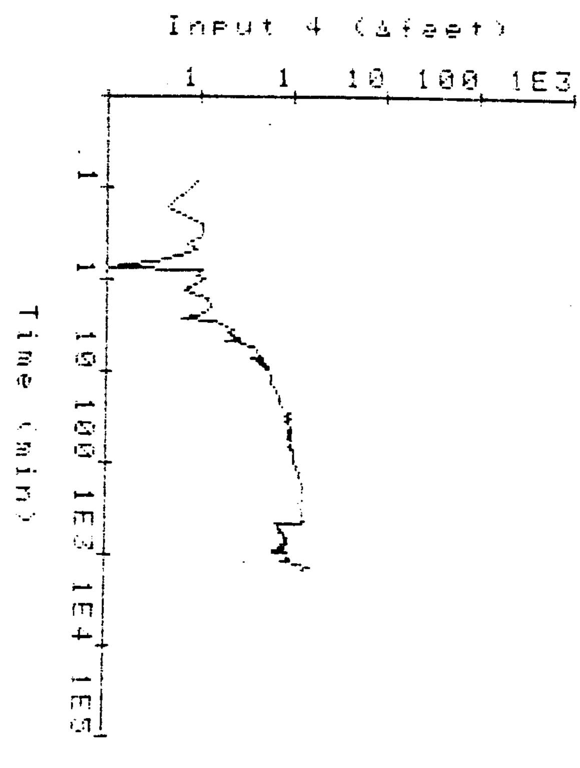




1123	[illegible]	[illegible]	-1.01
1125	[illegible]	[illegible]	-0.99
1127	72.193	[illegible]	-0.96
1129	74.193	66.51	-1.04
1131	76.193	66.49	-1.02
1133	78.193	66.53	-1.06
1135	80.193	66.53	-1.06
1137	82.193	66.51	-1.04
1139	84.193	66.57	-1.10
1141	86.193	66.57	-1.10
1143	88.193	66.57	-1.10
1145	90.193	66.58	-1.10
1147	92.193	66.57	-1.10
1149	94.193	66.58	-1.11
1151	96.193	66.56	-1.09
1153	98.193	66.58	-1.10
1215	120.150	66.60	-1.13
1235	140.160	66.74	-1.26
1255	160.160	66.76	-1.28
1315	180.170	66.78	-1.31
1335	200.150	66.77	-1.30
1355	220.150	66.79	-1.32
1415	240.150	66.67	-1.20
1435	260.070	66.78	-1.30
1455	280.070	66.81	-1.33
1515	300.070	66.68	-1.21
1535	320.070	66.77	-1.30
1555	340.070	66.84	-1.37
1615	360.070	66.85	-1.38
1635	380.070	66.82	-1.35
1655	400.070	66.83	-1.35
1715	420.070	66.83	-1.36
1735	440.070	66.82	-1.35
1755	460.030	66.88	-1.41
1815	480.030	66.83	-1.36
1835	500.030	66.16	-0.68
1855	520.030	66.23	-0.76
1915	540.030	66.21	-0.74
1935	560.030	66.25	-0.77
1955	580.030	66.26	-0.79
2015	600.030	66.24	-0.77
2035	620.030	66.33	-0.86
2055	640.170	66.36	-0.89
2115	660.050	66.35	-0.88
2135	680.050	66.38	-0.91
2155	700.050	66.40	-0.93
2215	720.050	66.36	-0.89
2235	740.100	66.40	-0.93
2255	760.100	66.33	-0.86
2315	780.100	66.32	-0.85
2335	800.100	66.28	-0.81
2355	820.130	66.37	-0.90
0015	840.130	66.36	-0.89
0035	860.130	66.31	-0.84
0055	880.130	66.28	-0.81
0115	900.130	66.13	-0.66
0135	920.130	66.25	-0.78
0155	940.130	66.35	-0.88
0215	960.130	66.26	-0.79
0235	980.130	66.14	-0.67
0255	1000.100	66.41	-0.94
0355	1060.300	66.42	-0.94
0455	1120.300	66.45	-0.98
0555	1180.300	66.44	-0.97
0655	1240.300	66.30	-0.83
0755	1300.300	66.85	-1.37
0855	1360.300	66.83	-1.36
0955	1420.200	66.92	-1.45
1055	1480.200	67.14	-1.67
1114	1499.900	66.78	-1.31

Average leve 55





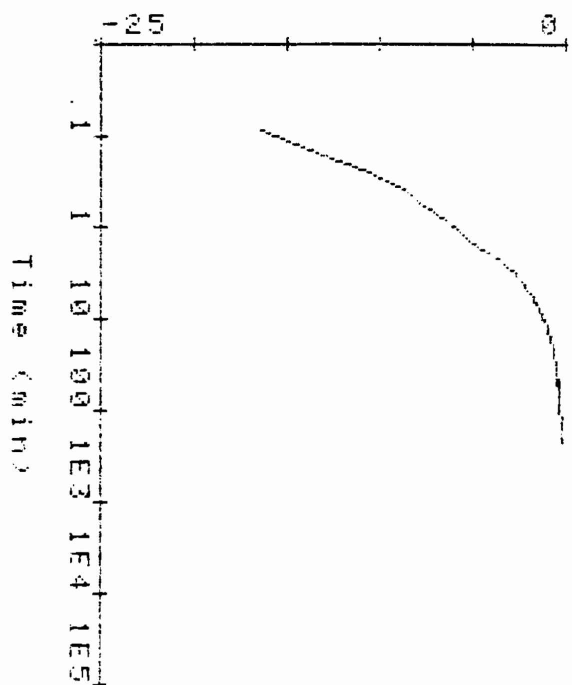
________RECOVERY REPORT________

Started at 1114
Lasted 216.07 min

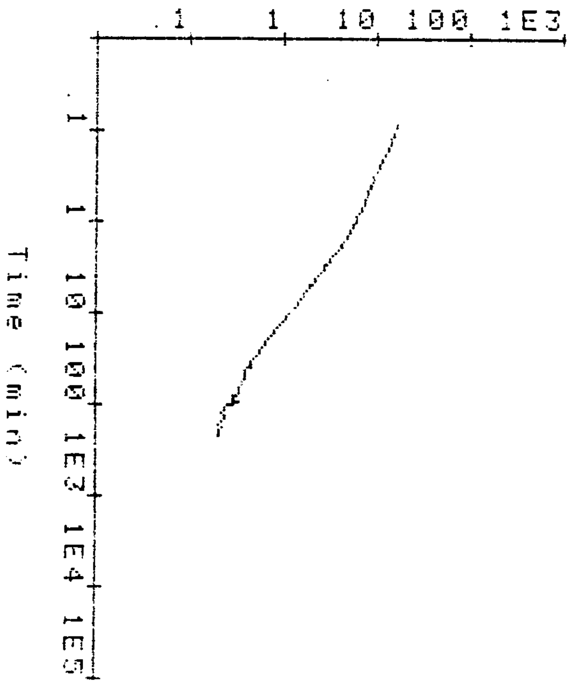
Input 1 (feet):

Time	ET (min)	level	Δlevel
1115	0.084	83.93	-16.46
1115	0.167	80.40	-12.93
1115	0.251	77.94	-10.47
1115	0.334	76.62	-9.15
1115	0.417	75.98	-8.51
1115	0.501	75.55	-8.08
1115	0.584	75.12	-7.65
1115	0.667	74.73	-7.26
1115	0.751	74.37	-6.90
1115	0.834	74.02	-6.55
1115	0.917	73.71	-6.24
1115	1.001	73.42	-5.95
1116	1.376	72.73	-5.26
1116	1.710	72.08	-4.61
1116	2.043	71.42	-3.95
1117	2.376	70.94	-3.47
1117	2.710	70.57	-3.10
1117	3.043	70.29	-2.82
1118	3.376	70.18	-2.71
1118	3.710	69.98	-2.51
1118	4.043	69.79	-2.32
1119	4.376	69.65	-2.17
1119	4.710	69.53	-2.06
1119	5.043	69.43	-1.96
1120	5.377	69.33	-1.86
1120	5.710	69.26	-1.79
1120	6.043	69.19	-1.71
1121	6.377	69.11	-1.64
1121	6.710	69.07	-1.60
1121	7.043	69.00	-1.53
1122	7.377	68.95	-1.48
1122	7.710	68.91	-1.44
1122	8.043	68.85	-1.38
1123	8.377	68.81	-1.34
1123	8.710	68.77	-1.30
1123	9.043	68.74	-1.27
1124	9.376	68.70	-1.22
1124	9.710	68.67	-1.20
1124	10.043	68.64	-1.17
1127	12.141	68.48	-1.01
1129	14.141	68.36	-0.89
1131	16.141	68.29	-0.82
1133	18.142	68.22	-0.75
1135	20.142	68.13	-0.66
1137	22.142	68.12	-0.65
1139	24.142	68.09	-0.62
1141	26.142	68.05	-0.58
1143	28.142	68.03	-0.56
1145	30.142	68.00	-0.53
1147	32.142	67.98	-0.50
1149	34.142	67.93	-0.46
1151	3[illegible]	[illegible]	-0.46
1153	3[illegible]	[illegible]	-0.45
1155	4[illegible]	[illegible]	-0.42
1157	42	[illegible]	-0.40
1159	44	[illegible]87	-0.40
1201	46	[illegible]86	-0.39
1203	48[illegible]	[illegible].86	-0.39
1205	50.142	67.87	-0.40
1207	52.142	67.87	-0.40
1209	54.142	67.86	-0.39
1211	56.142	67.85	-0.37
1213	58.142	67.85	-0.37
1215	60.142	67.85	-0.37
1217	62.142	67.83	-0.36
1219	64.142	67.82	-0.35
1221	66.142	67.82	-0.35
1223	68.142	67.80	-0.33
1225	70.142	67.80	-0.33
1227	72.142	67.82	-0.35
1229	74.142	67.80	-0.33
1231	76.097	67.80	-0.33
1233	78.142	67.79	-0.32
1235	80.142	67.79	-0.32
1237	82.142	67.77	-0.30
1239	84.142	67.76	-0.29
1241	86.142	67.76	-0.29
1243	88.142	67.77	-0.30
1245	90.142	67.80	-0.33
1247	92.142	67.80	-0.33
1249	94.142	67.80	-0.33
1251	96.142	67.77	-0.30
1253	98.142	67.76	-0.29
1255	100.140	67.73	-0.26
1315	120.310	67.69	-0.22
1335	140.310	67.70	-0.23
1355	160.310	67.67	-0.20
1415	180.320	67.69	-0.22
1435	200.320	67.67	-0.20
1451	216.070	67.67	-0.20

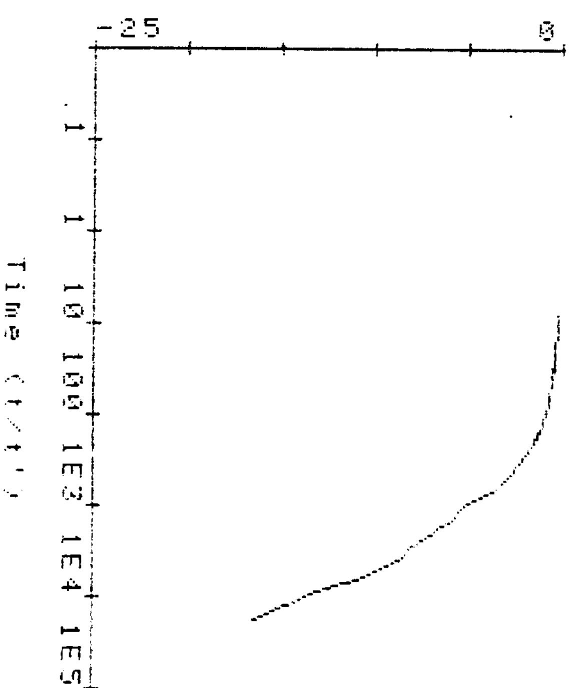
Input 1 (Δfeet)



Input 1 (Δfeet)



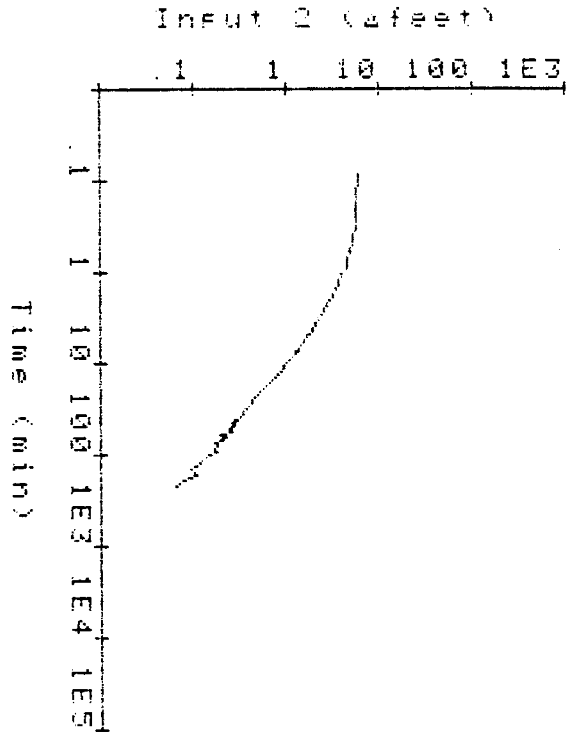
Input 1 (Δfeet)

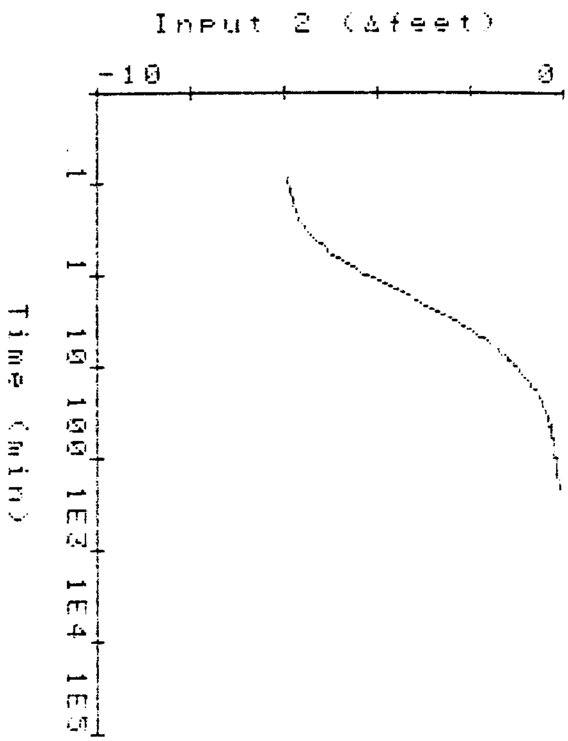


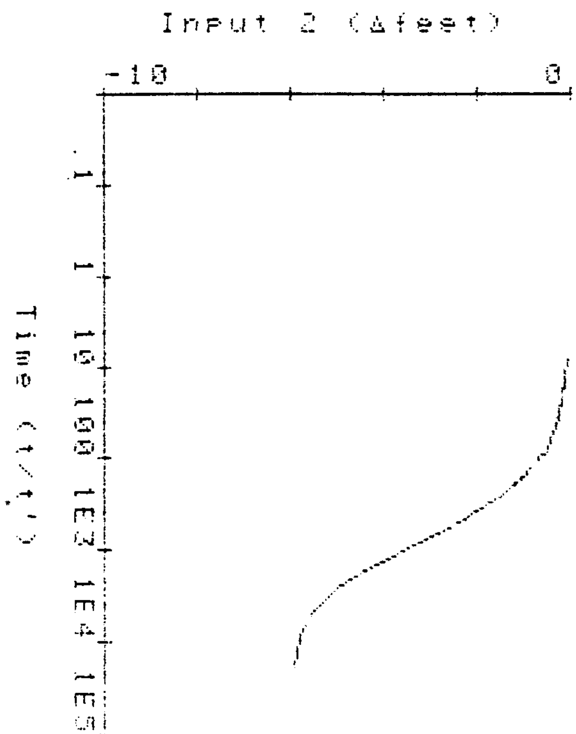
Input 2 (feet):

Time	ET (min)	level	Δlevel
1115	0.084	70.48	-5.96
1115	0.167	70.35	-5.82
1115	0.251	70.20	-5.68
1115	0.334	70.02	-5.50
1115	0.417	69.82	-5.30
1115	0.501	69.63	-5.11
1115	0.584	69.49	-4.97
1115	0.667	69.35	-4.83
1115	0.751	69.19	-4.67
1115	0.834	69.04	-4.52
1115	0.917	68.90	-4.38
1115	1.001	68.75	-4.22
1116	1.376	68.23	-3.70
1116	1.710	67.85	-3.33
1116	2.043	67.57	-3.05
1117	2.376	67.31	-2.79
1117	2.710	67.11	-2.59
1117	3.043	66.93	-2.41
1118	3.376	66.77	-2.25
1118	3.710	66.64	-2.11
1118	4.043	66.53	-2.01
1119	4.376	66.41	-1.89
1119	4.710	66.34	-1.81
1119	5.043	66.23	-1.71
1120	5.377	66.18	-1.66
1120	5.710	66.08	-1.56
1120	6.043	66.04	-1.52
1121	6.377	65.96	-1.44
1121	6.710	65.91	-1.38
1121	7.043	65.87	-1.35
1122	7.377	65.83	-1.31
1122	7.710	65.75	-1.23
1122	8.043	65.73	-1.20
1123	8.377	65.69	-1.17
1123	8.710	65.65	-1.13
1123	9.043	65.60	-1.07
1124	9.376	65.59	-1.07
1124	9.710	65.56	-1.03
1124	10.043	65.54	-1.01
1127	12.141	65.38	-0.86
1129	14.141	65.28	-0.76
1131	16.141	65.18	-0.66
1133	18.142	65.11	-0.59
1135	20.142	65.04	-0.51
1137	22.142	65.02	-0.50
1139	24.142	64.99	-0.47
1141	26.142	64.95	-0.43
1143	28.142	64.93	-0.41
1145	30.142	64.91	-0.39
1147	32.142	64.89	-0.37
1149	34.142	64.86	-0.34
1151	36.142	64.85	-0.33
1153	38.142	64.83	-0.31
1155	40.142	64.83	-0.31
1157	42.142	64.80	-0.28
1159	44.142	64.80	-0.28
1201	46.142	64.78	-0.26
1203	48.142	64.78	-0.26
1205	50.142	64.79	-0.27
1207	5[illegible]	[illegible]78	-0.26
1209	5[illegible]	[illegible]76	-0.24
1211	5[illegible]	[illegible]77	-0.25
1213	5[illegible]	[illegible]76	-0.23

1215	[illegible]	[illegible]	-0.23
1217	[illegible]	[illegible]	-0.19
1219	64.142	[illegible]	-0.22
1221	66.142	64.74	-0.21
1223	68.142	64.72	-0.20
1225	70.142	64.73	-0.21
1227	72.142	64.71	-0.18
1229	74.142	64.70	-0.18
1231	76.097	64.69	-0.17
1233	78.142	64.70	-0.18
1235	80.142	64.69	-0.17
1237	82.142	64.69	-0.17
1239	84.142	64.69	-0.16
1241	86.142	64.69	-0.17
1243	88.142	64.69	-0.16
1245	90.142	64.69	-0.17
1247	92.142	64.68	-0.16
1249	94.142	64.69	-0.17
1251	96.142	64.68	-0.16
1253	98.142	64.68	-0.16
1255	100.140	64.66	-0.14
1315	120.310	64.64	-0.12
1335	140.310	64.62	-0.10
1355	160.310	64.63	-0.10
1415	180.320	64.60	-0.08
1435	200.320	64.59	-0.07
1451	216.070	64.59	-0.07



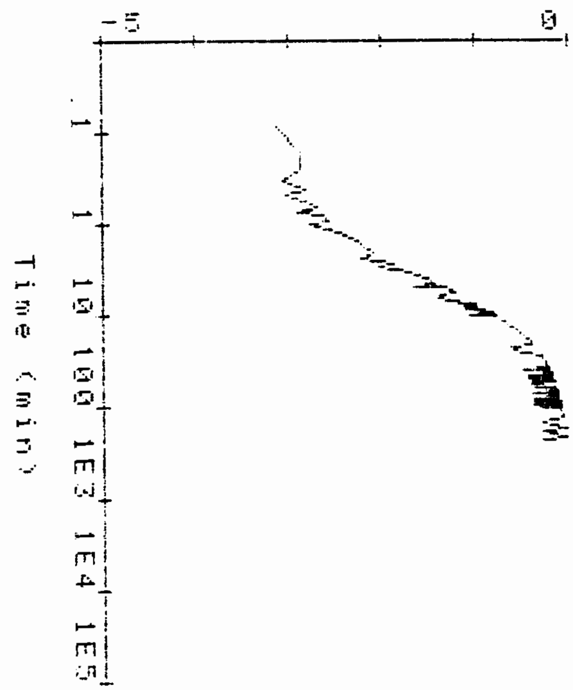


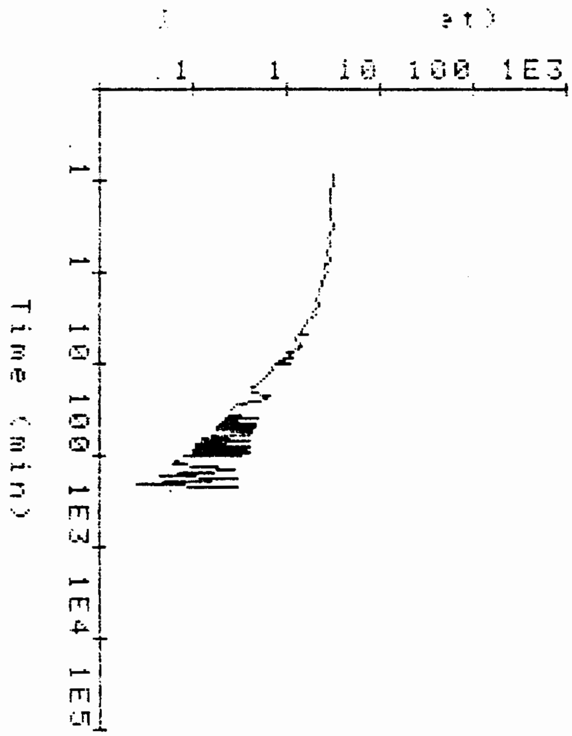


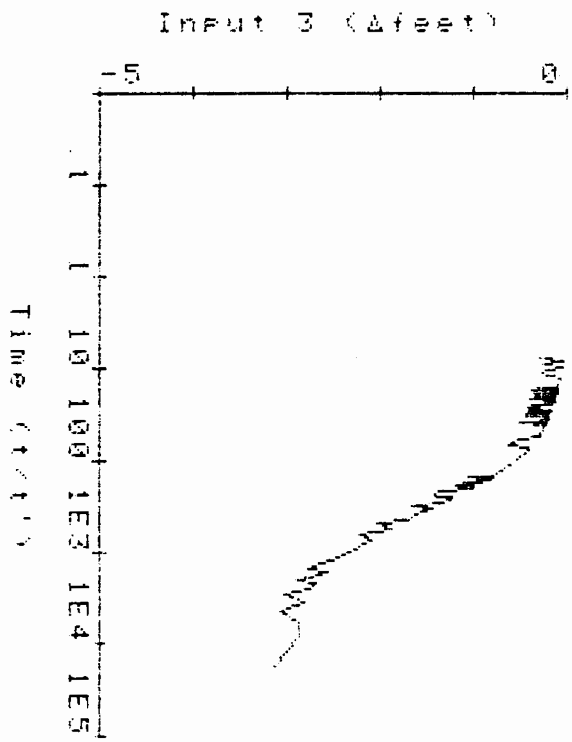
Input 3 (feet):

Time	ET (min)	level	Δlevel
1115	0.084	68.31	-3.13
1115	0.167	68.06	-2.88
1115	0.251	68.06	-2.88
1115	0.334	68.25	-3.07
1115	0.417	68.00	-2.82
1115	0.501	68.21	-3.03
1115	0.584	67.94	-2.76
1115	0.667	67.88	-2.70
1115	0.751	68.08	-2.90
1115	0.834	67.80	-2.61
1115	0.917	67.75	-2.57
1115	1.001	67.96	-2.78
1116	1.376	67.54	-2.36
1116	1.710	67.40	-2.21
1116	2.043	67.28	-2.10
1117	2.376	67.41	-2.23
1117	2.710	67.05	-1.86
1117	3.043	67.20	-2.02
1118	3.376	66.85	-1.67
1118	3.710	66.81	-1.63
1118	4.043	66.69	-1.51
1119	4.376	66.62	-1.44
1119	4.710	66.82	-1.64
1119	5.043	66.50	-1.32
1120	5.377	66.44	-1.26
1120	5.710	66.39	-1.21
1120	6.043	66.60	-1.42
1121	6.377	66.58	-1.40
1121	6.710	66.52	-1.34
1121	7.043	66.48	-1.30
1122	7.377	66.18	-1.00
1122	7.710	66.37	-1.19
1122	8.043	66.25	-1.07
1123	8.377	66.08	-0.90
1123	8.710	66.30	-1.12
1123	9.043	66.02	-0.83
1124	9.376	65.99	-0.81
1124	9.710	66.23	-1.05
1124	10.043	65.95	-0.77
1127	12.141	65.84	-0.66
1129	14.141	65.74	-0.56
1131	16.141	65.67	-0.49
1133	18.142	65.62	-0.43
1135	20.142	65.60	-0.42
1137	22.142	65.82	-0.64
1139	24.142	65.77	-0.59
1141	26.142	65.67	-0.49
1143	28.142	65.47	-0.29
1145	30.142	65.45	-0.27
1147	32.142	65.44	-0.26
1149	34.142	65.42	-0.24
1151	36.142	65.41	-0.23
1153	38.142	65.67	-0.49
1155	40.142	65.39	-0.21
1157	42.142	65.38	-0.20
1159	44.142	65.62	-0.44
1201	46.142	65.37	-0.19
1203	48.142	65.36	-0.18
1205	50[illegible]	[illegible].62	-0.44
1207	52[illegible]	[illegible]59	-0.41
1209	54[illegible]	[illegible]34	-0.16
1211	56.[illegible]	[illegible]9	-0.41
1213	58.[illegible]	[illegible]6	-0.38
1215	60.142	[illegible]3	-0.15
1217	62.142	65.56	-0.38
1219	64.142	65.32	-0.14
1221	66.142	65.31	-0.13
1223	68.142	65.30	-0.12
1225	70.142	65.31	-0.13
1227	72.142	65.57	-0.39
1229	74.142	65.30	-0.12
1231	76.097	65.29	-0.11
1233	78.142	65.53	-0.34
1235	80.142	65.29	-0.11
1237	82.142	65.57	-0.39
1239	84.142	65.28	-0.10
1241	86.142	65.28	-0.10
1243	88.142	65.55	-0.37
1245	90.142	65.56	-0.38
1247	92.142	65.56	-0.38
1249	94.142	65.28	-0.10
1251	96.142	65.29	-0.11
1253	98.142	65.50	-0.32
1255	100.140	65.26	-0.08
1315	120.310	65.24	-0.06
1335	140.310	65.46	-0.28
1355	160.310	65.22	-0.04
1415	180.320	65.47	-0.29
1435	200.320	65.21	-0.03
1451	216.070	65.47	-0.29

Input 3 (Δfeet)



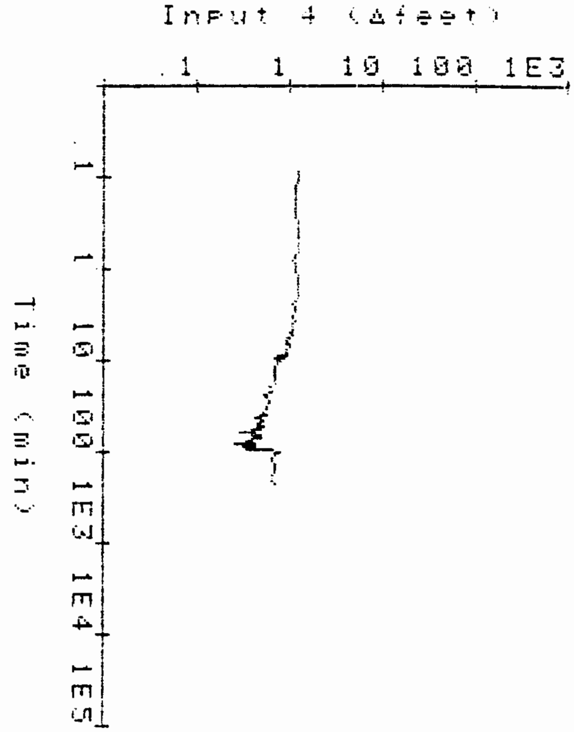


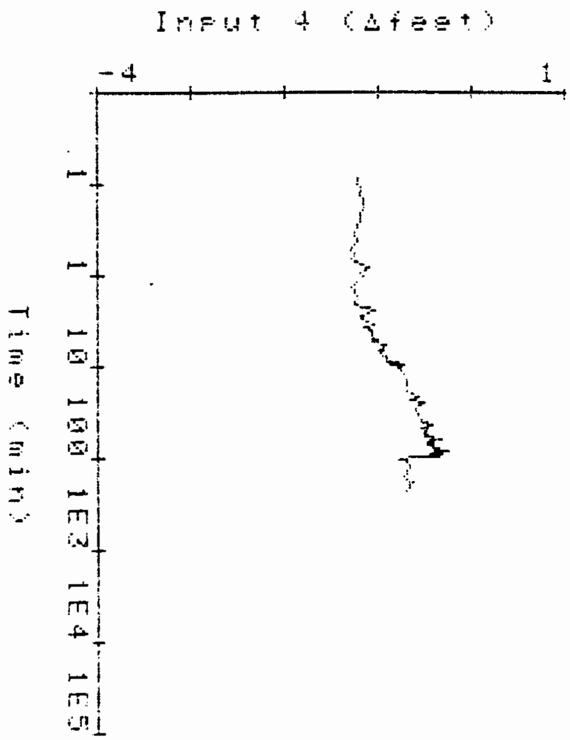


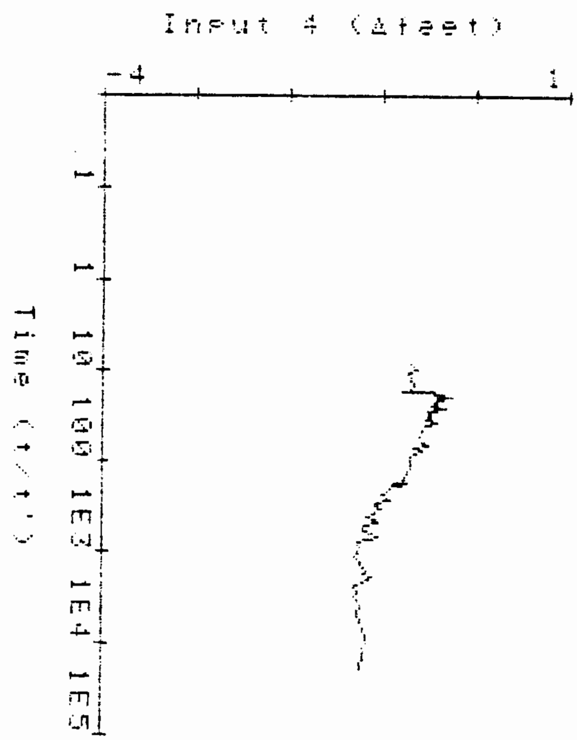
Input 4 (feet):

Time	ET (min)	level	Δlevel
1115	0.084	66.69	-1.22
1115	0.167	66.61	-1.14
1115	0.251	66.65	-1.18
1115	0.334	66.73	-1.26
1115	0.417	66.69	-1.22
1115	0.501	66.74	-1.27
1115	0.584	66.71	-1.23
1115	0.667	66.76	-1.28
1115	0.751	66.66	-1.19
1115	0.834	66.57	-1.10
1115	0.917	66.65	-1.18
1115	1.001	66.62	-1.15
1116	1.376	66.75	-1.28
1116	1.710	66.68	-1.21
1116	2.043	66.72	-1.25
1117	2.376	66.51	-1.04
1117	2.710	66.65	-1.18
1117	3.043	66.67	-1.20
1118	3.376	66.52	-1.05
1118	3.710	66.63	-1.16
1118	4.043	66.52	-1.05
1119	4.376	66.53	-1.06
1119	4.710	66.48	-1.01
1119	5.043	66.54	-1.07
1120	5.377	66.53	-1.06
1120	5.710	66.38	-0.91
1120	6.043	66.40	-0.93
1121	6.377	66.40	-0.93
1121	6.710	66.46	-0.98
1121	7.043	66.44	-0.97
1122	7.377	66.41	-0.94
1122	7.710	66.38	-0.91
1122	8.043	66.39	-0.91
1123	8.377	66.38	-0.91
1123	8.710	66.24	-0.77
1123	9.043	66.36	-0.89
1124	9.376	66.18	-0.71
1124	9.710	66.25	-0.78
1124	10.043	66.22	-0.75
1127	12.141	66.18	-0.71
1129	14.141	66.15	-0.68
1131	16.141	66.17	-0.70
1133	18.142	66.16	-0.68
1135	20.142	66.02	-0.55
1137	22.142	66.12	-0.65
1139	24.142	65.99	-0.52
1141	26.142	66.04	-0.56
1143	28.142	66.07	-0.60
1145	30.142	66.06	-0.59
1147	32.142	66.03	-0.56
1149	34.142	66.03	-0.56
1151	36.142	66.00	-0.53
1153	38.142	65.96	-0.48
1155	40.142	66.02	-0.54
1157	42.142	65.89	-0.41
1159	44.142	65.99	-0.52
1201	46.142	66.00	-0.52
1203	48.142	65.94	-0.47
1205	50.142	65.99	-0.50
1207	52.142	65.98	-0.51
1209	54.142	65.95	-0.48
1211	56.1[illegible]	[illegible]5.86	-0.39
1213	58.1[illegible]	[illegible]5.96	-0.49
1215	60.1[illegible]	[illegible]5.87	-0.40

1217	62.[illegible]	[illegible]	-0.30
1219	64.[illegible]	[illegible]	-0.48
1221	66.142	[illegible]	-0.45
1223	68.142	65.95	-0.48
1225	70.142	65.91	-0.44
1227	72.142	65.88	-0.40
1229	74.142	65.86	-0.39
1231	76.097	65.80	-0.33
1233	78.142	65.86	-0.39
1235	80.142	65.88	-0.41
1237	82.142	65.72	-0.25
1239	84.142	65.83	-0.36
1241	86.142	65.81	-0.34
1243	88.142	65.89	-0.42
1245	90.142	65.86	-0.39
1247	92.142	65.80	-0.33
1249	94.142	65.96	-0.49
1251	96.142	66.04	-0.57
1253	98.142	66.26	-0.79
1255	100.140	66.16	-0.69
1315	120.310	66.12	-0.65
1335	140.310	66.17	-0.70
1355	160.310	66.19	-0.72
1415	180.320	66.11	-0.63
1435	200.320	66.13	-0.66
1451	216.070	66.17	-0.70







SE2000 manufactured by
In-situ, inc.
Larami [illegible] ing

[illegible]ARTON [illegible]UTHWEST PUMPTE[illegible]
[illegible]un 4
10/08/84

SE200B DATA
constant rate test

[illegible] LAWSON ASSOCIATES
[illegible]ON TEXAS
[illegible] # 6310 013.12
[illegible]ANT-RATE PUMPING TEST OF
P[illegible] AT SPARTON TECH[illegible]
[illegible]UERQUE NEW MEXICO
TE[illegible] WILL RUN 120 MINUTES I[illegible]
ORDER TO ACQUIRE EARLY TIME-
DRAWDOWN DATA IN THE SURROUNDING
WELLS.

TRANSDUCER TABLE

Input 1: PW-1
  Transducer s/n: 135
  Scale factor: 49.95
  Initial level: 65.57 feet

Input 2: MW-12
  Transducer s/n: 871/846
  Scale factor: 10.02
  Initial level: 64.68 feet

Input 3: MW-13
  Transducer s/n: 477/830
  Scale factor: 10.12
  Initial level: 64.69 feet

Input 4: MW-14
  Transducer s/n: 034
  Scale factor: 10.1
  Initial level: 65.65 feet

PUMP SCHEDULE

Drawdown for 180 min
Pump at 180 GPM
Pump set at 126 feet

Recovery for 180 min

SAMPLING SCHEDULE

0-1	min	@	5 sec
1-10	min	@	20 sec
10-100	min	@	2 min
100-1000	min	@	20 min
1000-10000	min	@	60 min
10000-99999	min	@	200 min

---------DRAWDOWN REPORT---------

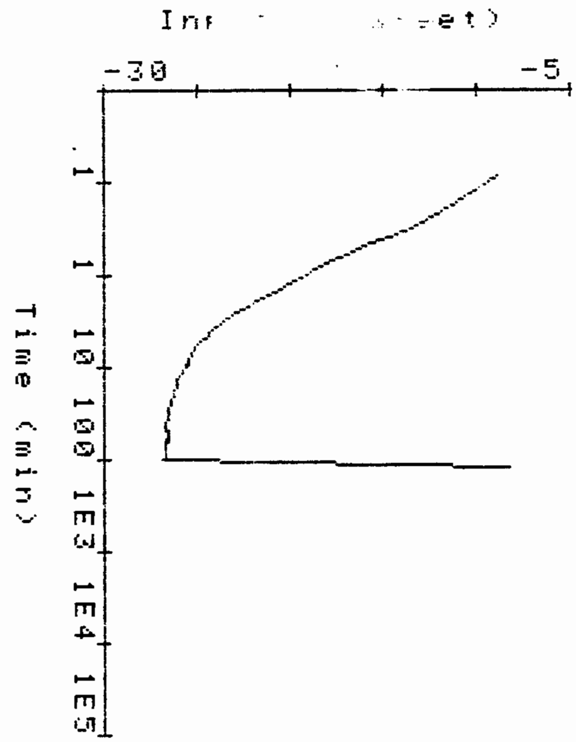
Started at 1515
Lasted 120.02 min

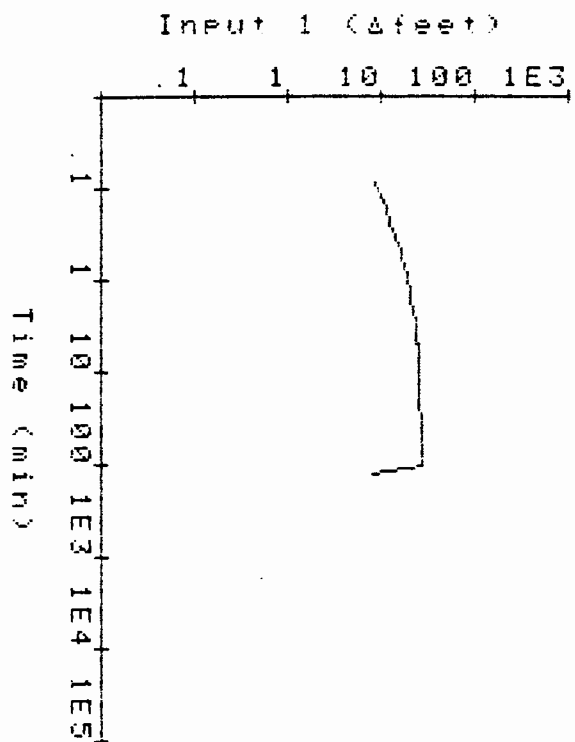
Input 1 (feet):

Time	ET (min)	level	Δlevel
1515	0.000	65.57	0.00
1515	0.084	74.50	-8.93
1515	0.167	76.73	-11.16
1515	0.251	78.29	-12.72
1515	0.334	79.53	-13.96
1515	0.417	80.68	-15.11
1515	0.501	81.64	-16.07
1515	0.584	82.42	-16.85
1515	0.667	83.11	-17.54
1515	0.751	83.65	-18.08
1515	0.834	84.05	-18.48
1515	0.917	84.45	-18.88
1516	1.001	84.75	-19.18
1516	1.377	85.86	-20.29
1516	1.710	86.83	-21.26
1517	2.043	87.59	-22.02
1517	2.377	88.24	-22.67
1517	2.710	88.67	-23.10
1518	3.043	89.00	-23.43
1518	3.377	89.33	-23.76
1518	3.710	89.59	-24.02
1519	4.043	89.74	-24.17
1519	4.377	89.97	-24.40
1519	4.710	90.16	-24.59
1520	5.043	90.33	-24.76
1520	5.377	90.44	-24.87
1520	5.710	90.57	-25.00
1521	6.043	90.66	-25.09
1521	6.377	90.69	-25.12
1521	6.710	90.78	-25.21
1522	7.043	90.82	-25.25
1522	7.377	90.90	-25.33
1522	7.710	90.89	-25.32
1523	8.043	90.98	-25.41
1523	8.377	91.00	-25.43
1523	8.710	91.05	-25.48
1524	9.043	91.11	-25.54
1524	9.377	91.15	-25.58
1524	9.710	91.18	-25.61
1525	10.043	91.22	-25.65
1527	12.127	91.44	-25.87
1529	14.127	91.62	-26.05
1531	16.075	91.74	-26.17
1533	18.075	91.81	-26.24
1535	[illegible]	91.87	-26.30
1537	[illegible]	[illegible]96	-26.39
1539	[illegible]	[illegible]91	-26.34

1541	2[illegible]	[illegible]98	-26.41
1543	2[illegible]	[illegible]09	-26.52
1545	30.133	92.11	-26.54
1547	32.133	92.14	-26.57
1549	34.133	92.17	-26.60
1551	36.133	92.19	-26.62
1553	38.133	92.29	-26.72
1555	40.133	92.27	-26.70
1557	42.133	92.29	-26.72
1559	44.270	92.22	-26.65
1601	46.213	92.22	-26.65
1603	48.213	92.19	-26.62
1605	50.213	92.22	-26.65
1607	52.213	92.11	-26.54
1609	54.213	92.10	-26.53
1611	56.213	92.19	-26.62
1613	58.213	92.13	-26.56
1615	60.213	92.14	-26.57
1617	62.213	92.26	-26.69
1619	64.213	92.27	-26.70
1621	66.213	92.20	-26.63
1623	68.213	92.23	-26.66
1625	70.213	92.24	-26.67
1627	72.213	92.27	-26.70
1629	74.213	92.24	-26.67
1631	76.213	92.26	-26.69
1635	80.138	92.30	-26.73
1637	82.138	92.32	-26.75
1639	84.138	92.33	-26.76
1641	86.138	92.27	-26.70
1643	88.053	92.32	-26.75
1645	90.072	92.29	-26.72
1647	92.072	92.32	-26.75
1649	94.072	92.32	-26.75
1651	96.073	92.32	-26.75
1653	98.072	92.42	-26.85
1655	100.070	92.37	-26.80
1715	120.020	73.81	-8.24

Average level: 88.85

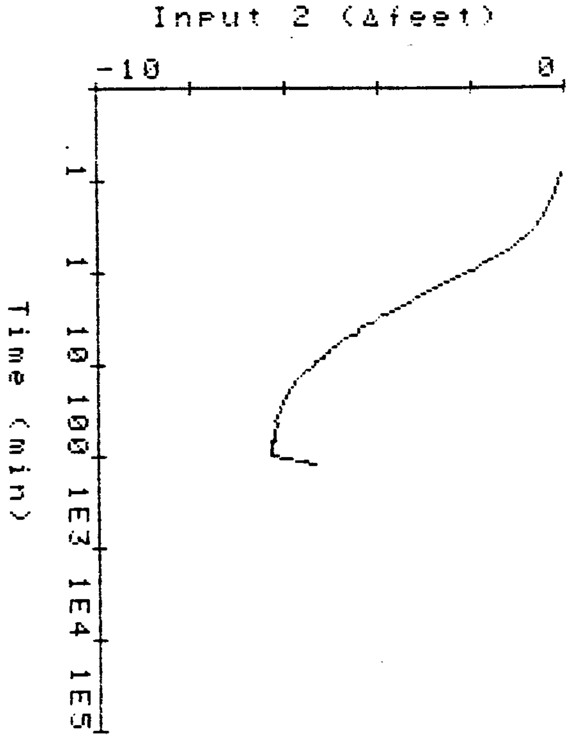


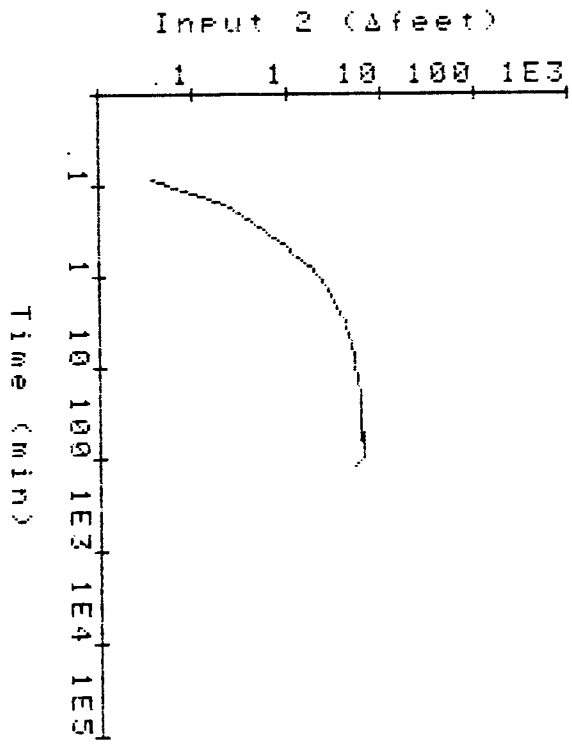


Input 2 (feet):

Time	ET (min)	level	Δlevel
1515	0.000	64.68	0.00
1515	0.084	64.72	-0.04
1515	0.167	64.91	-0.23
1515	0.251	65.09	-0.41
1515	0.334	65.29	-0.61
1515	0.417	65.48	-0.80
1515	0.501	65.67	-0.99
1515	0.584	65.87	-1.19
1515	0.667	66.05	-1.37
1515	0.751	66.24	-1.56
1515	0.834	66.42	-1.74
1515	0.917	66.57	-1.89
1516	1.001	66.70	-2.02
1516	1.377	67.23	-2.55
1516	1.710	67.59	-2.91
1517	2.043	67.91	-3.23
1517	2.377	68.17	-3.49
1517	2.710	68.39	-3.71
1518	3.043	68.59	-3.91
1518	3.377	68.76	-4.08
1518	3.710	68.88	-4.20
1519	4.043	69.03	-4.35
1519	4.377	69.14	-4.46
1519	4.710	69.23	-4.55
1520	5.043	69.31	-4.63
1520	5.377	69.42	-4.74
1520	5.710	69.46	-4.78
1521	6.043	69.54	-4.86
1521	6.377	69.60	-4.92
1521	6.710	69.66	-4.98
1522	7.043	69.73	-5.05
1522	7.377	69.75	-5.07
1522	7.710	69.82	-5.14
1523	8.043	69.85	-5.17
1523	8.377	69.88	-5.20
1523	8.710	69.93	-5.25
1524	9.043	70.01	-5.32
1524	9.377	70.04	-5.36
1524	9.710	70.06	-5.38
1525	10.043	70.07	-5.39
1527	12.127	70.28	-5.60
1529	14.127	70.42	-5.74
1531	16.075	70.50	-5.82
1533	18.075	70.58	-5.90
1535	20.075	70.61	-5.93
1537	22.075	70.65	-5.97
1539	24.[illegible]	70.70	-6.02
1541	26.[illegible]	[illegible]74	-6.06
1543	28.[illegible]	[illegible]75	-6.07
1545	[illegible]	[illegible]9	-6.11
1547	[illegible]	[illegible]0	-6.12
1549	34.133	[illegible]3	-6.15
1551	36.133	70.85	-6.17
1553	38.133	70.85	-6.17
1555	40.133	70.89	-6.21
1557	42.133	70.91	-6.23
1559	44.270	70.87	-6.19
1601	46.213	70.89	-6.21
1603	48.213	70.89	-6.21
1605	50.213	70.90	-6.22
1607	52.213	70.93	-6.25
1609	54.213	70.95	-6.27
1611	56.213	70.93	-6.25
1613	58.213	70.96	-6.28
1615	60.213	70.92	-6.23
1617	62.213	70.95	-6.27
1619	64.213	70.95	-6.27
1621	66.213	70.94	-6.26
1623	68.213	70.95	-6.27
1625	70.213	70.98	-6.30
1627	72.213	70.96	-6.28
1629	74.213	70.97	-6.29
1631	76.213	70.98	-6.30
1635	80.138	70.99	-6.31
1637	82.138	71.02	-6.34
1639	84.138	70.98	-6.30
1641	86.138	71.00	-6.32
1643	88.053	71.01	-6.33
1645	90.072	71.01	-6.33
1647	92.072	71.02	-6.34
1649	94.072	71.00	-6.32
1651	96.073	71.01	-6.33
1653	98.072	71.02	-6.34
1655	100.070	71.00	-6.32
1715	120.020	70.03	-5.35

Average level: 70.56



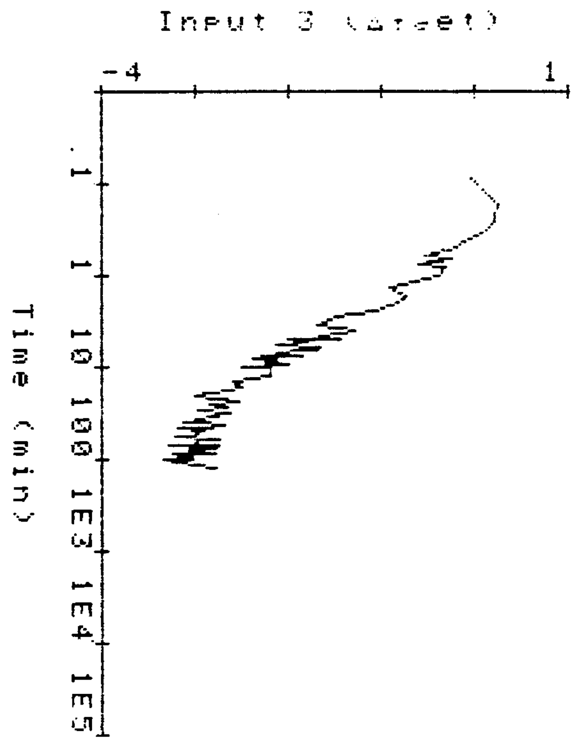


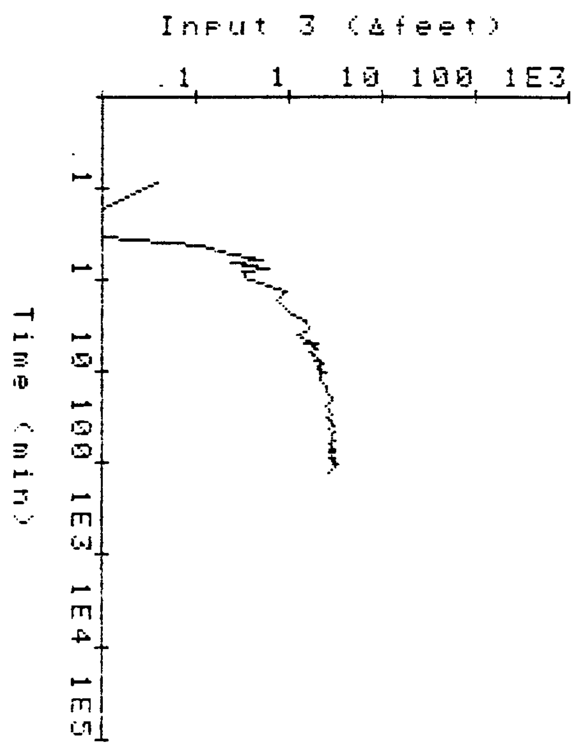
Input 3 (feet):

Time	ET (min)	level	Δlevel
1515	0.000	64.69	0.00
1515	0.084	64.73	-0.04
1515	0.167	64.45	0.24
1515	0.251	64.47	0.22
1515	0.334	64.60	0.09
1515	0.417	64.81	-0.12
1515	0.501	64.86	-0.18
1515	0.584	65.22	-0.53
1515	0.667	64.93	-0.25
1515	0.751	65.29	-0.60
1515	0.834	65.01	-0.32
1515	0.917	65.04	-0.35
1516	1.001	65.10	-0.41
1516	1.377	65.61	-0.92
1516	1.710	65.42	-0.73
1517	2.043	65.59	-0.90
1517	2.377	65.75	-1.06
1517	2.710	66.20	-1.51
1518	3.043	66.24	-1.56
1518	3.377	66.37	-1.68
1518	3.710	66.12	-1.43
1519	4.043	65.97	-1.28
1519	4.377	66.34	-1.65
1519	4.710	66.13	-1.44
1520	5.043	66.69	-2.00
1520	5.377	66.46	-1.77
1520	5.710	66.80	-2.11
1521	6.043	66.36	-1.67
1521	6.377	66.42	-1.73
1521	6.710	66.67	-1.98
1522	7.043	66.73	-2.04
1522	7.377	66.97	-2.28
1522	7.710	66.53	-1.84
1523	8.043	67.07	-2.38
1523	8.377	66.81	-2.12
1523	8.710	66.89	-2.20
1524	9.043	66.94	-2.25
1524	9.377	66.70	-2.01
1524	9.710	67.20	-2.52
1525	10.043	66.87	-2.18
1527	12.127	66.88	-2.19
1529	14.127	67.28	-2.59
1531	16.075	67.19	-2.50
1533	18.075	67.36	-2.67
1535	20.075	67.68	-2.99
1537	22.075	67.45	-2.76
1539	24.447	67.21	-2.52
1541	26.133	67.52	-2.83
1543	28.133	67.33	-2.64
1545	30.133	67.65	-2.96
1547	32.133	67.32	-2.63
1549	34.133	67.56	-2.87
1551	36.133	67.60	-2.91
1553	38.133	67.81	-3.12
1555	40.133	67.63	-2.94
1557	42.133	67.39	-2.70
1559	44.270	67.61	-2.92
1601	46.213	67.88	-3.19
1603	48.213	67.60	-2.91
1605	5[illegible]	[illegible]65	-2.96
1607	5[illegible]	[illegible]	-2.97
1609	5[illegible]	[illegible]	-2.99

1611	56.[illegible]	67.70	-3.01
1613	58.[illegible]	[illegible]	-3.22
1615	60.213	67.43	-2.74
1617	62.213	67.70	-3.01
1619	64.213	67.66	-2.97
1621	66.213	67.70	-3.01
1623	68.213	67.68	-2.99
1625	70.213	67.43	-2.74
1627	72.213	67.96	-3.27
1629	74.213	[illegible]	-2.78
1631	76.[illegible]	[illegible]	-3.07
1635	80.[illegible]	[illegible]	-2.99
1637	82.13[illegible]	[illegible]	-2.91
1639	84.13[illegible]	[illegible]	-3.26
1641	86.138	67.48	-2.79
1643	88.053	67.71	-3.02
1645	90.072	67.74	-3.06
1647	92.072	67.72	-3.03
1649	94.072	67.88	-3.20
1651	96.073	67.72	-3.03
1653	98.072	67.72	-3.03
1655	100.070	68.02	-3.33
1715	120.020	67.46	-2.77

Average level: 67.47





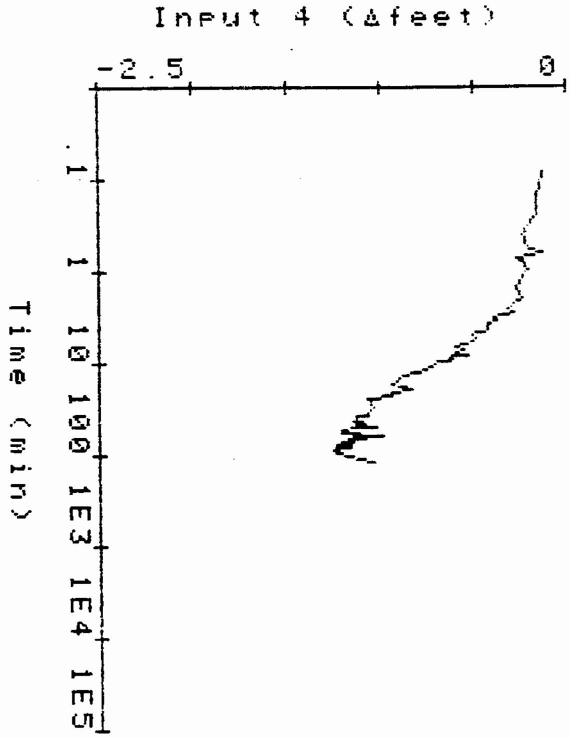
Input 4 (feet):

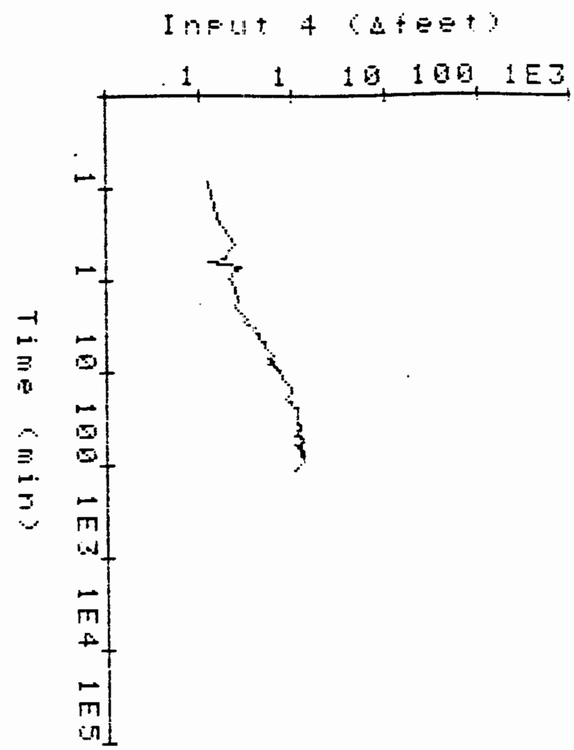
Time	ET (min)	level	Δlevel
1515	0.000	65.65	0.00
1515	0.084	65.77	-0.12
1515	0.167	65.80	-0.15
1515	0.251	65.81	-0.16
1515	0.334	65.86	-0.21
1515	0.417	65.89	-0.24
1515	0.501	65.86	-0.21
1515	0.584	65.85	-0.20
1515	0.667	65.78	-0.13
1515	0.751	65.92	-0.27
1515	0.834	65.88	-0.23
1515	0.917	65.87	-0.22
1516	1.001	65.86	-0.21
1516	1.377	65.90	-0.24
1516	1.710	65.91	-0.26
1517	2.043	65.88	-0.23
1517	2.377	65.93	-0.27
1517	2.710	65.97	-0.32
1518	3.043	65.94	-0.29
1518	3.377	66.04	-0.39
1518	3.710	66.02	-0.37
1519	4.043	66.07	-0.42
1519	4.377	66.08	-0.43
1519	4.710	66.10	-0.45
1520	5.043	66.13	-0.48
1520	5.377	66.15	-0.50
1520	5.710	66.13	-0.48
1521	6.043	66.17	-0.52
1521	6.377	66.20	-0.55
1521	6.710	66.20	-0.55
1522	7.043	66.24	-0.59
1522	7.377	66.20	-0.55
1522	7.710	66.19	-0.54
1523	8.043	66.24	-0.59
1523	8.377	66.18	-0.53
1523	8.710	66.26	-0.61
1524	9.043	66.28	-0.63
1524	9.377	66.25	-0.60
1524	9.710	66.30	-0.65
1525	10.043	66.34	-0.68
1527	12.127	66.40	-0.75
1529	14.127	66.53	-0.88
1531	16.075	66.56	-0.91
1533	18.[illegible]	66.60	-0.94
1535	20.[illegible]	[illegible] 48	-0.83
1537	22[illegible]	[illegible]	-0.93
1539	24[illegible]	[illegible]	-0.94
1541	26.[illegible]	[illegible]	-1.06
1543	28.133	[illegible]	-1.05
1545	30.133	66.76	-1.05
1547	32.133	66.69	-1.04
1549	34.133	66.69	-1.04
1551	36.133	66.72	-1.07
1553	38.133	66.71	-1.06
1555	40.133	66.77	-1.12
1557	42.133	66.78	-1.12
1559	44.270	66.75	-1.10
1601	46.213	66.79	-1.14
1603	48.213	66.76	-1.11
1605	50.213	66.76	-1.11
1607	52.213	66.66	-1.01
1609	54.213	66.79	-1.14
1611	56.213	66.85	-1.20
1613	58.213	66.85	-1.20
1615	60.213	66.80	-1.15
1617	62.213	66.85	-1.20
1619	64.213	66.63	-0.98
1621	66.213	66.80	-1.14
1623	68.213	66.82	-1.17
1625	70.213	66.79	-1.14
1627	72.213	66.73	-1.08
1629	74.213	66.85	-1.20
1631	76.213	66.84	-1.19
1635	80.138	66.81	-1.16
1637	82.138	66.89	-1.24
1639	84.138	66.81	-1.16
1641	86.138	66.89	-1.23
1643	88.053	66.87	-1.22
1645	90.072	66.90	-1.25
1647	92.072	66.87	-1.22
1649	94.072	66.89	-1.24
1651	96.073	66.88	-1.23
1653	98.072	66.89	-1.24
1655	100.070	66.89	-1.24
1715	120.020	66.69	-1.03

Average level: 66.69

IRT

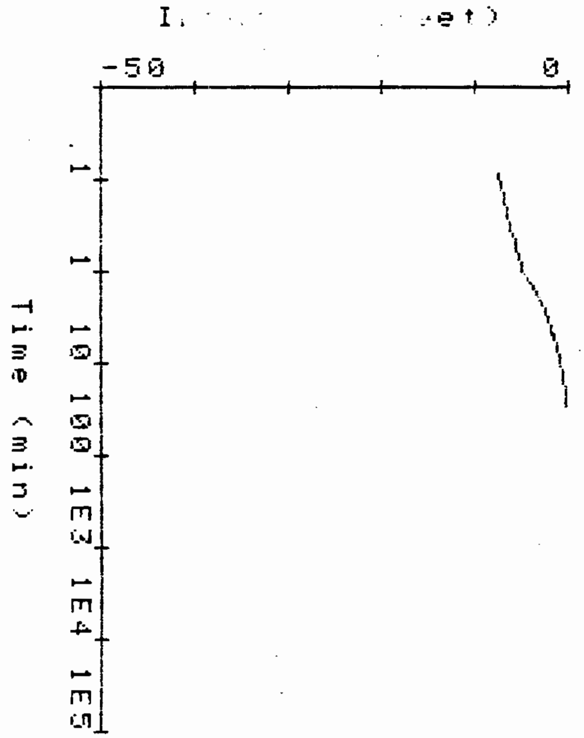
Started at 1715
Lasted 30.123 min

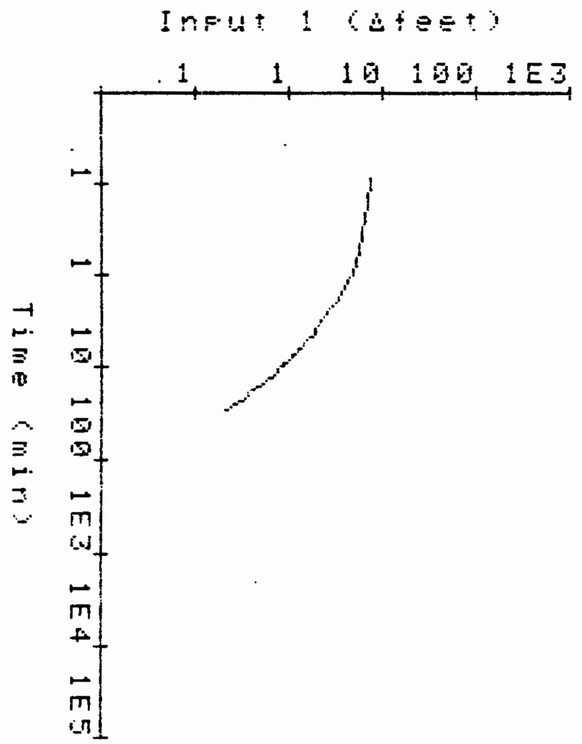


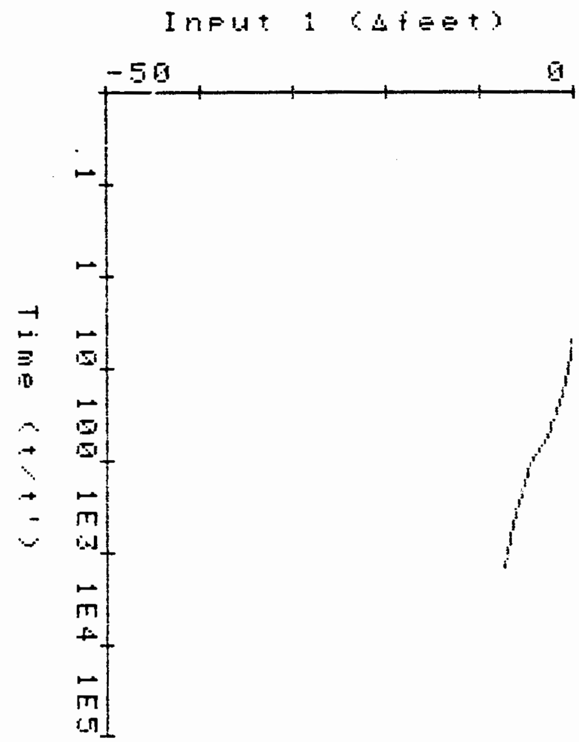


Input 1 (feet):

Time	ET (min)	level	Δlevel
1715	0.084	72.92	-7.35
1715	0.167	72.53	-6.96
1715	0.251	72.15	-6.58
1715	0.334	71.84	-6.27
1715	0.417	71.56	-5.99
1715	0.501	71.29	-5.72
1715	0.584	71.04	-5.47
1715	0.667	70.83	-5.26
1715	0.751	70.74	-5.17
1715	0.834	70.70	-5.13
1716	0.917	70.60	-5.03
1716	1.001	70.47	-4.90
1716	1.376	69.63	-4.06
1716	1.710	69.10	-3.53
1717	2.043	68.70	-3.13
1717	2.376	68.41	-2.84
1717	2.710	68.18	-2.61
1718	3.043	67.98	-2.41
1718	3.376	67.82	-2.25
1718	3.710	67.67	-2.10
1719	4.043	67.54	-1.97
1719	4.376	67.43	-1.86
1719	4.710	67.33	-1.76
1720	5.043	67.21	-1.64
1720	5.377	67.13	-1.56
1720	5.710	67.04	-1.47
1721	6.043	66.97	-1.40
1721	6.377	66.90	-1.33
1721	6.710	66.84	-1.27
1722	7.043	66.78	-1.21
1722	7.377	66.71	-1.14
1722	7.710	66.67	-1.09
1723	8.043	66.62	-1.05
1723	8.377	66.58	-1.01
1723	8.710	66.54	-0.96
1724	9.043	66.49	-0.92
1724	9.376	66.46	-0.89
1724	9.710	66.43	-0.86
1725	10.043	66.41	-0.84
1727	12.134	66.25	-0.68
1729	14.134	66.12	-0.55
1731	16.155	66.05	-0.48
1733	18.137	65.97	-0.40
1735	20.198	65.93	-0.36
1737	22.187	65.90	-0.33
1739	24.187	65.86	-0.29
1741	26.187	65.83	-0.26
1743	28.187	65.80	-0.23
1745	30.123	65.77	-0.20

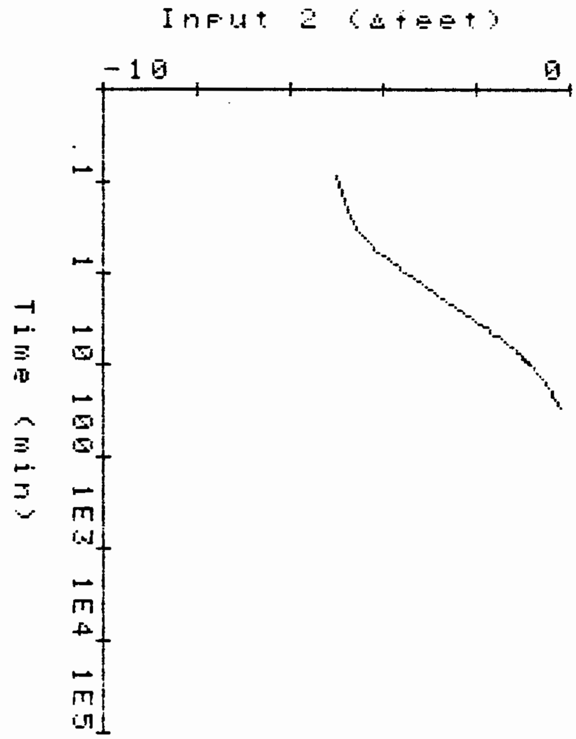

-50
0
.1
1
10
100
1E3
1E4
1E5
Time (min)

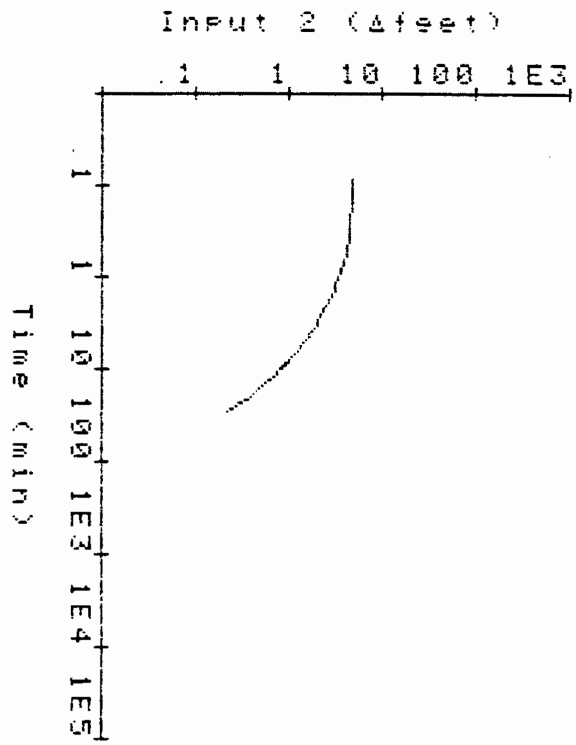

Input 1 (Δfeet)
.1
1
10
100
1E3
.1
1
10
100
1E3
1E4
1E5
Time (min)


Input 1 (Δfeet)
-50
0
.1
1
10
100
1E3
1E4
1E5
Time (t/t')

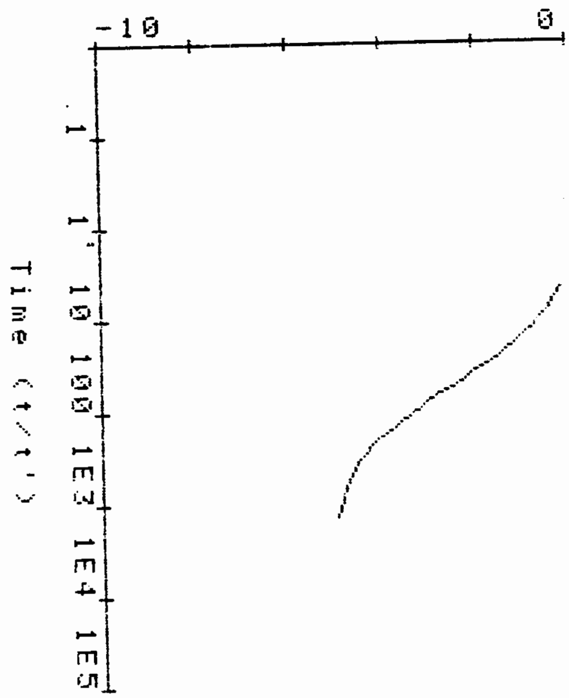
Input 2 (feet):

Time	ET (min)	level	Δlevel
1715	0.084	69.69	-5.01
1715	0.167	69.52	-4.84
1715	0.251	69.37	-4.69
1715	0.334	69.22	-4.54
1715	0.417	69.07	-4.39
1715	0.501	68.92	-4.24
1715	0.584	68.77	-4.09
1715	0.667	68.65	-3.97
1715	0.751	68.50	-3.82
1715	0.834	68.40	-3.72
1716	0.917	68.28	-3.60
1716	1.001	68.20	-3.52
1716	1.376	67.82	-3.13
1716	1.710	67.54	-2.86
1717	2.043	67.31	-2.63
1717	2.376	67.10	-2.42
1717	2.710	66.95	-2.27
1718	3.043	66.79	-2.11
1718	3.376	66.67	-1.99
1718	3.710	66.55	-1.87
1719	4.043	66.45	-1.77
1719	4.376	66.36	-1.68
1719	4.710	66.27	-1.59
1720	5.043	66.21	-1.53
1720	5.377	66.12	-1.44
1720	5.710	66.06	-1.38
1721	6.043	65.99	-1.31
1721	6.377	65.93	-1.25
1721	6.710	65.89	-1.20
1722	7.043	65.84	-1.16
1722	7.377	65.79	-1.11
1722	7.710	65.76	-1.08
1723	8.043	65.71	-1.03
1723	8.377	65.66	-0.98
1723	8.710	65.64	-0.96
1724	9.043	65.61	-0.93
1724	9.376	65.56	-0.88
1724	9.710	65.54	-0.86
1725	10.043	65.51	-0.83
1727	12.134	65.36	-0.68
1729	14.134	65.24	-0.56
1731	16.155	65.17	-0.49
1733	18.137	65.12	-0.44
1735	20.198	65.06	-0.38
1737	22.187	65.03	-0.35
1739	24.187	64.98	-0.30
1741	26.187	64.95	-0.27
1743	28.187	64.91	-0.23
1745	30.123	64.90	-0.22



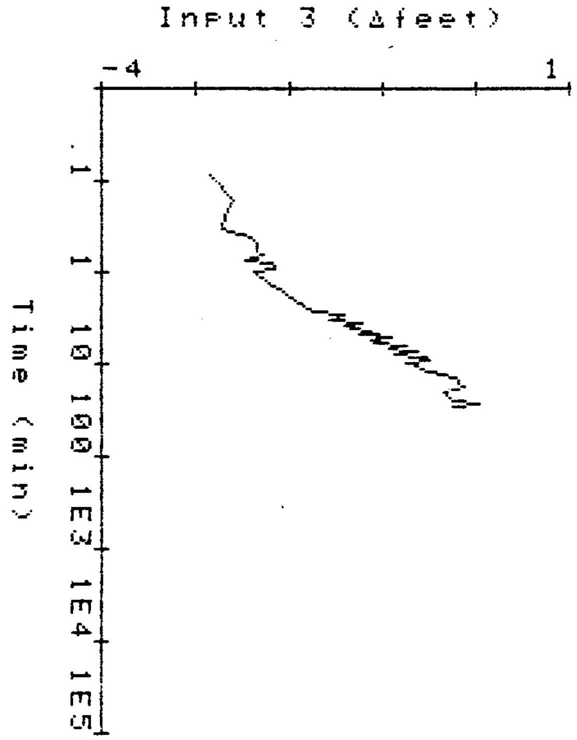


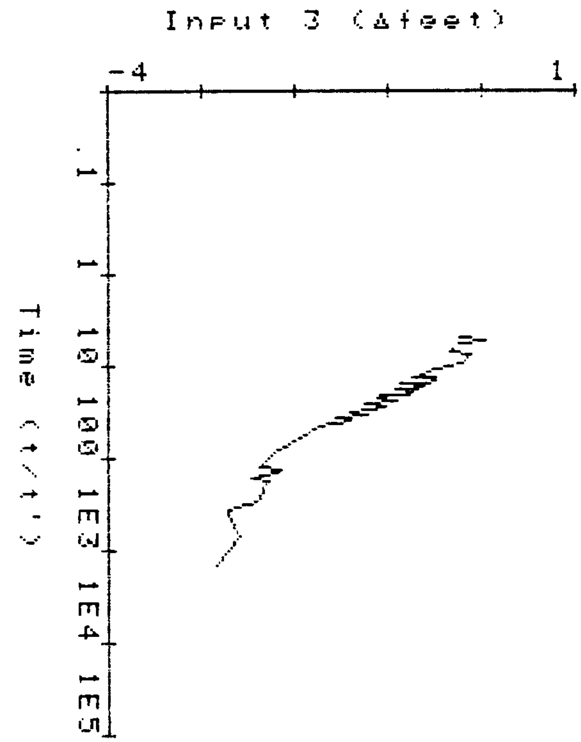
Input 2 (Δfeet)

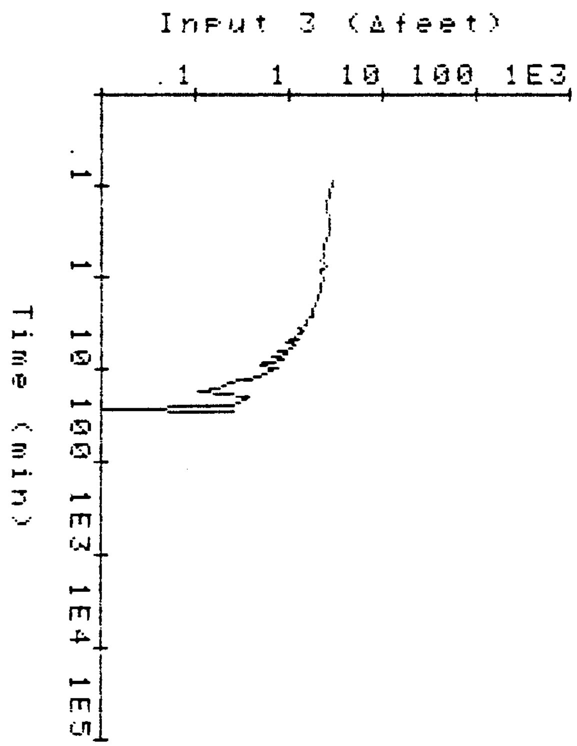


Input 3 (feet):

Time	ET (min)	level	Δlevel
1715	0.084	67.54	-2.85
1715	0.167	67.27	-2.58
1715	0.251	67.37	-2.68
1715	0.334	67.41	-2.72
1715	0.417	67.10	-2.41
1715	0.501	67.05	-2.36
1715	0.584	67.02	-2.33
1715	0.667	66.96	-2.27
1715	0.751	67.17	-2.48
1715	0.834	66.87	-2.18
1716	0.917	66.83	-2.14
1716	1.001	67.07	-2.38
1716	1.376	66.90	-2.21
1716	1.710	66.74	-2.05
1717	2.043	66.62	-1.93
1717	2.376	66.53	-1.84
1717	2.710	66.43	-1.74
1718	3.043	66.10	-1.41
1718	3.376	66.24	-1.55
1718	3.710	65.92	-1.23
1719	4.043	66.10	-1.41
1719	4.376	65.85	-1.16
1719	4.710	65.72	-1.03
1720	5.043	65.94	-1.25
1720	5.377	65.61	-0.92
1720	5.710	65.80	-1.11
1721	6.043	65.77	-1.08
1721	6.377	65.47	-0.78
1721	6.710	65.42	-0.74
1722	7.043	65.64	-0.95
1722	7.377	65.41	-0.72
1722	7.710	65.32	-0.63
1723	8.043	65.58	-0.89
1723	8.377	65.27	-0.58
1723	8.710	65.23	-0.54
1724	9.043	65.20	-0.51
1724	9.376	65.17	-0.48
1724	9.710	65.44	-0.75
1725	10.043	65.40	-0.71
1727	12.134	65.19	-0.50
1729	14.134	64.91	-0.22
1731	16.155	64.87	-0.18
1733	18.137	64.80	-0.11
1735	20.198	65.04	-0.35
1737	22.187	65.00	-0.32
1739	24.187	64.97	-0.28
1741	26.187	64.94	-0.25
1743	28.187	64.66	0.03
1745	30.123	64.94	-0.25

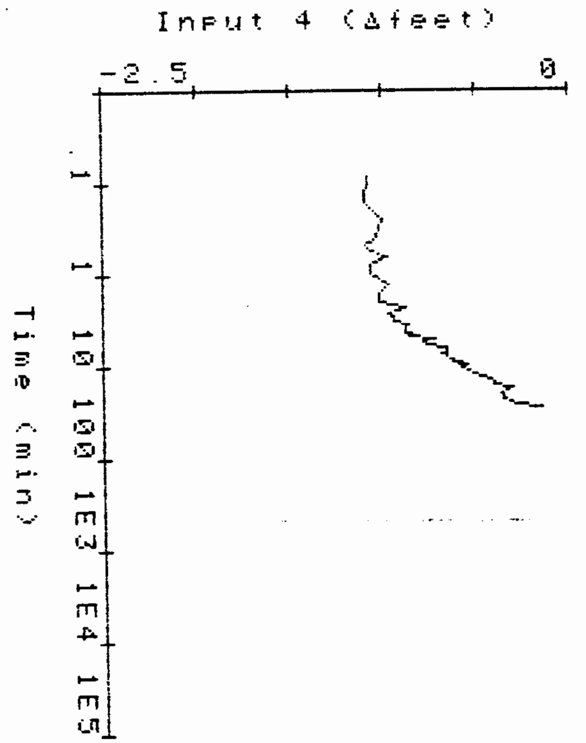

Input 3 (Δfeet)
-4
1
.1
1
10
100
1E3
1E4
1E5
Time (min)

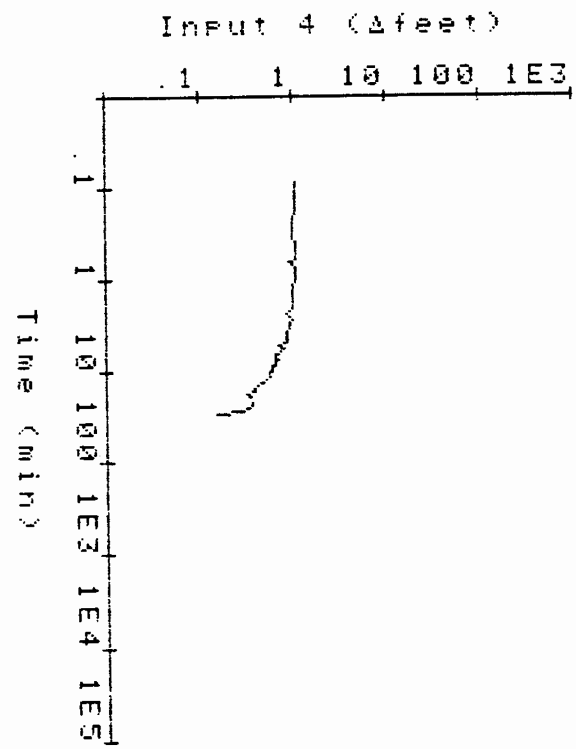

Input 3 (Δfeet)
-4
1
.1
1
10
100
1E3
1E4
1E5
Time (t/t')

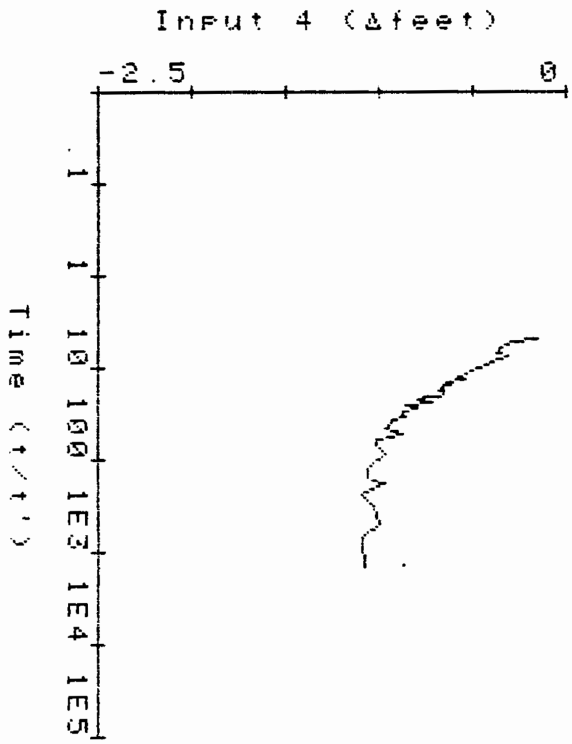

Input 3 (Δfeet)
.1
1
10
100
1E3
.1
1
10
100
1E3
1E4
1E5
Time (min)

Input 4 (feet):

Time	ET (min)	level	Δlevel
1715	0.084	66.73	-1.08
1715	0.167	66.75	-1.10
1715	0.251	66.66	-1.00
1715	0.334	66.66	-1.01
1715	0.417	66.70	-1.05
1715	0.501	66.74	-1.09
1715	0.584	66.69	-1.04
1715	0.667	66.62	-0.96
1715	0.751	66.69	-1.04
1715	0.834	66.71	-1.06
1716	0.917	66.72	-1.07
1716	1.001	66.72	-1.07
1716	1.376	66.62	-0.97
1716	1.710	66.67	-1.02
1717	2.043	66.66	-1.01
1717	2.376	66.52	-0.87
1717	2.710	66.62	-0.97
1718	3.043	66.59	-0.94
1718	3.376	66.59	-0.94
1718	3.710	66.50	-0.85
1719	4.043	66.52	-0.87
1719	4.376	66.52	-0.87
1719	4.710	66.46	-0.80
1720	5.043	66.50	-0.85
1720	5.377	66.37	-0.72
1720	5.710	66.45	-0.80
1721	6.043	66.41	-0.76
1721	6.377	66.32	-0.67
1721	6.710	66.31	-0.66
1722	7.043	66.31	-0.66
1722	7.377	66.34	-0.69
1722	7.710	66.32	-0.66
1723	8.043	66.30	-0.65
1723	8.377	66.27	-0.62
1723	8.710	66.29	-0.64
1724	9.043	66.27	-0.61
1724	9.376	66.25	-0.60
1724	9.710	66.20	-0.54
1725	10.043	66.25	-0.59
1727	12.134	66.17	-0.52
1729	14.134	66.07	-0.42
1731	16.155	66.05	-0.40
1733	18.137	65.97	-0.31
1735	20.198	66.03	-0.38
1737	22.187	66.01	-0.36
1739	24.187	66.00	-0.35
1741	26.187	65.97	-0.32
1743	28.187	65.95	-0.30
1745	30.123	65.81	-0.15



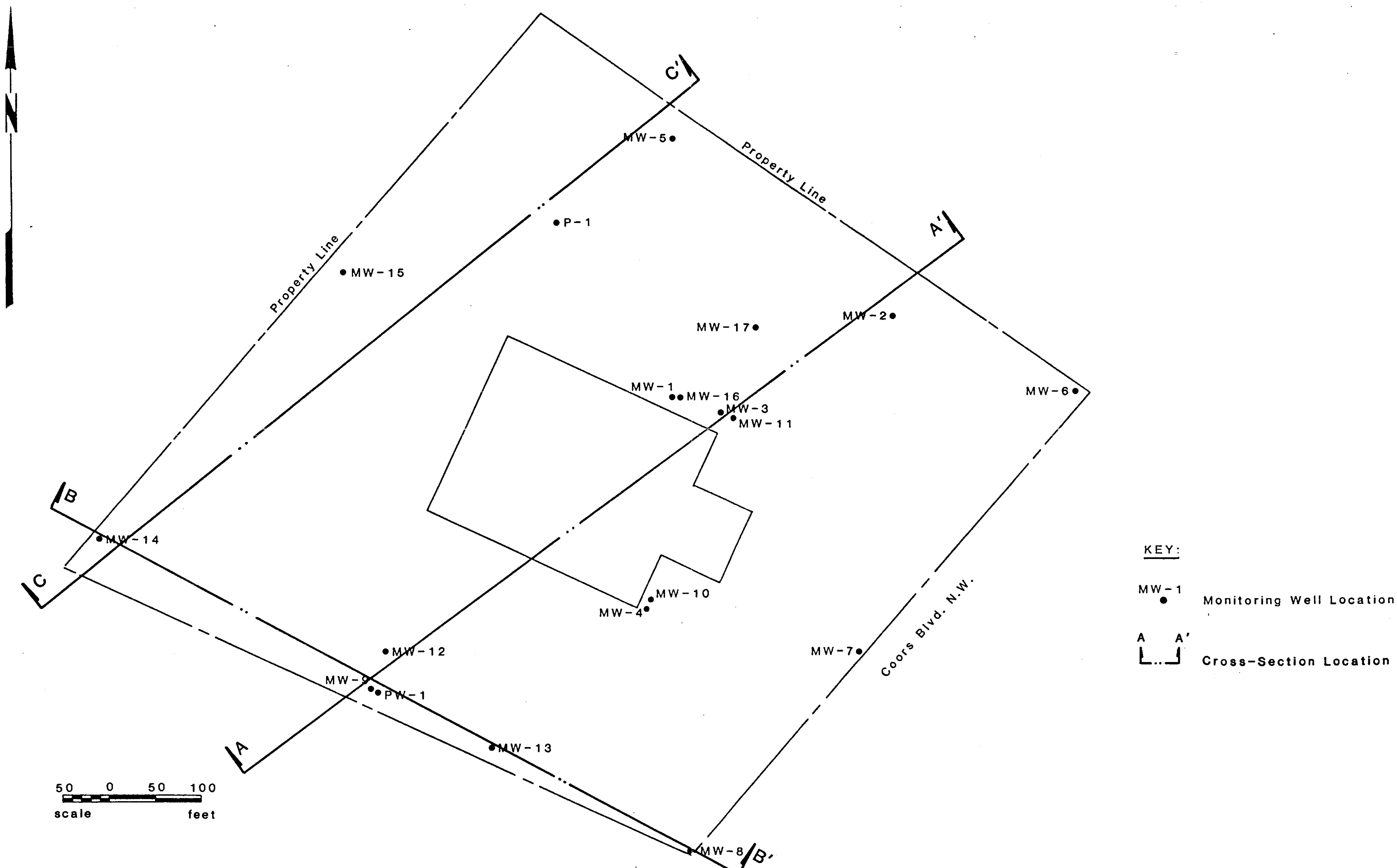




SE200B manufactured by
In-situ, inc.
Lar[illegible]

Appendix F

Figures 1 through 21



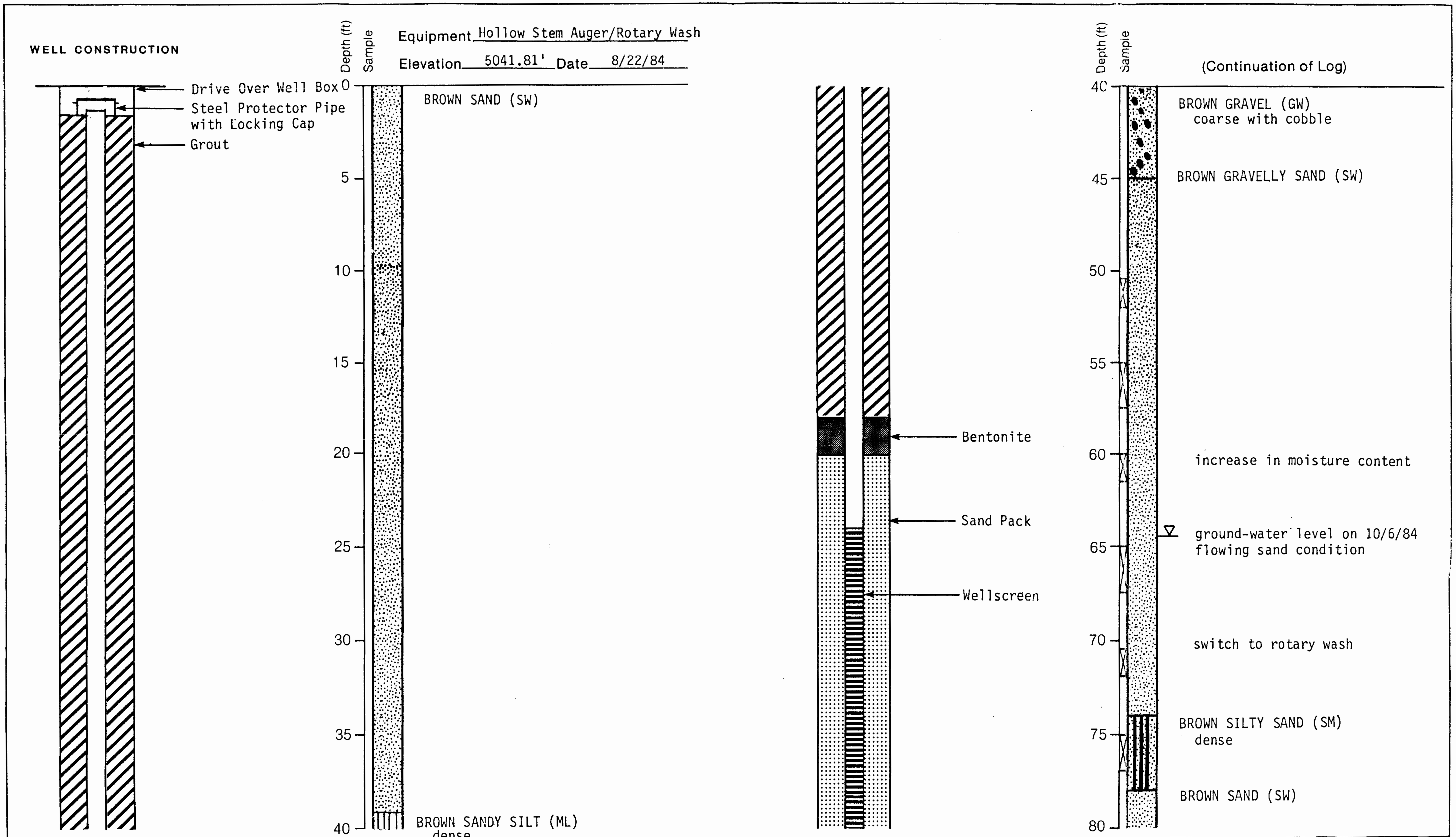
Reference: Sparton Tech. Inc. Survey by Denney-Gross & Assoc., Inc., Dated 10/5/84.

Harding Lawson Associates
Engineers, Geologists & Geophysicists

SITE LOCATION MAP
Sparton Technology, Inc.
Albuquerque, New Mexico

FIGURE 1

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
LM	6310,013.12	DG	1/11/85		



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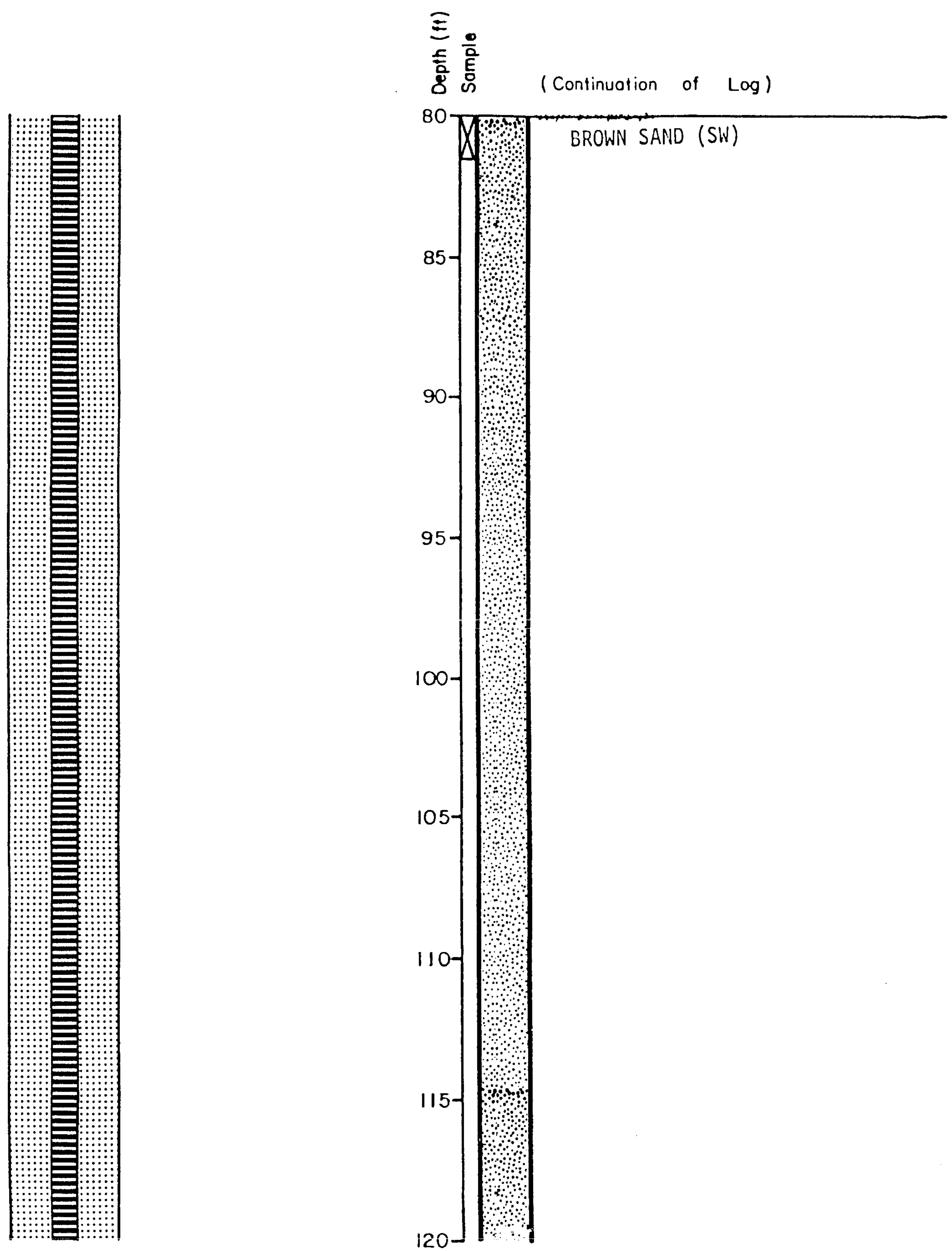
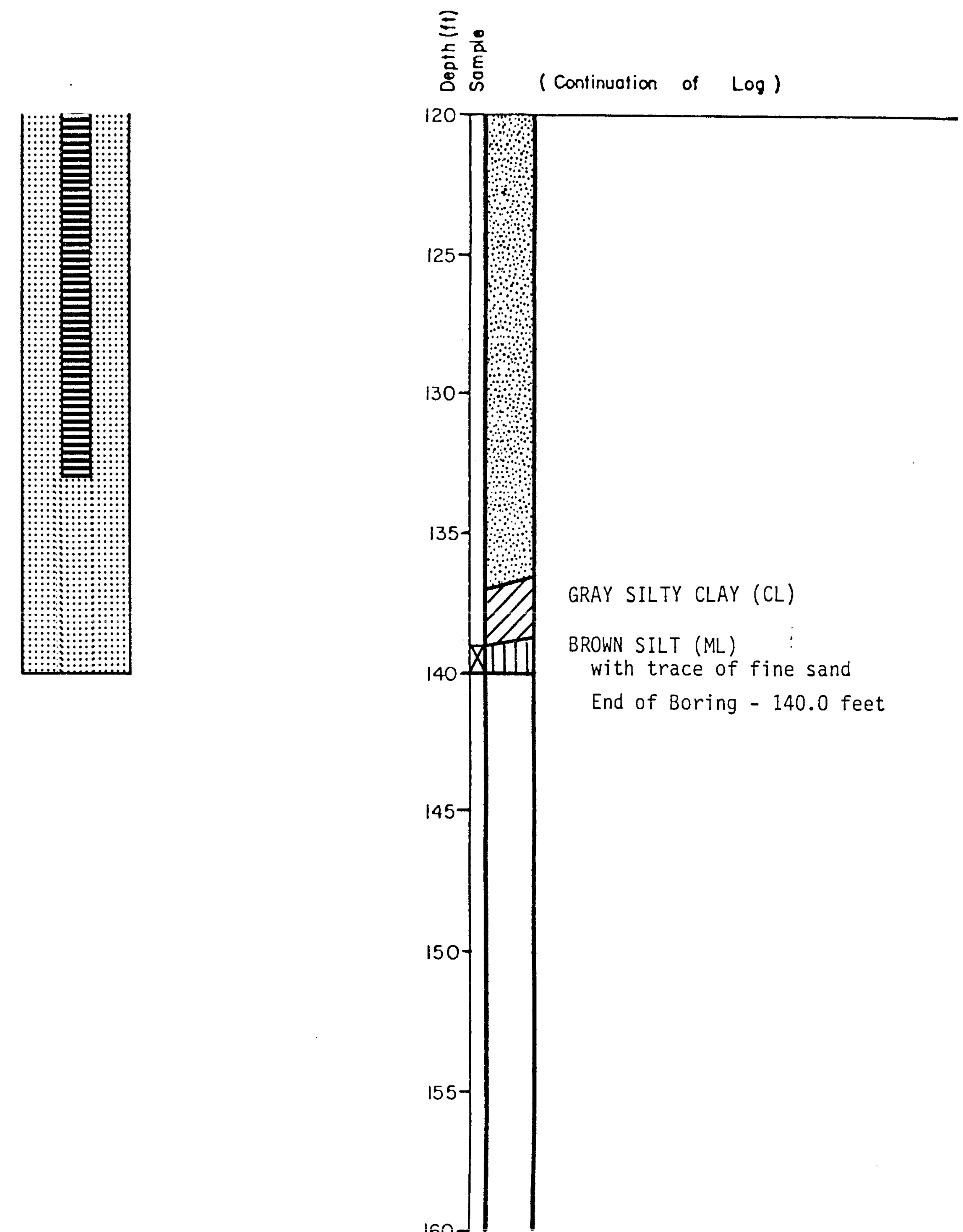
LOG OF WELL MW-12
Sparton Technology, Inc.
Albuquerque, New Mexico

FIGURE 2A

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
[illegible]	6310,013.12	[illegible]			





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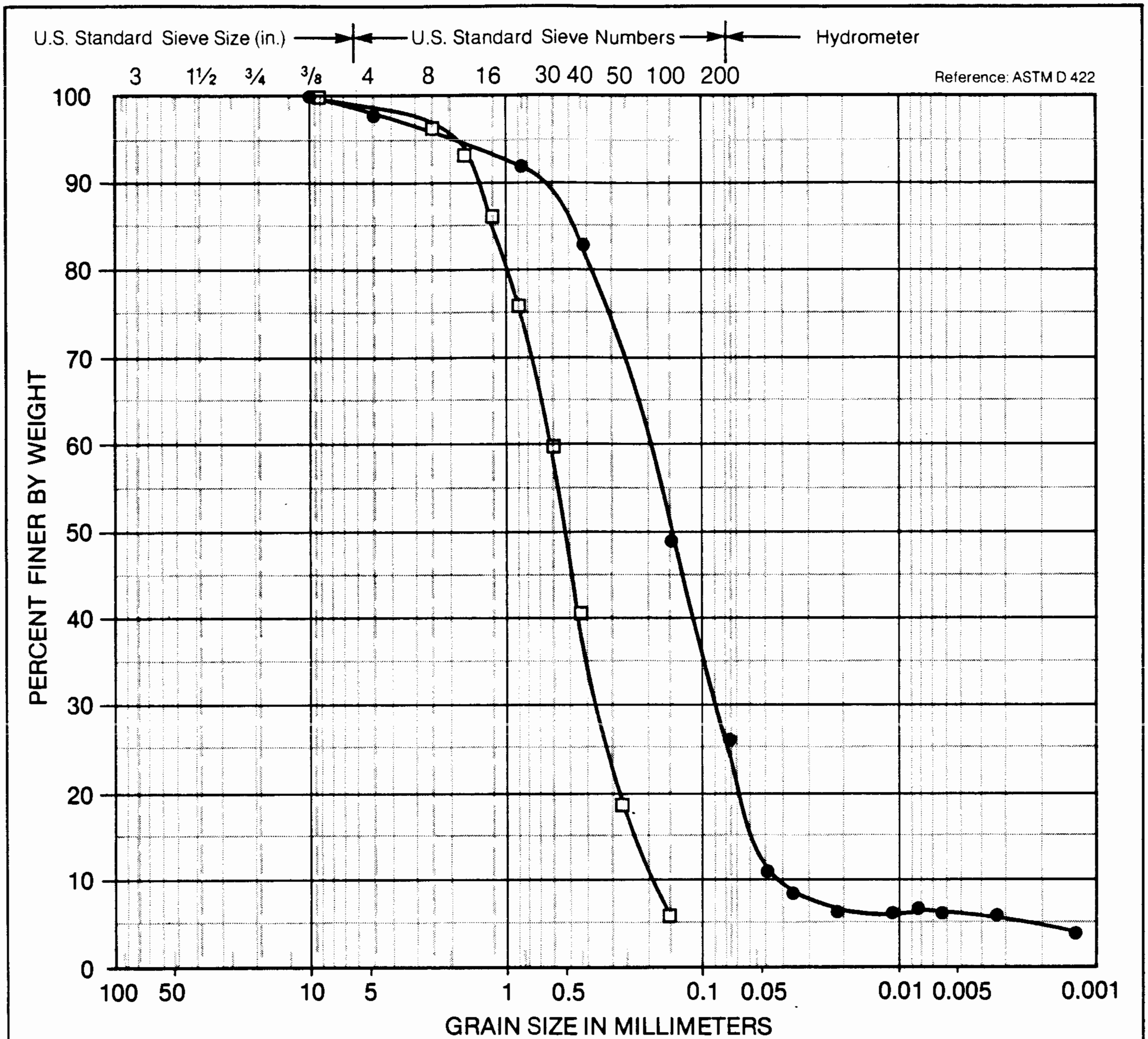
LOG OF WELL MW-12 (Cont'd)
Sparton Technology, Inc.
Albuquerque, New Mexico

FIGURE
2B

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
LM	6310,013.12	DLK	1/11/8		



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Sample Source	Classification
●	MW-12 at 75-77'	Silty Sand (SM) (spooned sample) Analyzed by HLA
□	MW-12 at 60-70' ; 80-135'	Sand (SW) (washed sample) Analyzed by Rodgers and Co.

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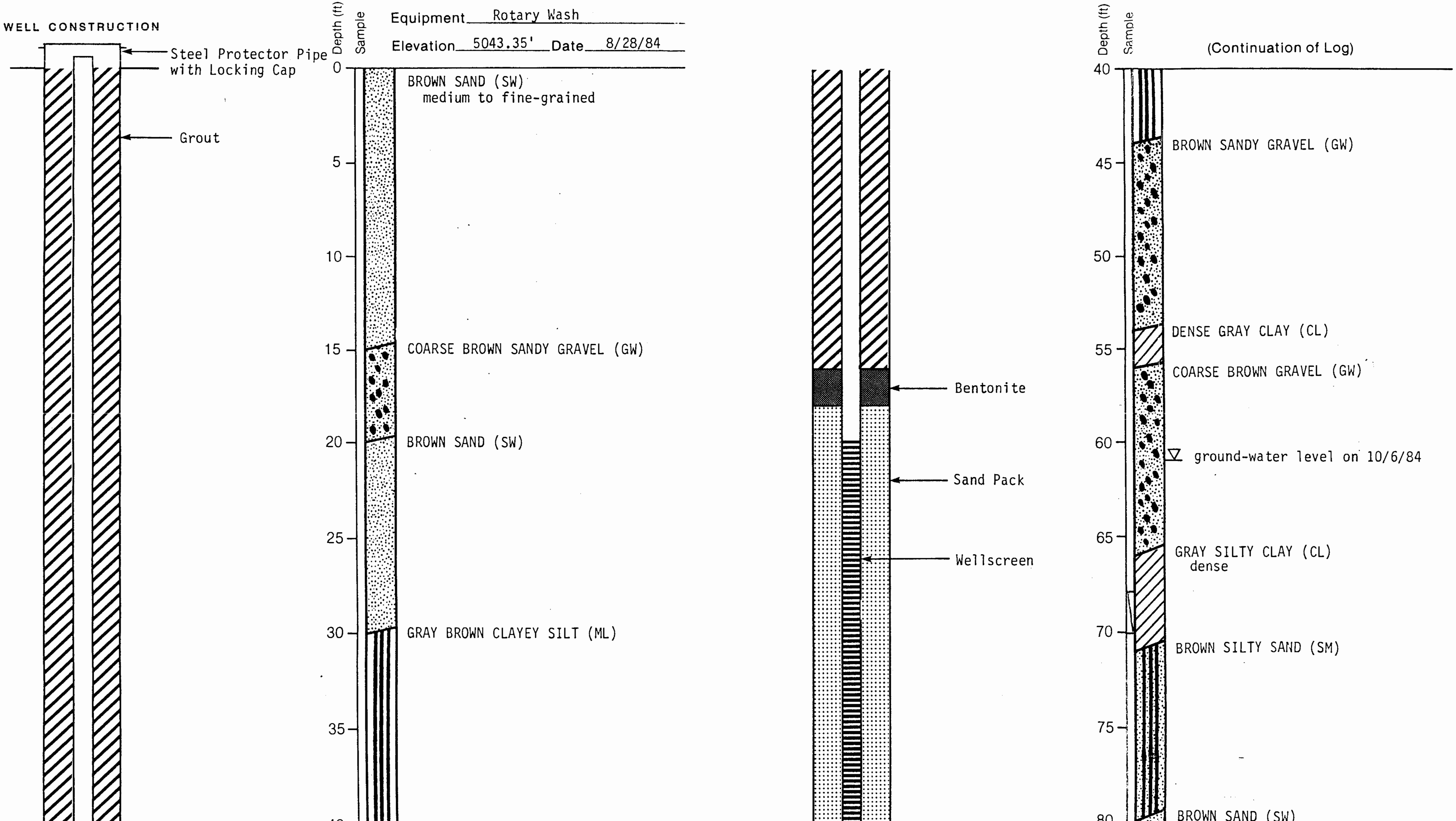
Particle Size Analysis
Sparton Technology, Inc.
Albuquerque, New Mexico

FIGURE 3

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
LM	6310,013.12	DCB	1/11/85		



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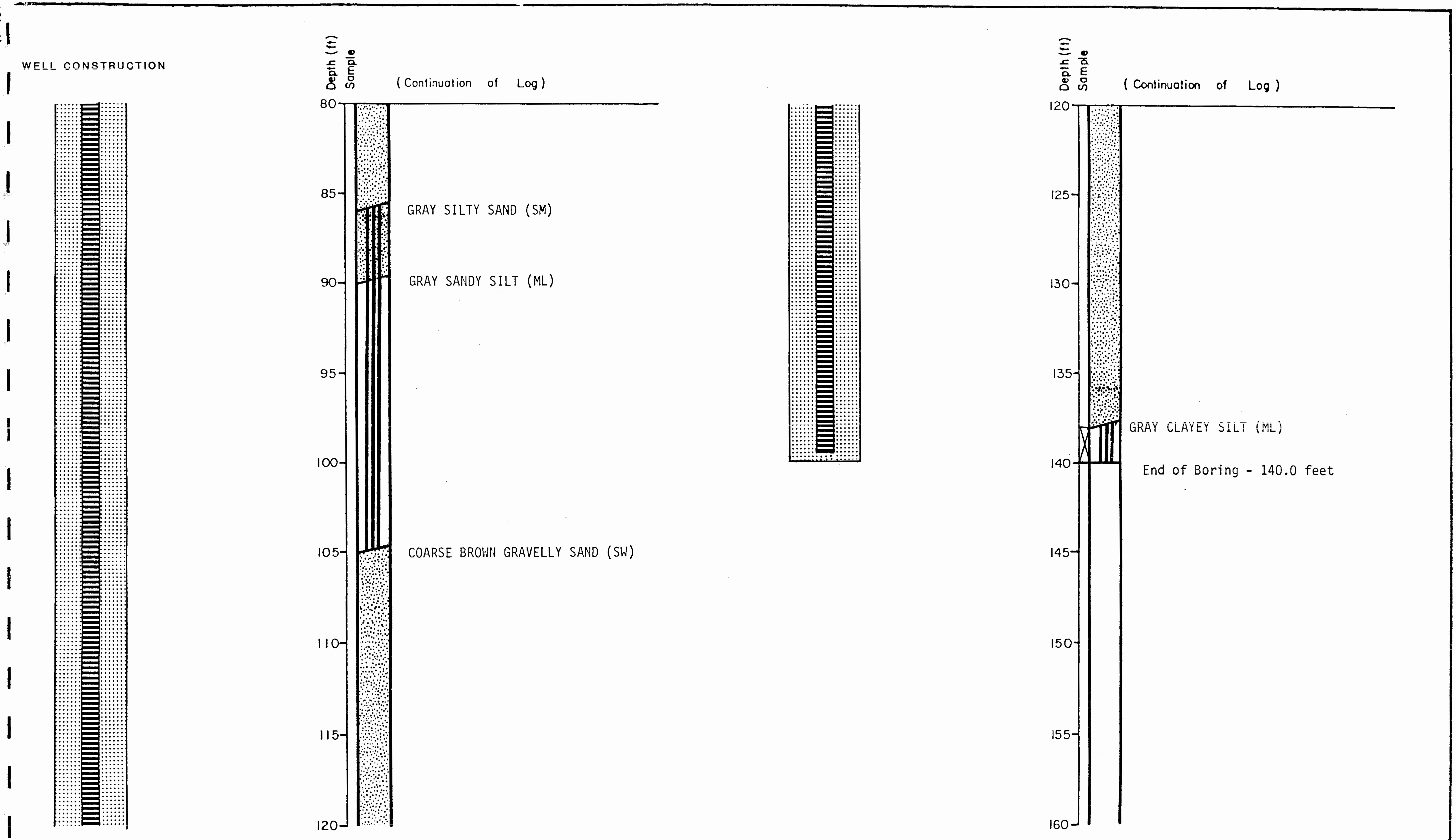
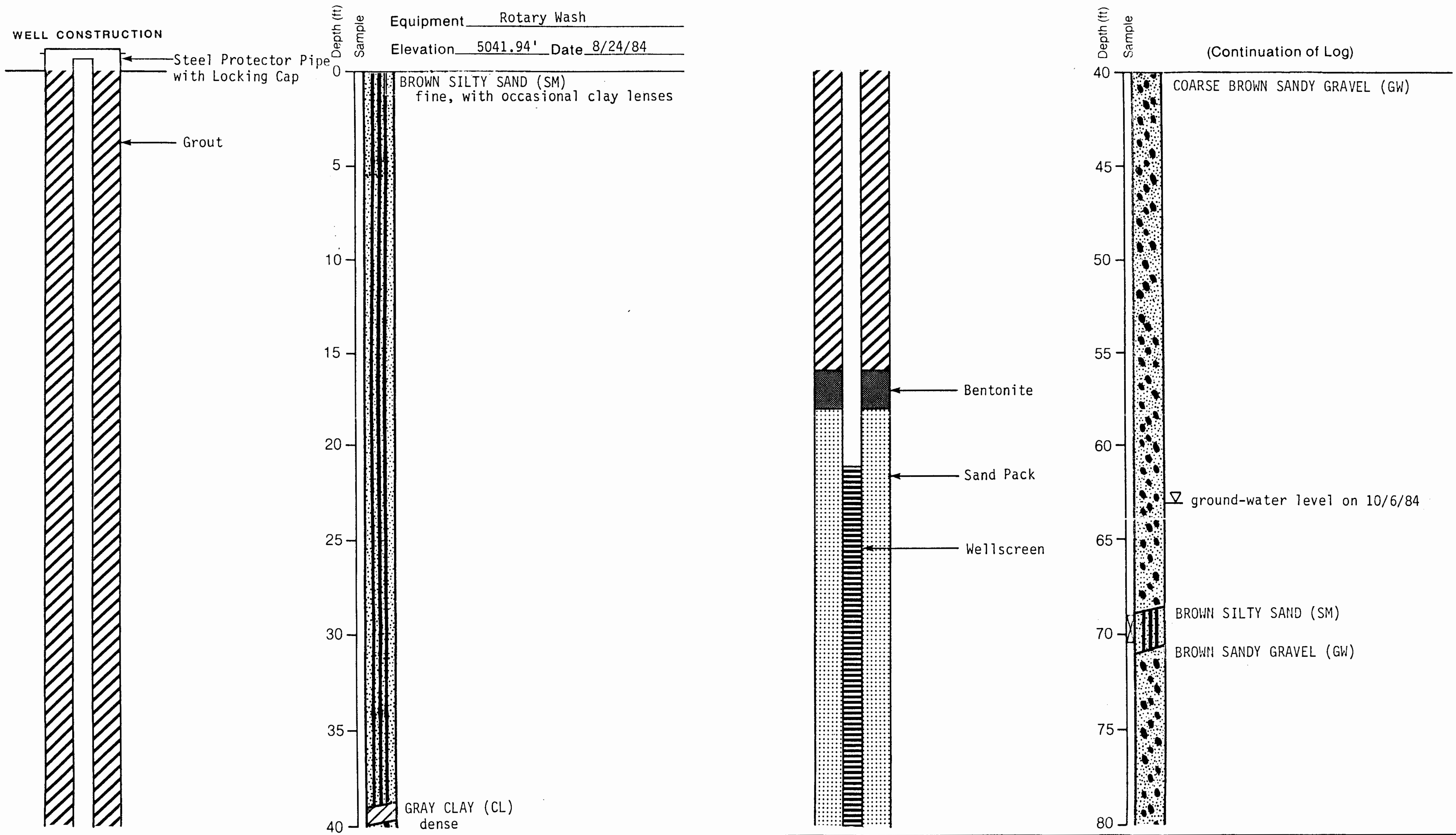
LOG OF WELL MW-13
Sparton Technology, Inc.
Albuquerque, New Mexico

FIGURE
4A

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
LM	6310,013.12	DLB	1/11/85		



Harding Lawson Associates Engineers, Geologists & Geophysicists	LOG OF WELL MW-13 (Cont'd) Sparton Technology, Inc. Albuquerque, New Mexico		FIGURE 4B
DRAWN LM	JOB NUMBER 6310,013.12	APPROVED DLB	DATE 1/11/85	REVISED	DATE



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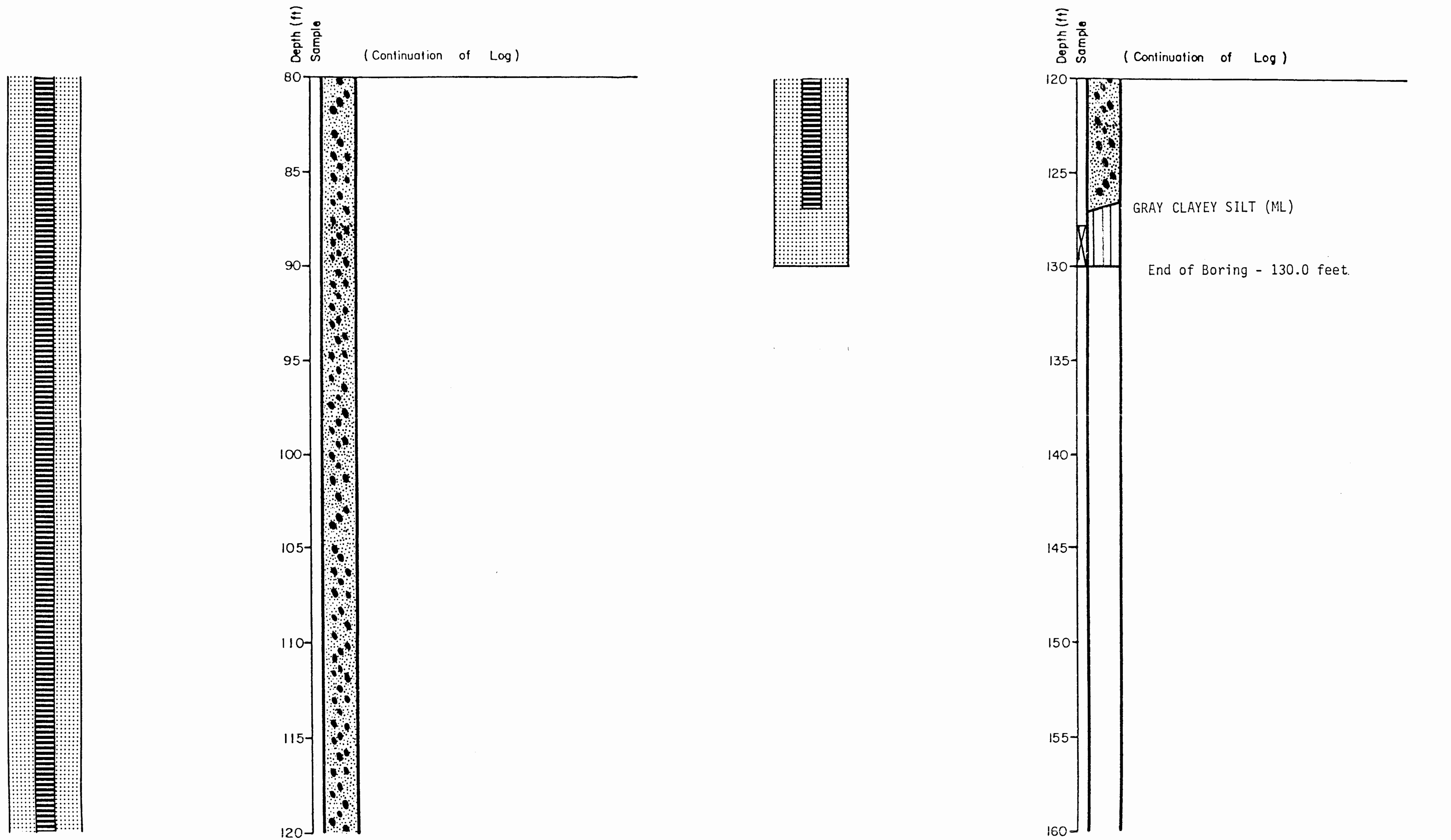
LOG OF WELL MW-14
Sparton Technology, Inc.
Albuquerque, New Mexico

FIGURE 5A

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HM	6310,013.12	DLB	1/11/85		



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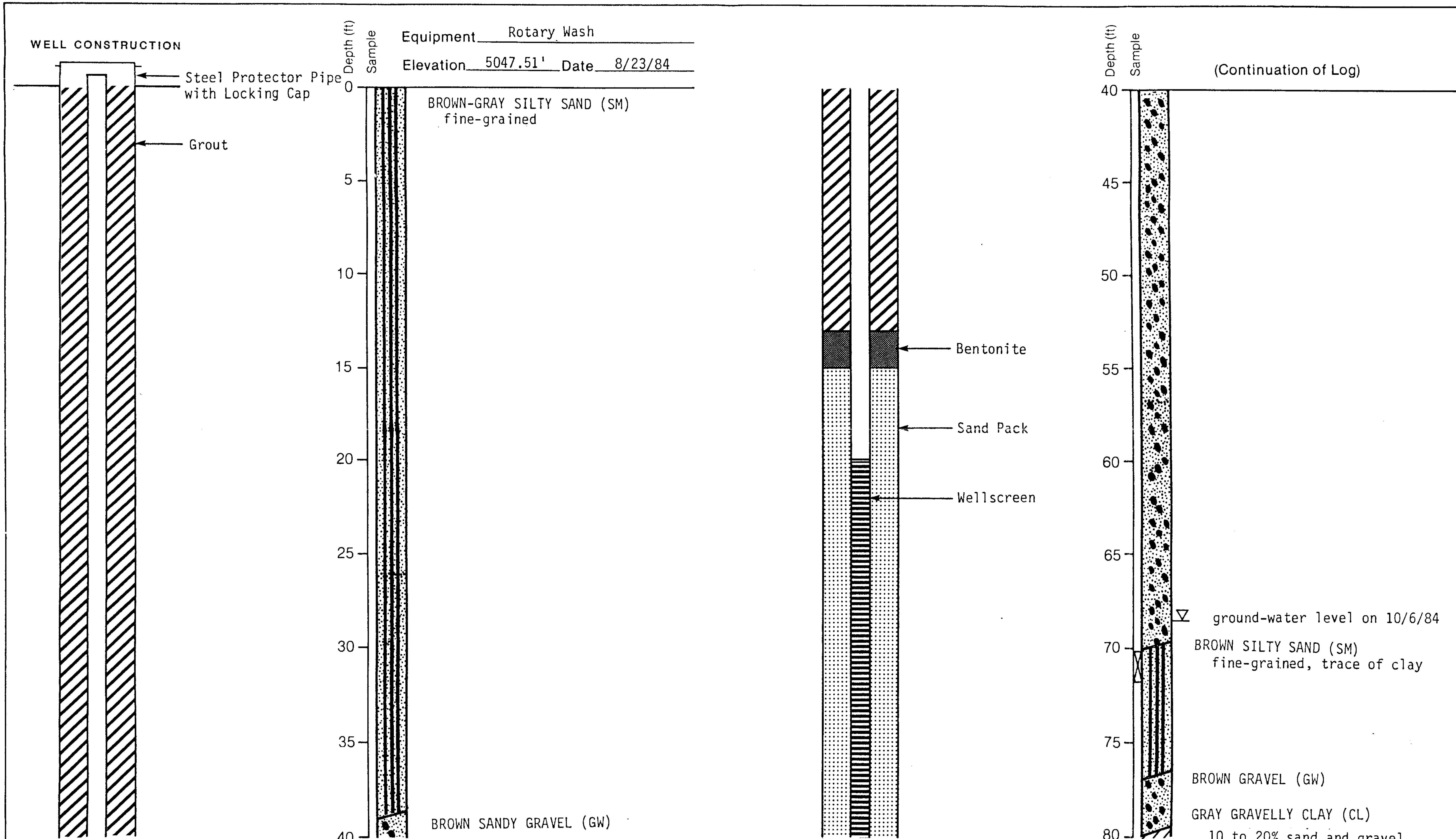
LOG OF WELL MW-14 (Cont'd)
Sparton Technology, Inc.
Albuquerque, New Mexico

FIGURE
5B

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
LM	6310,013.12	DCB	1/11/[illegible]		



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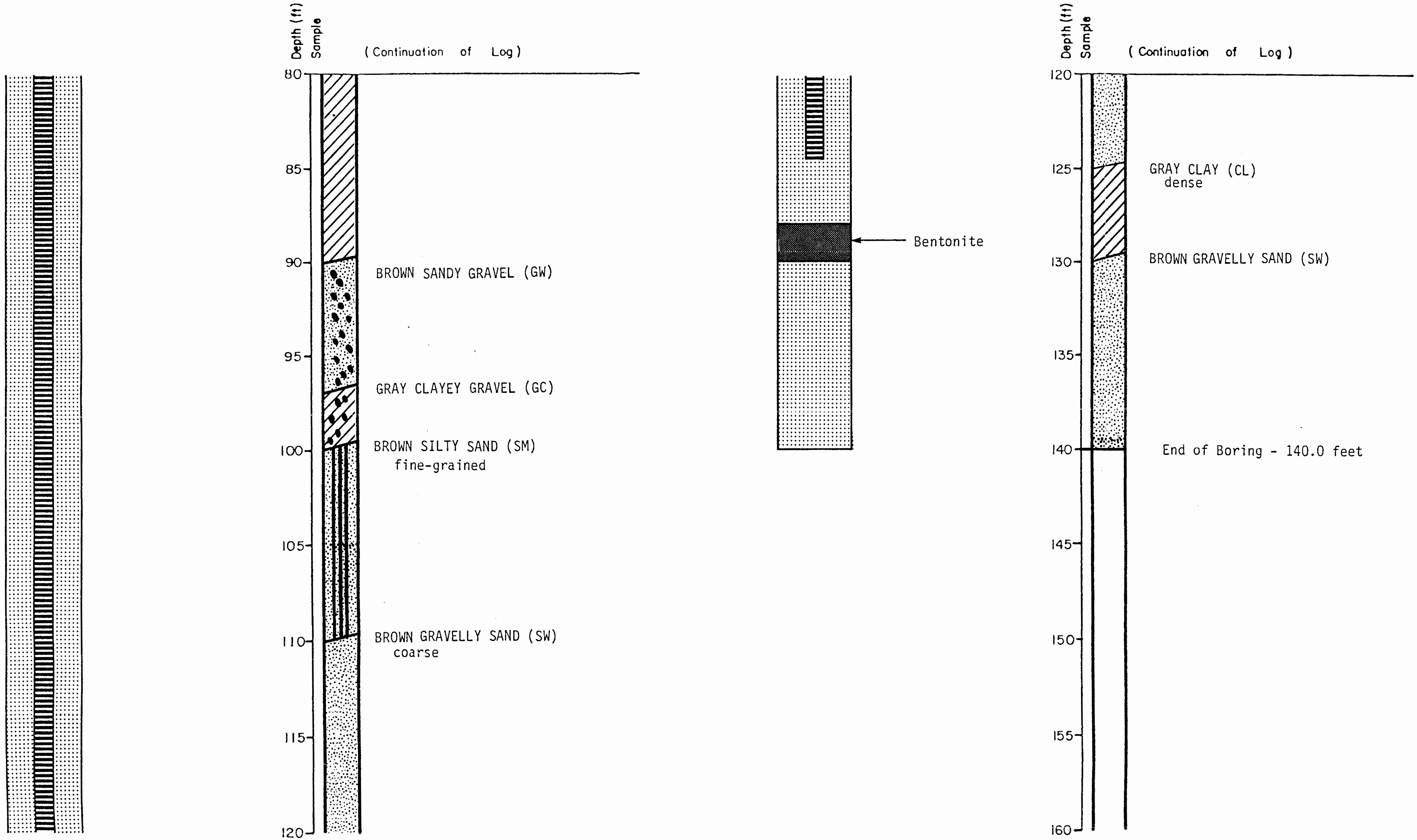
LOG OF WELL MW-15
Sparton Technology, Inc.
Albuquerque, New Mexico

FIGURE 6A

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
LM	6310,013.12	DCR	[illegible]		



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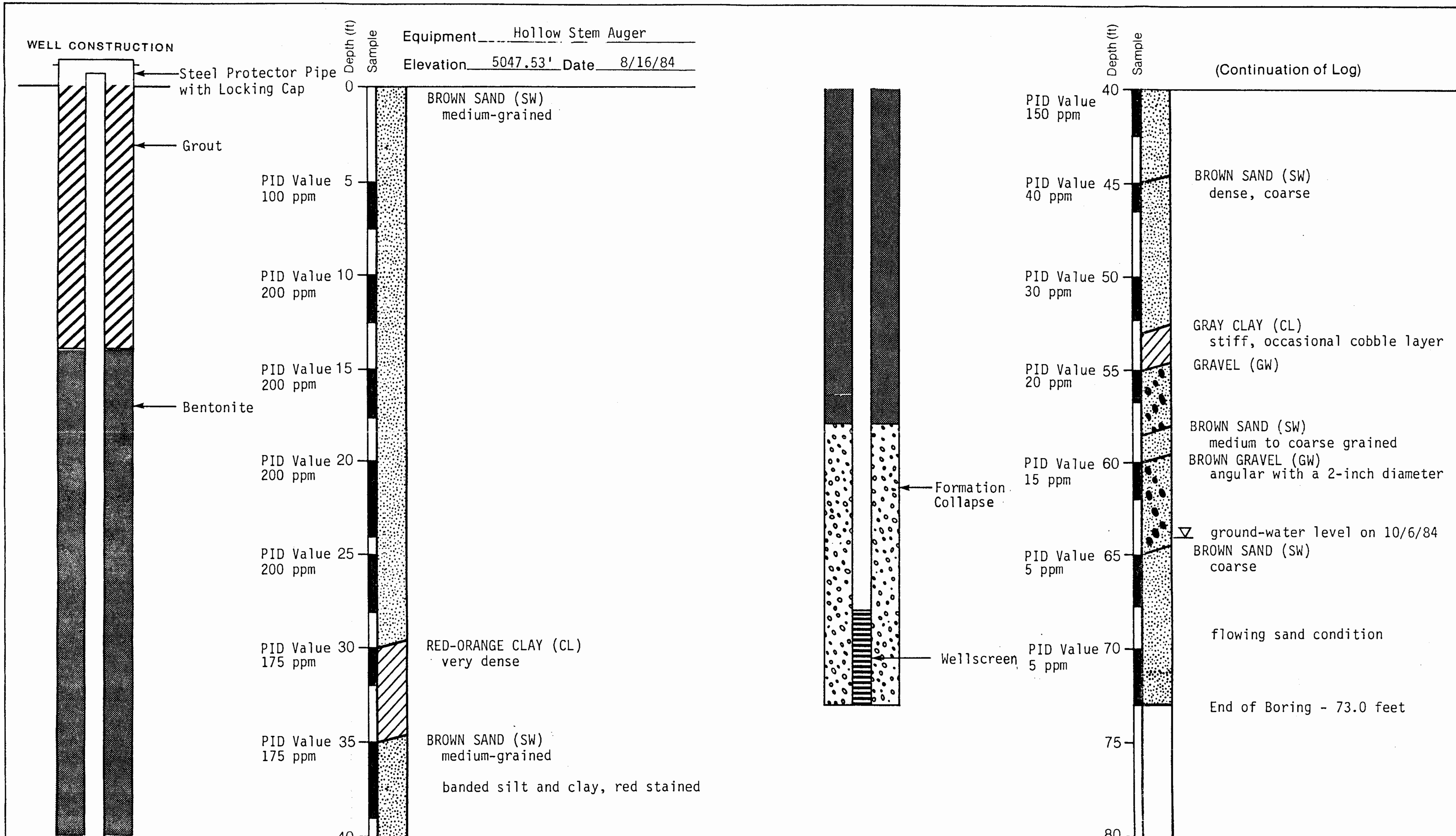
LOG OF WELL MW-15 (Cont'd)
Sparton Technology, Inc.
Albuquerque, New Mexico

FIGURE
6B

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
LM	6310,013.12	DLB	1/11/8[illegible]		



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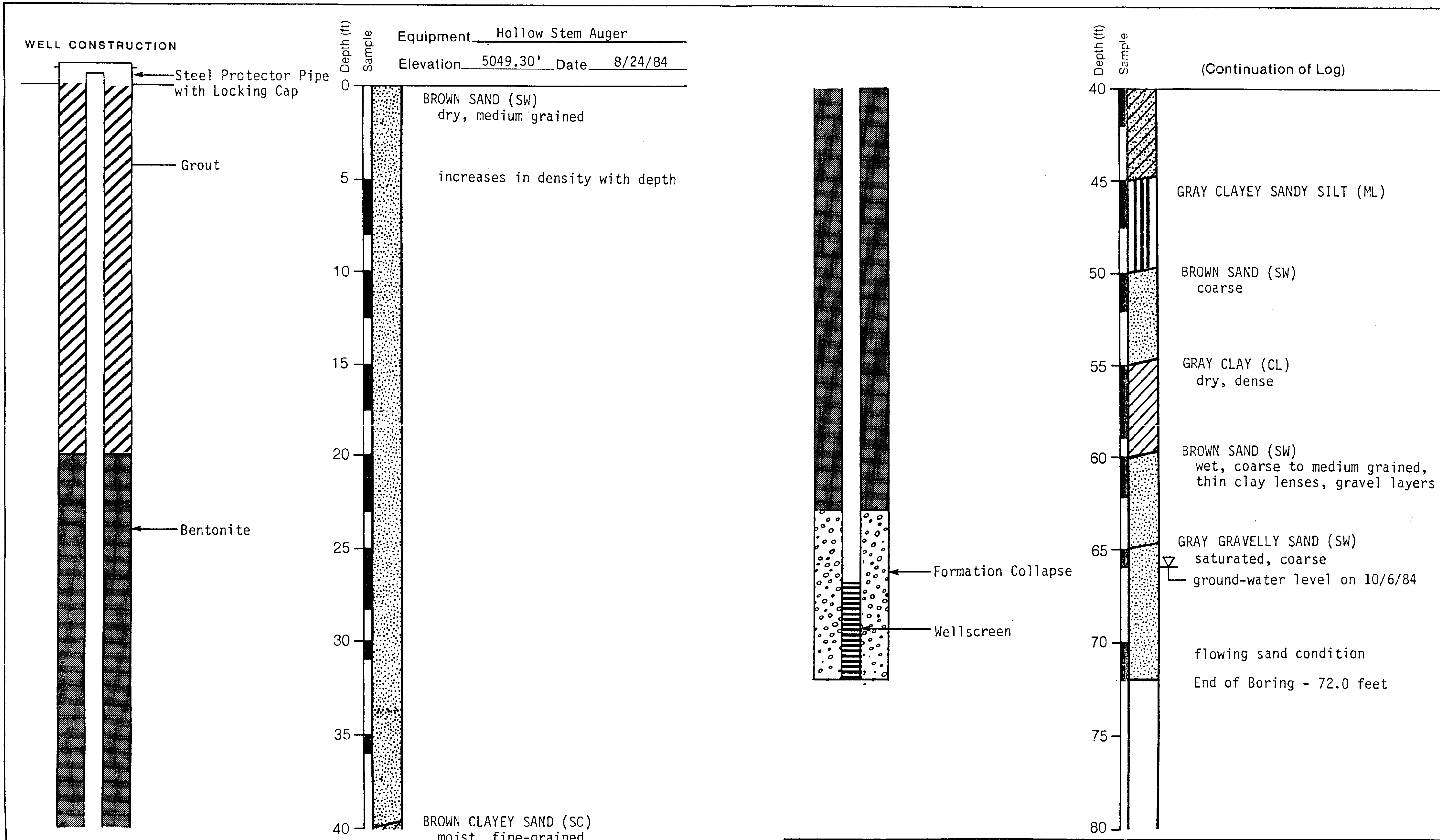
LOG OF WELL MW-16

Sparton Technology, Inc.
Albuquerque, New Mexico

FIGURE 7

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
LM	6310,013.12	DLB	1/11/85		

NOTE: PID Values were obtained with an HNU Systems Model 101 with an 11.7eV lamp and are referenced to benzene.



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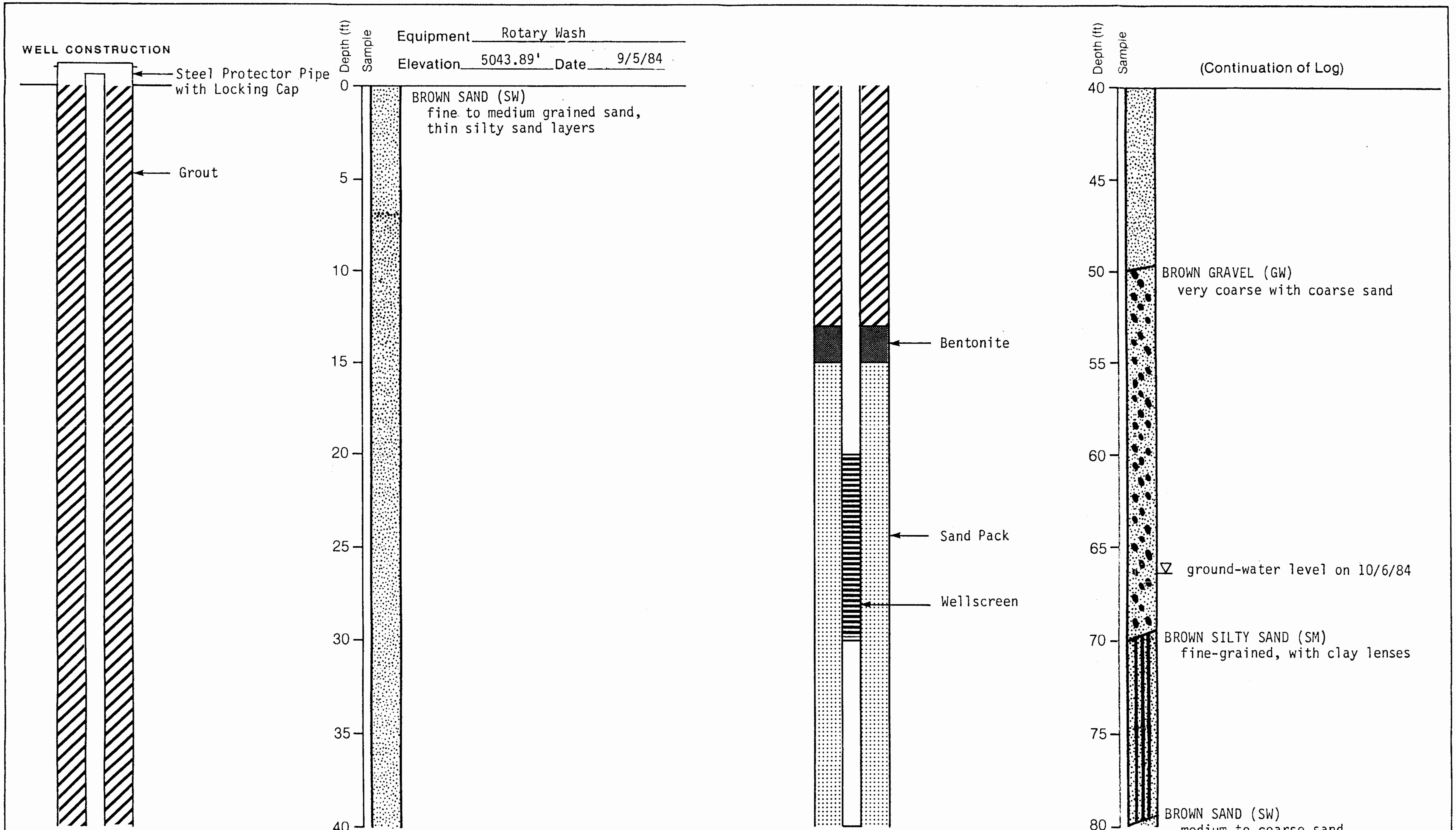
LOG OF WELL MW-17
Sparton Technology, Inc.
Albuquerque, New Mexico

FIGURE
8

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
JM	6310,013.12	[illegible]	[illegible]		



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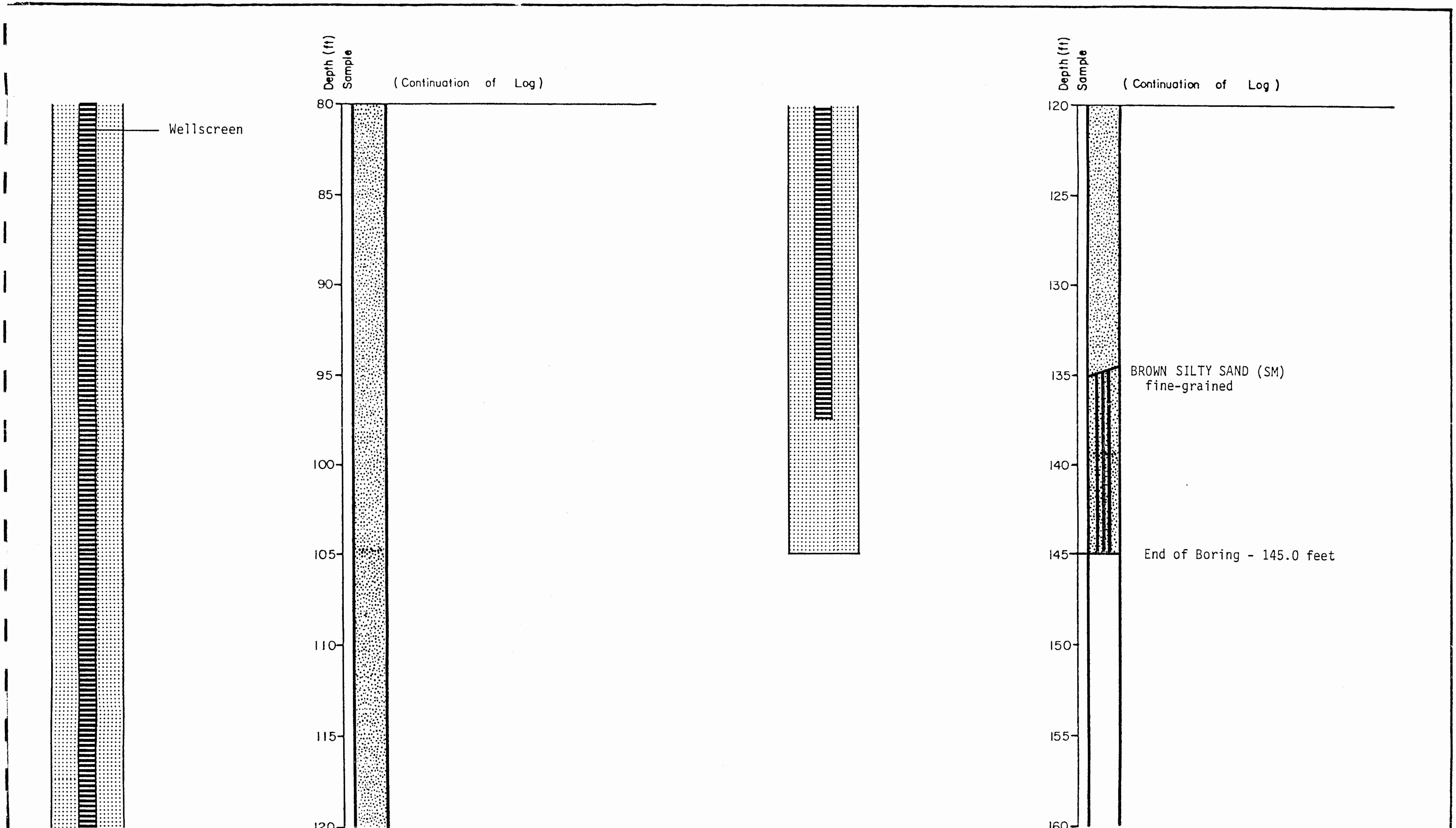
LOG OF WELL PW-1
Sparton Technology, Inc.
Albuquerque, New Mexico

FIGURE 9A

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
LM	6310,013.12	DLE	1/1/85		



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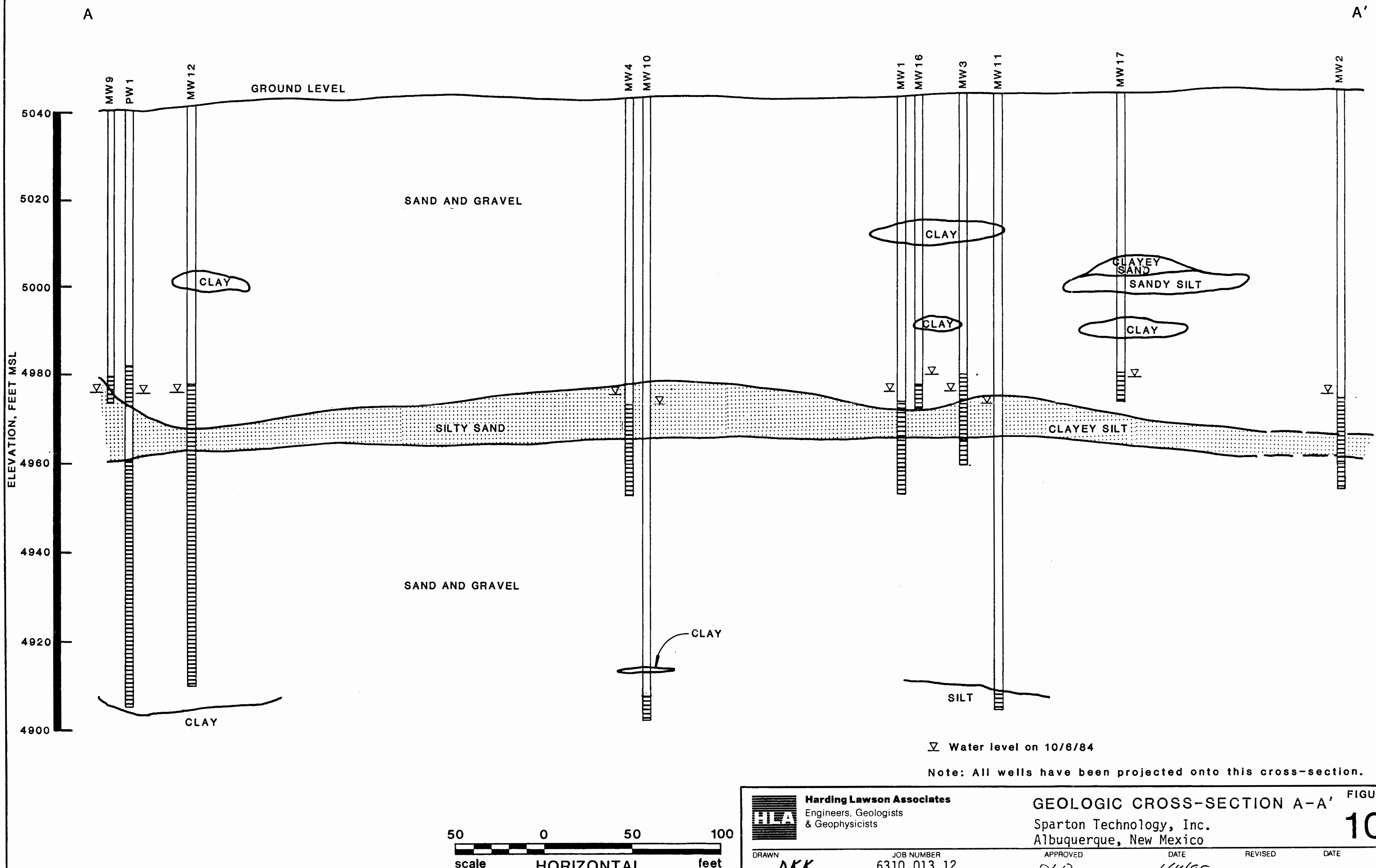
LOG OF WELL PW-1 (Cont'd)
Sparton Technology, Inc.
Albuquerque, New Mexico

FIGURE
9B

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
LM	6310,013.12	DLB	1/11/85		



Water level on 10/6/84

Note: All wells have been projected onto this cross-section.

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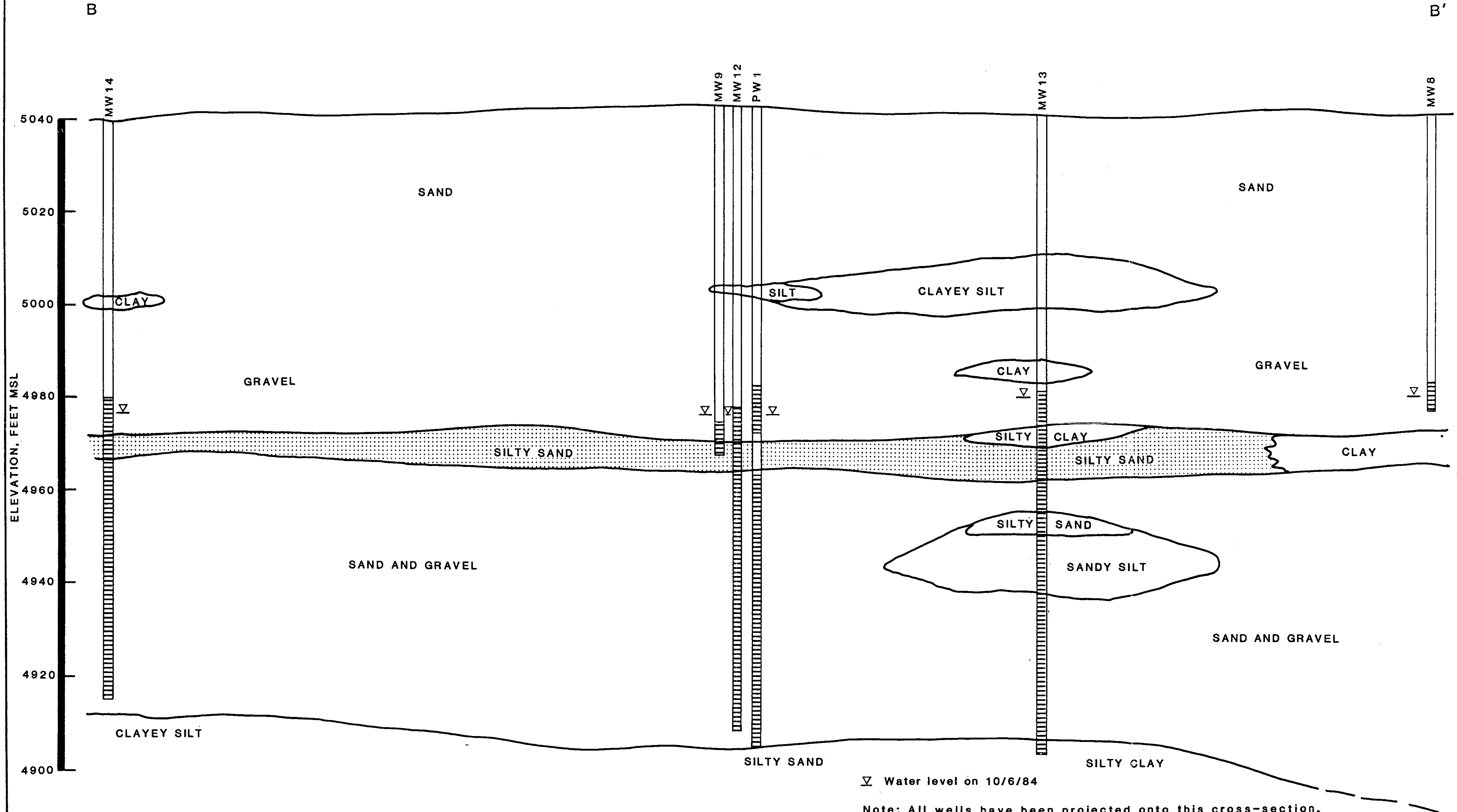
GEOLOGIC CROSS-SECTION A-A'

Sparton Technology, Inc.
Albuquerque, New Mexico

FIGURE 10

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
D.K.K.	6310,013.12	DLB	1/11/85		



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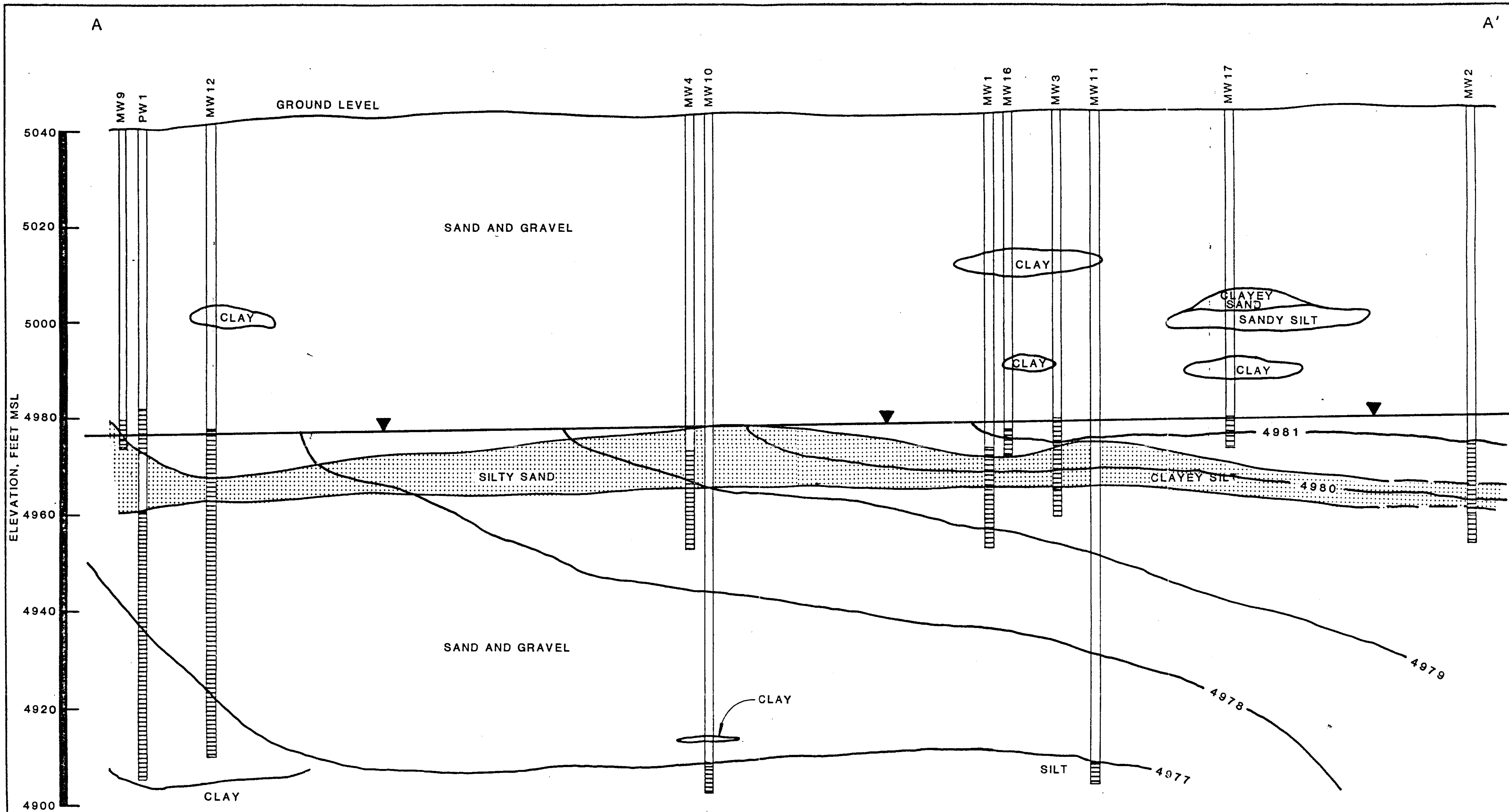
GEOLOGIC CROSS-SECTION B-B'
Sparton Technology, Inc.
Albuquerque, New Mexico

FIGURE 11

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
D.K.K.	6310,013.12	DLB	1/11/85		



Note: All wells have been projected onto this cross-section.

KEY

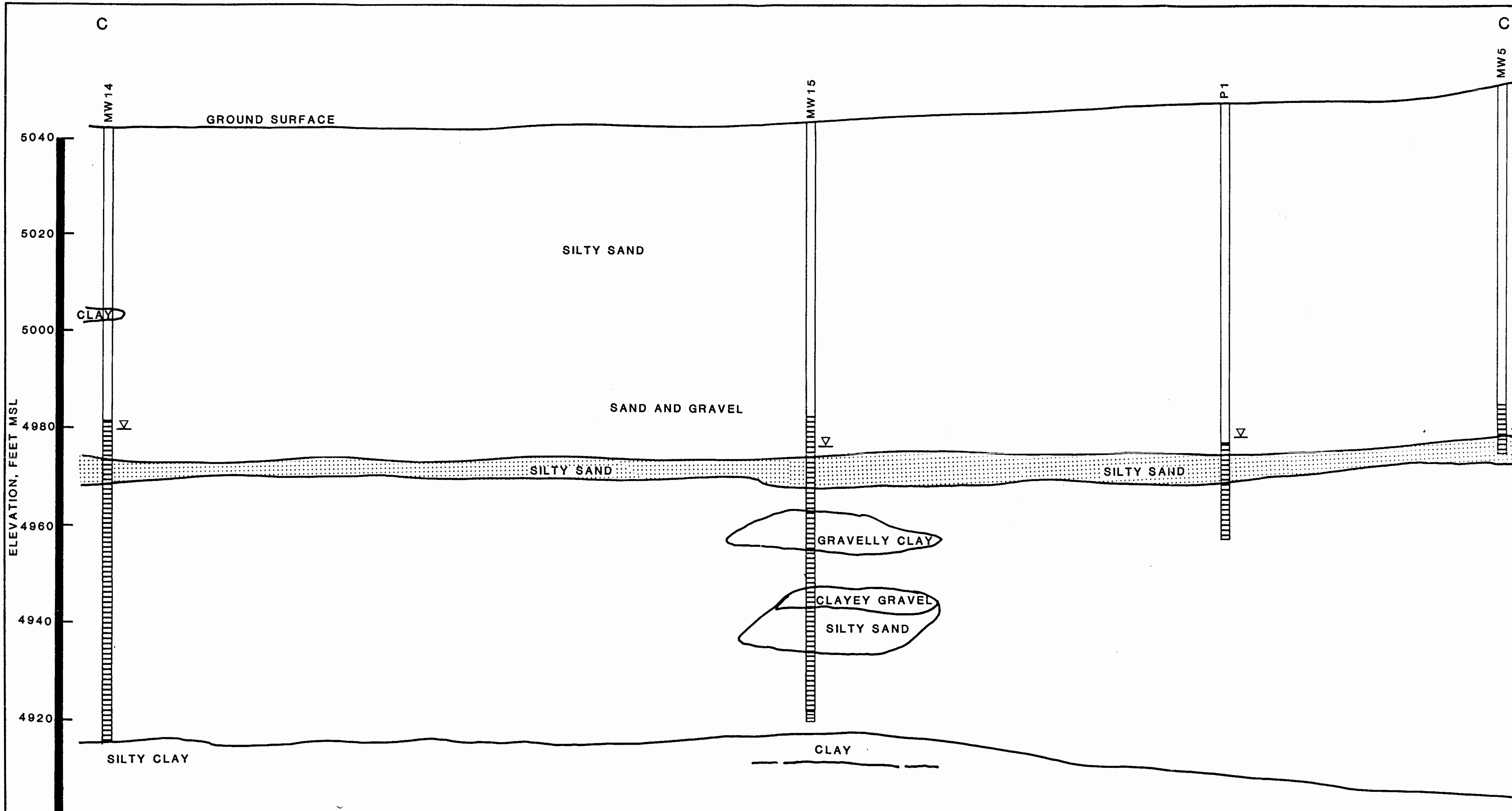
Water Table

4977 — Piezometric Head Contour in feet above MSL

50 0 50 100

scale HORIZONTAL feet

Harding Lawson Associates Engineers, Geologists & Geophysicists	STATIC PIEZOMETRIC HEAD			FIGURE 13
	Sparton Technology, Inc. Albuquerque, New Mexico			
DRAWN D.K.K.	JOB NUMBER 6310,013.12	APPROVED	DATE	REVISED / DATE



∇ Water level on 10/6/84

Note: All wells have been projected onto this cross-section.

Harding Lawson Associates
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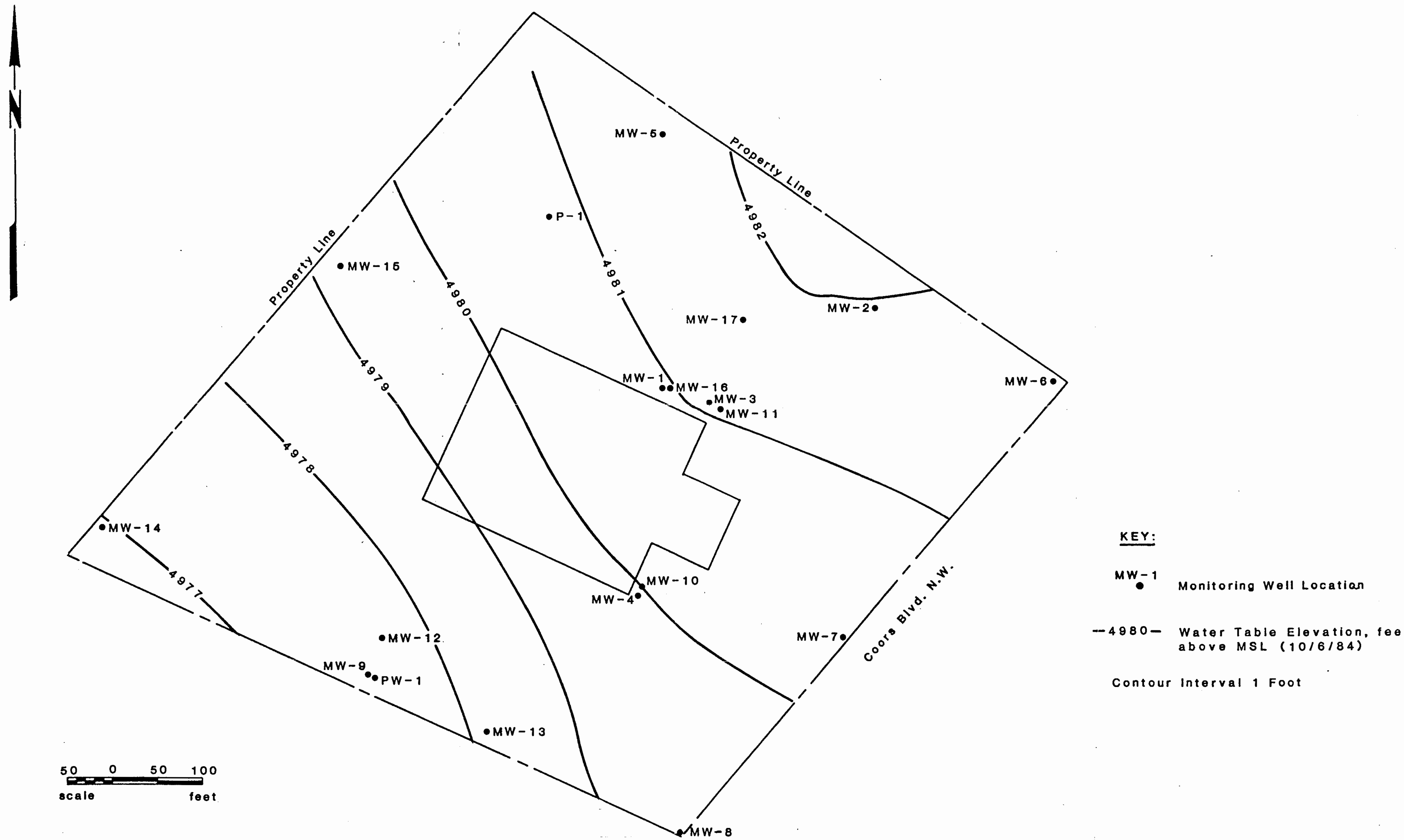
& Geophysicists

GEOLOGIC CROSS-SECTION C-C'
Sparton Technology, Inc.
Albuquerque, New Mexico

FIGURE 12

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
D.K.K.	6310,013.12	DCB	1/11/85		



Reference: Sparton Tech. Inc. Survey by Denney-Gross & Assoc., Inc., Dated 10/5/84.

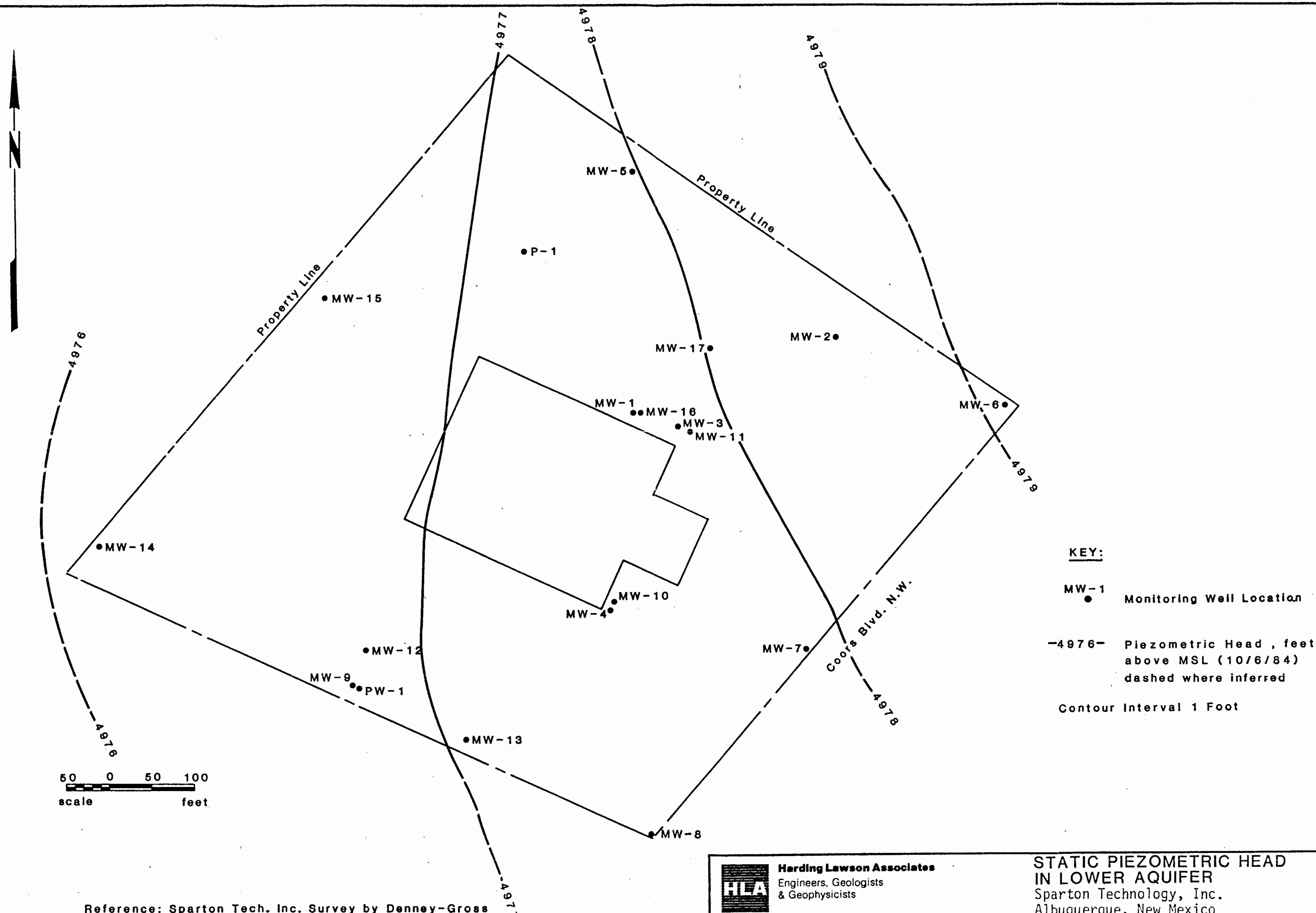
Harding Lawson Associates
Engineers, Geologists & Geophysicists

STATIC WATER TABLE IN UPPER AQUIFER

Sparton Technology, Inc.
Albuquerque, New Mexico

FIGURE 14

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HM	6310,013.12	DCB	11/15		



Reference: Sparton Tech. Inc. Survey by Denney-Gross & Assoc., Inc., Dated 10/5/84.

Harding Lawson Associates
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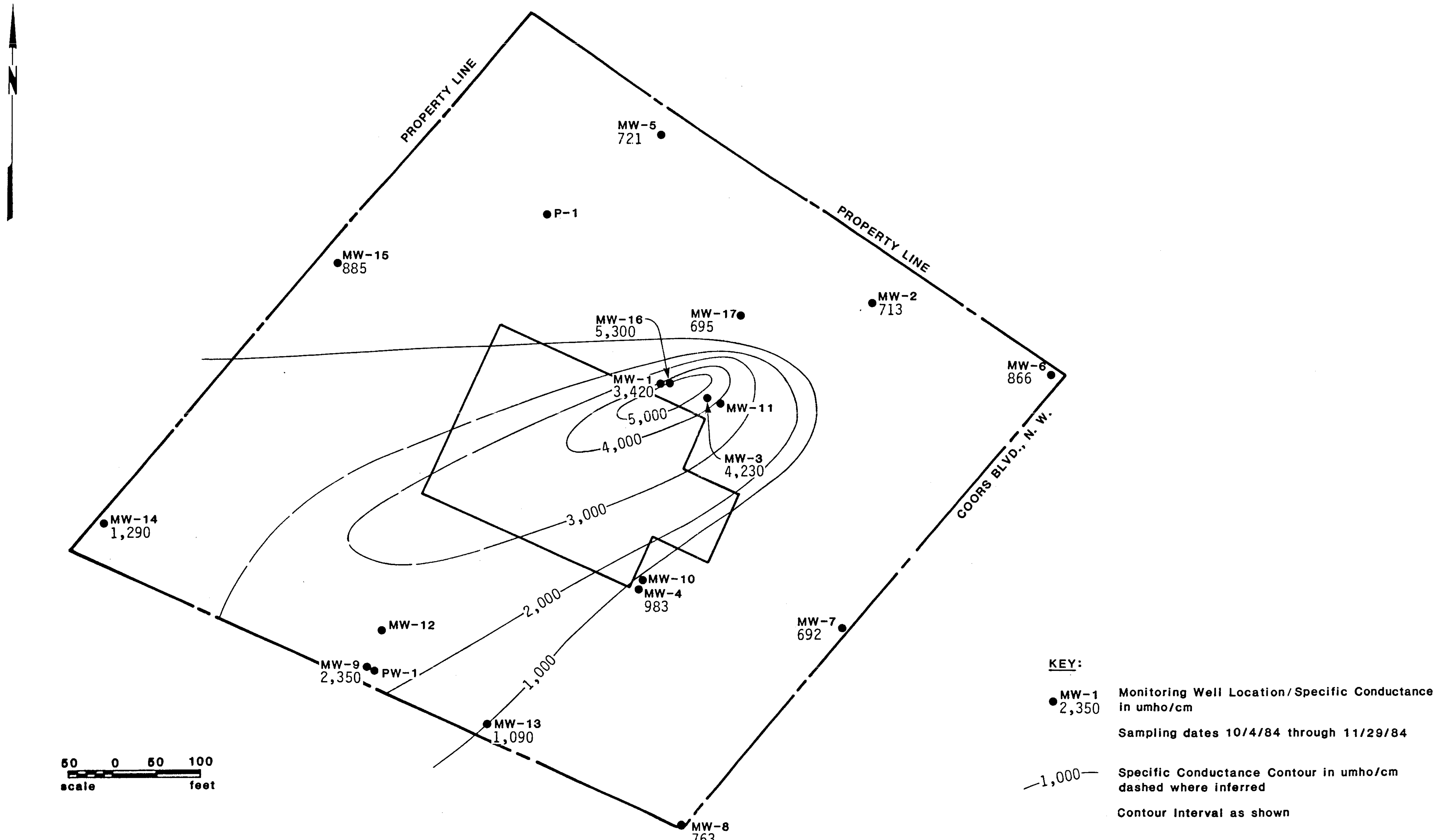
STATIC PIEZOMETRIC HEAD IN LOWER AQUIFER
Sparton Technology, Inc.
Albuquerque, New Mexico

FIGURE 15

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HM	6310,013.12	DRB	[illegible]		



Reference: Sparton Technology, Inc. Survey by Denney-Gross & Assoc., Inc., Dated 10/5/84.

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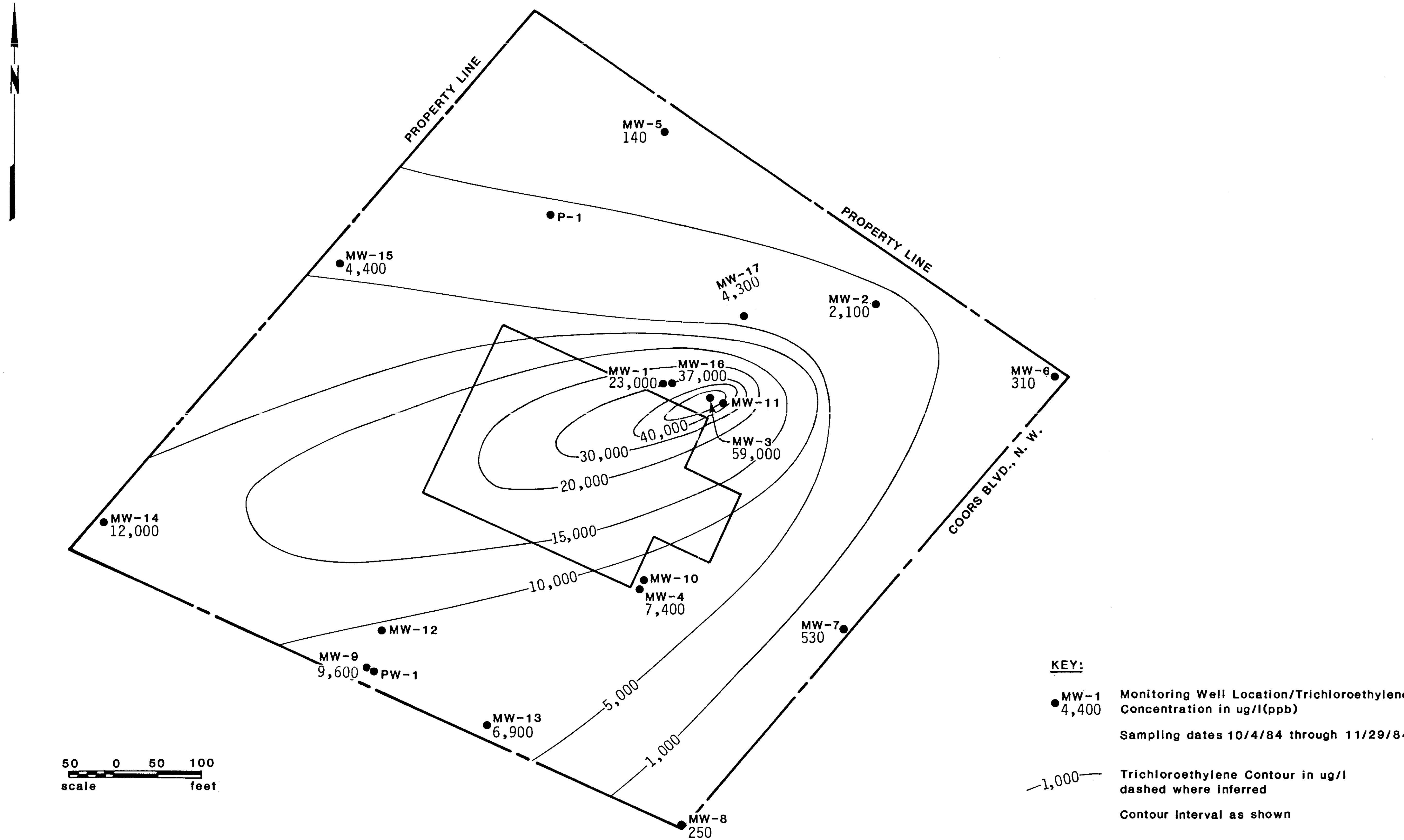
& Geophysicists

SPECIFIC CONDUCTANCE VALUES
IN UPPER AQUIFER
Sparton Technology, Inc.
Albuquerque, New Mexico

PLATE
16

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
JD	6310,013.12	Jm	3/85		



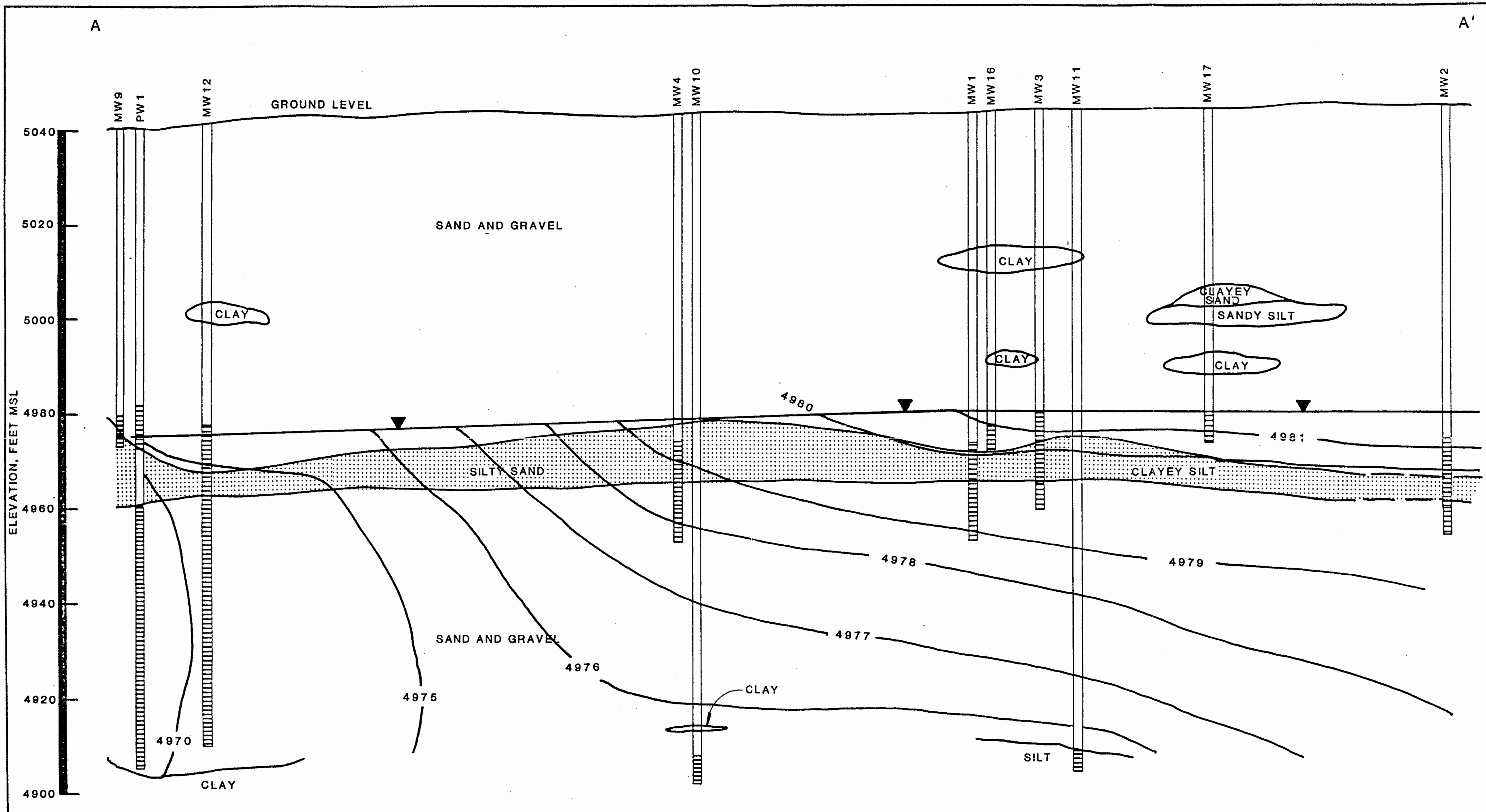
Reference: Sparton Technology, Inc. Survey by Denney-Gross & Assoc., Inc., Dated 10/5/84.

Harding Lawson Associates
Engineers, Geologists & Geophysicists

TRICHLOROETHYLENE CONCENTRATIONS IN UPPER AQUIFER
Sparton Technology, Inc.
Albuquerque, New Mexico

PLATE 17

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
JD	6310,013.12	JRn	3/85		



KEY:

Water Table

—4976~ Piezometric Head Contour in feet above MSL

Contour Interval as Shown

50 0 50 100

scale HORIZONTAL feet

Note: All wells have been projected onto this cross-section.

Harding Lawson Associates
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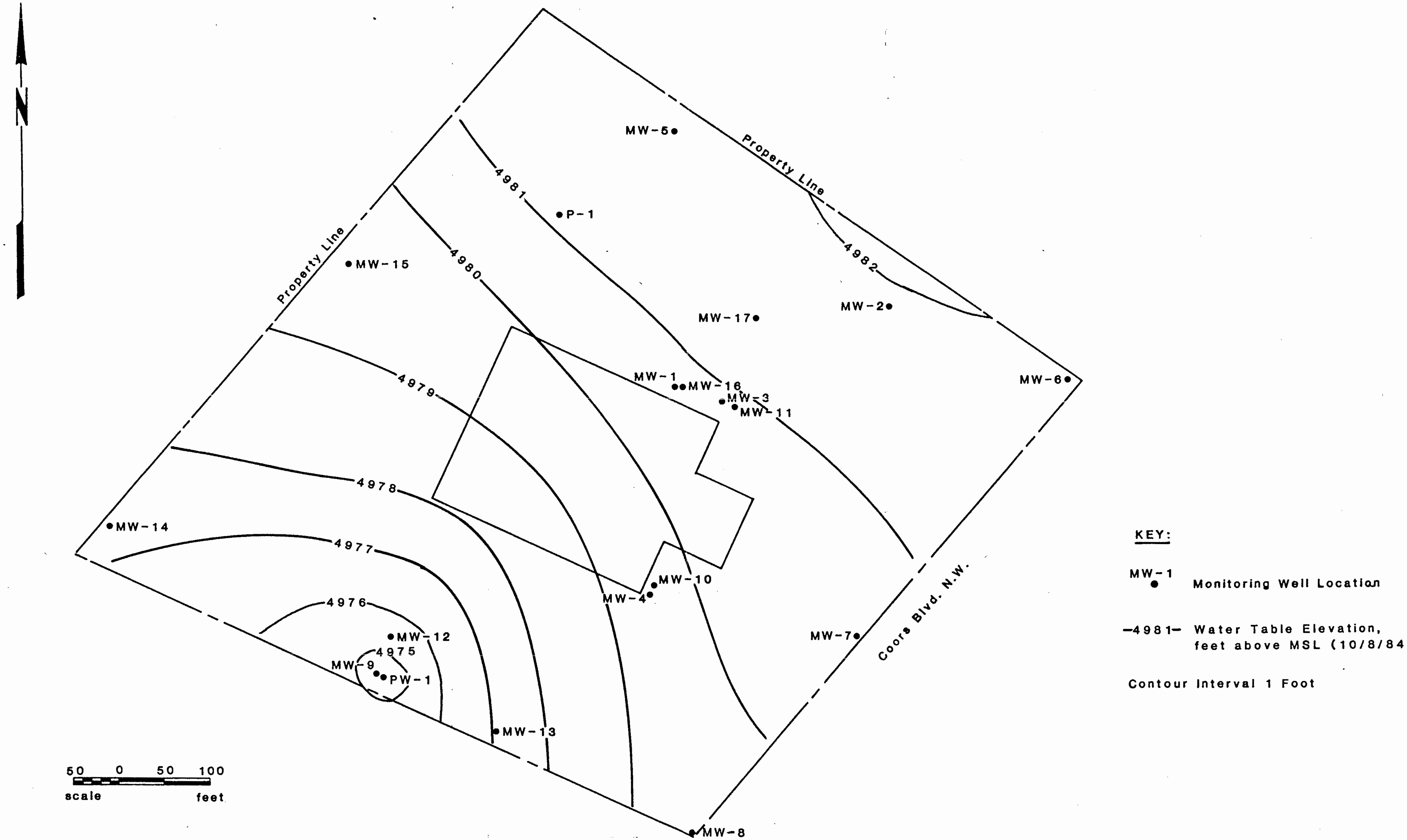
PIEZOMETRIC HEAD AT END OF PUMPING TEST
Sparton Technology, Inc.
Albucuerque, New Mexico

FIGURE 18

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
D.K.K.	6310,013.12	DLB	1/11/85		



Reference: Sparton Tech. Inc. Survey by Denney-Gross & Assoc., Inc., Dated 10/5/84.

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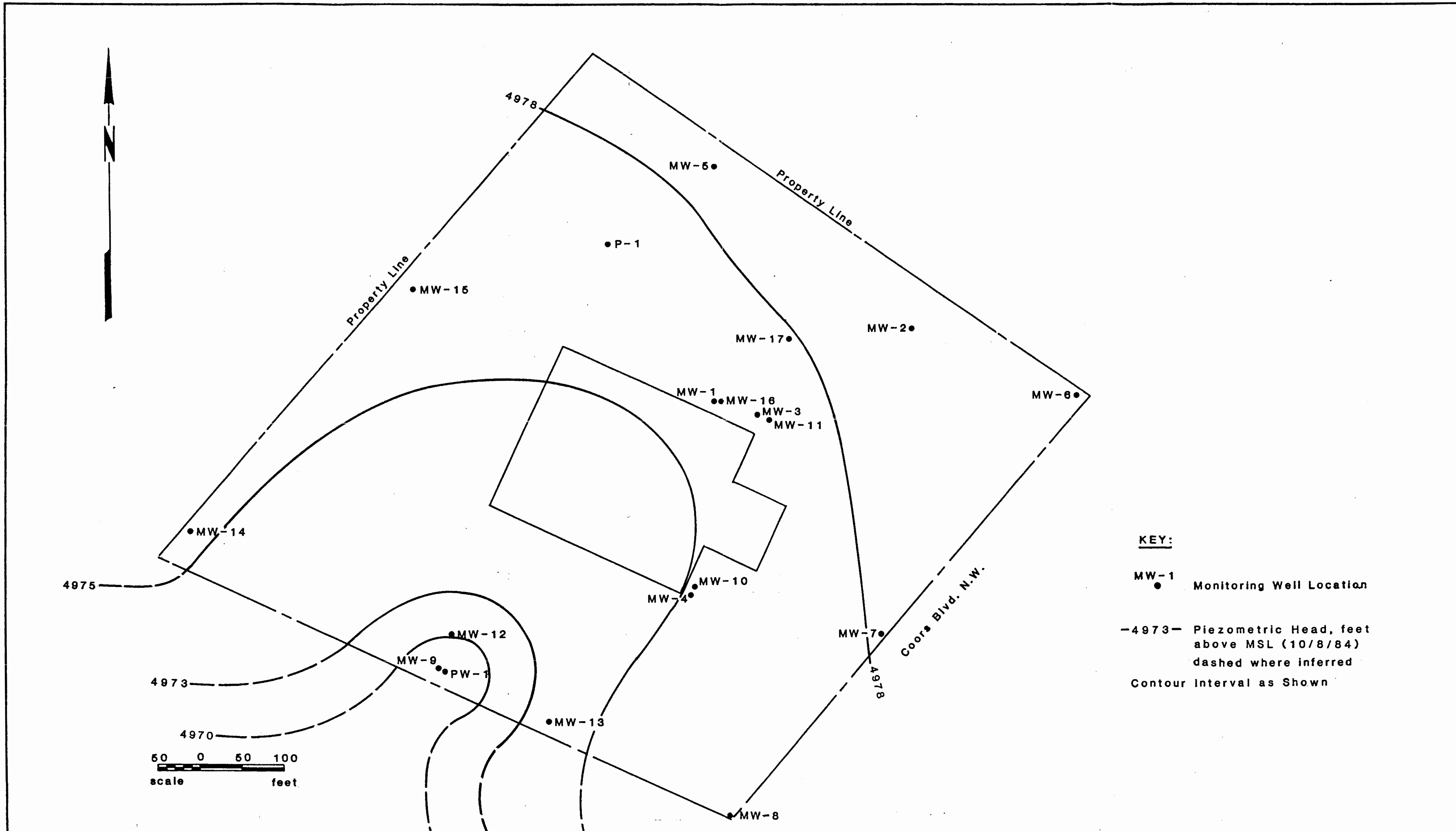
WATER TABLE IN UPPER AQUIFER AT END OF TEST
Sparton Technology, Inc.
Albuquerque, New Mexico

FIGURE 19

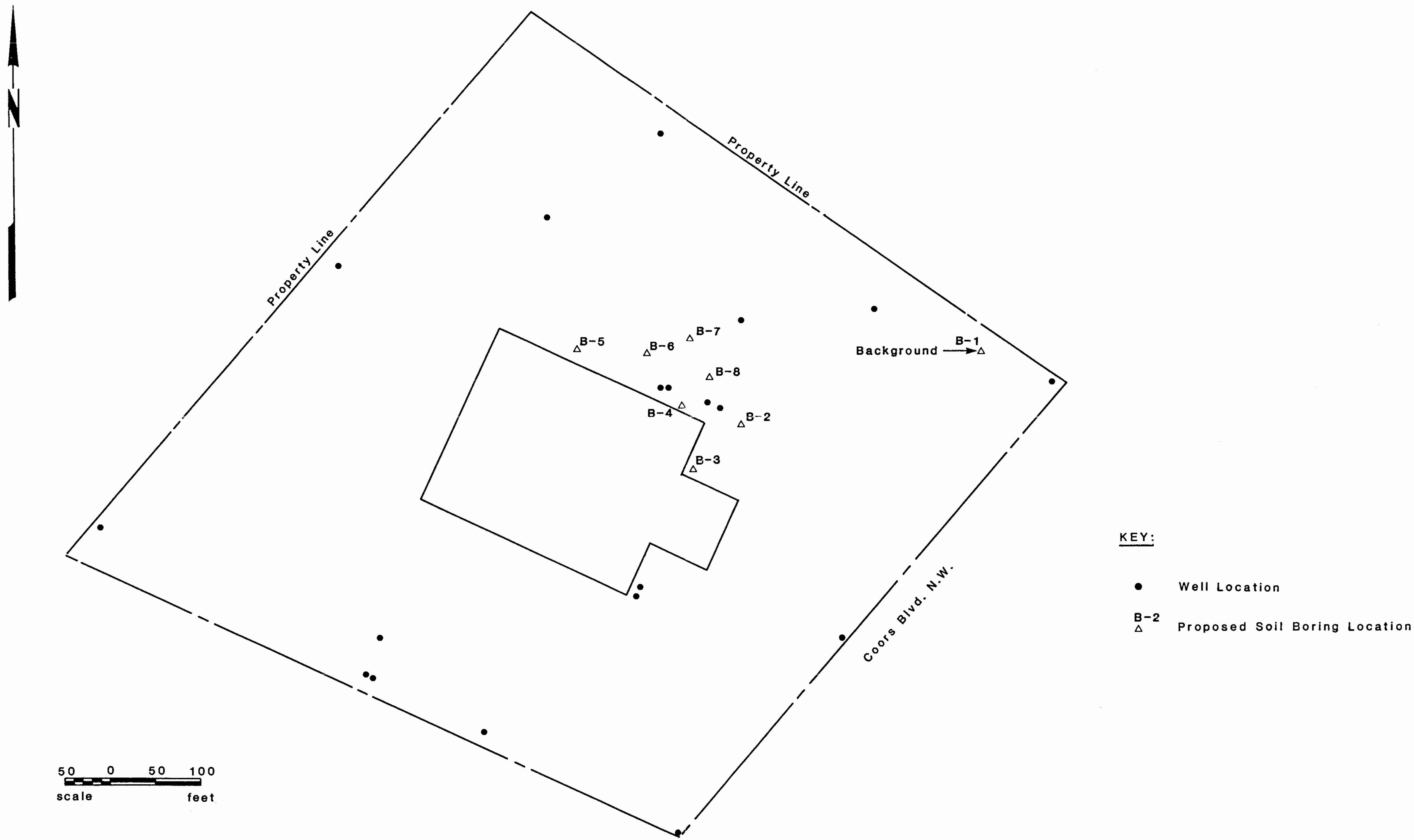
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
[illegible]	6310,013.12	[illegible]	1/11/85		



Reference: Sparton Tech. Inc. Survey by Denney-Gross & Assoc., Inc., Dated 10/5/84.

Harding Lawson Associates Engineers, Geologists & Geophysicists	PIEZOMETRIC HEAD IN LOWER AQUIFER AT END OF TEST Sparton Technology, Inc. Albuquerque, New Mexico	FIGURE 20

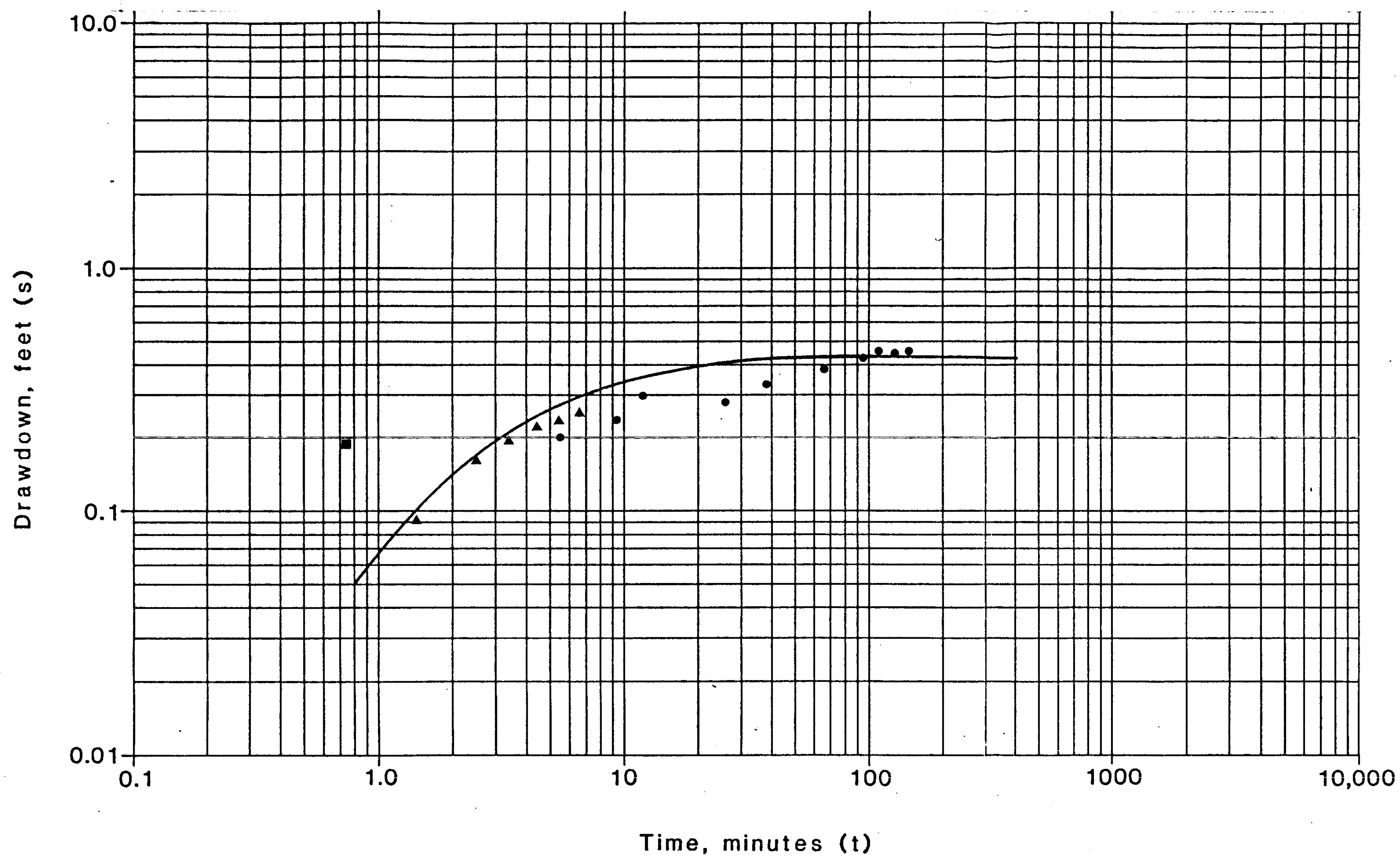
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HM	6310,013.12	DLB	1/11/85		



Reference: Sparton Tech. Inc. Survey by Denney-Gross & Assoc., Inc., Dated 10/5/84.

HLA Harding Lawson Associates Engineers, Geologists & Geophysicists	PROPOSED SOIL BORING LOCATIONS Sparton Technology, Inc. Albuquerque, New Mexico		FIGURE 21
DRAWN: HM	JOB NUMBER: 6310,013.12	APPROVED: DLB	DATE: 1/11/85

REVISED | DATE



LEGEND:

- ● Drawdown Data
- ▲ Recovery Data
- ■ Match Point

CALCULATIONS:

$v = 0.2$

$L(u,v) = 1$

$1/u = 1$

$s = 0.18$ feet

$t = 7.2$ minutes

$Q = 180$ gpm

$r = 306$ feet

$T = \frac{114.6\ Q}{s} * L(u,v)$ gpd/ft

$T = 114{,}600$ gpd/ft

$S = \frac{T\ t\ u}{2963\ r^2}$

$S = 0.0033$

$K'/b' = \frac{T\ v^2}{1.87\ r^2}$ 1/day

$K'/b' = 0.026$/day

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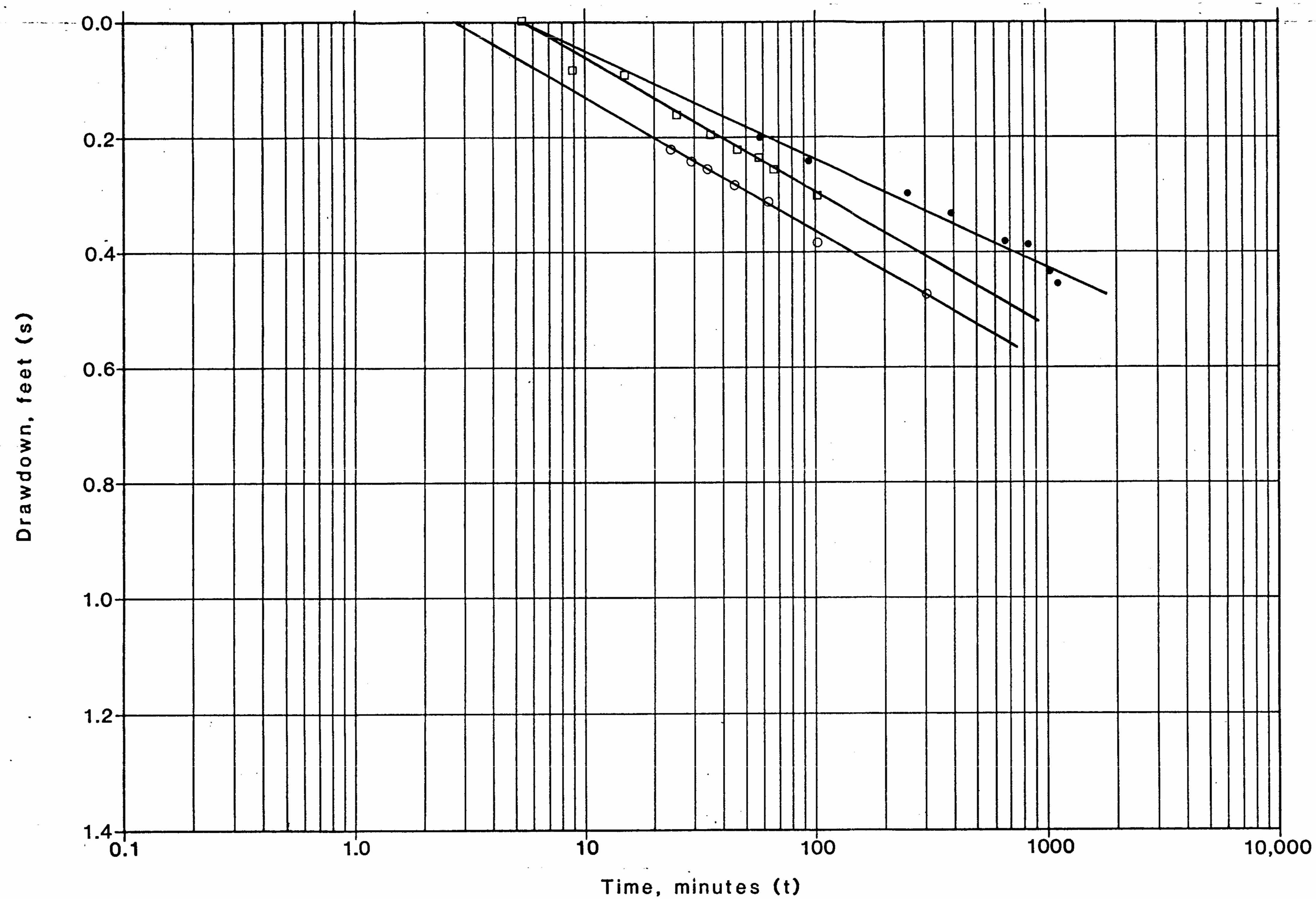
MW-4 PUMPING TEST DATA
Sparton Technology, Inc.
Albuquerque, New Mexico

FIGURE
E1

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
	6310,013.12				



LEGEND:

- ● Drawdown Data
- ○ Residual Drawdown Data
- □ Recovery Data

CALCULATIONS:

Q = 180 gpm

r = 306 feet

$T = \frac{264\ Q}{\Delta s}$ gpd/ft

$S = \frac{T\ to}{4790\ r^2}$

	Δs	to	T	S
●	0.205	5.2	232,000	0.0027
○	0.220	-	216,000	-
□	0.225	5.1	211,000	0.0024

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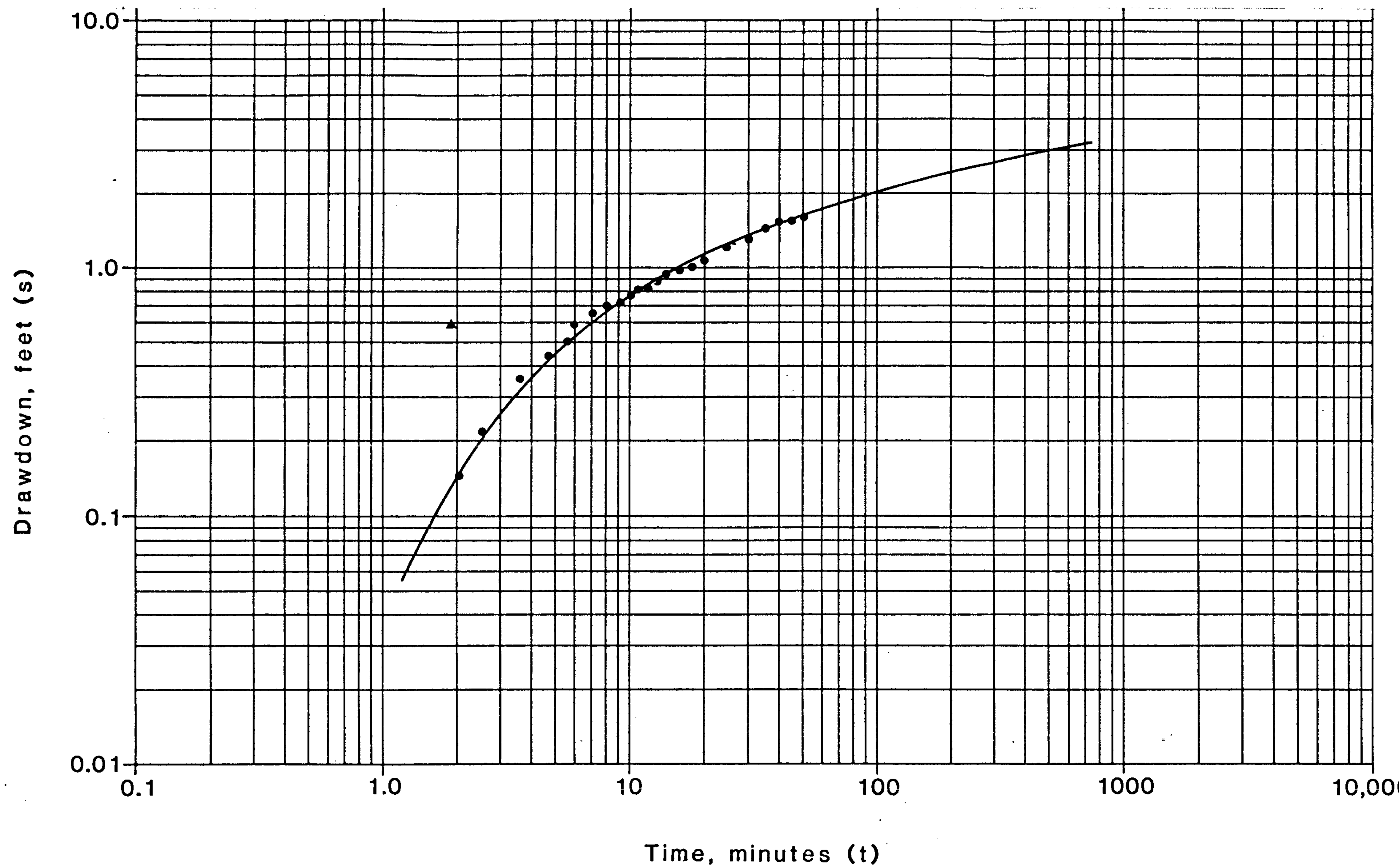
FIGURE **E2**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
LM	6310,013.12	DL13	1/11/85		



LEGEND:

- ● Drawdown Data
- ▲ Match Point

CALCULATIONS:

$v = 0$

$L(u,v) = 1$

$1/u = 1$

$s = 0.70$ feet

$t = 2.1$ minutes

$Q = 50$ gpm

$r = 8$ feet

$T = \frac{114.6\ Q}{s} * L(u,v)$ gpd/ft

$T = 9700$ gpd/ft

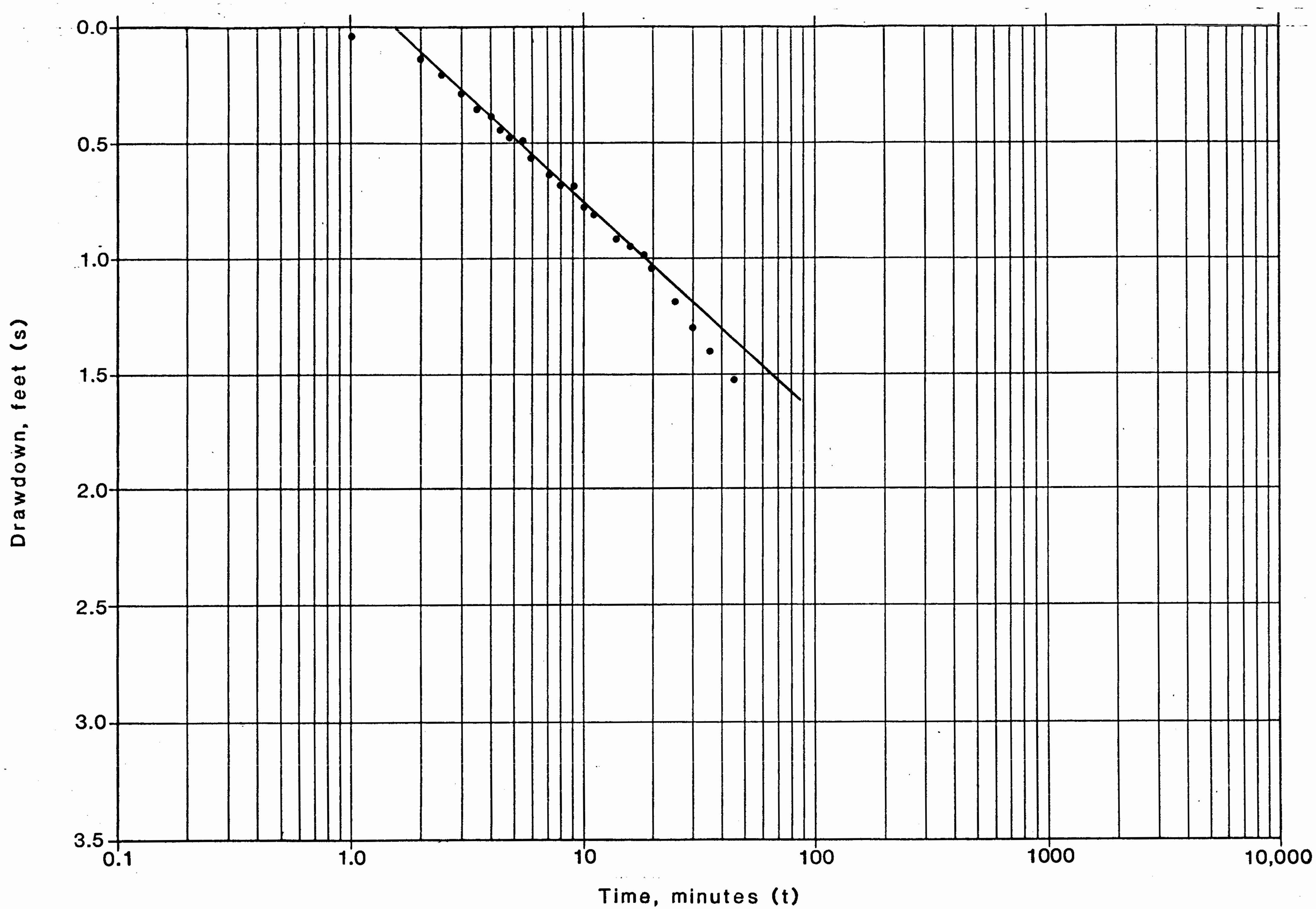
$S = \frac{T\ t\ u}{2963\ r^2}$

$S = 0.09$

$K'/b' = \frac{T\ v^2}{1.87\ r^2}$ 1/day

$K'/b' = 0$/day

HLA **Harding Lawson Associates** Engineers, Geologists & Geophysicists		MW-9 PUMPING TEST DATA Sparton Technology, Inc. Albuquerque, New Mexico	FIGURE E3
DRAWN EM	JOB NUMBER 6310,013.12	APPROVED DLB DATE [illegible]	REVISED DATE



LEGEND:

• Drawdown Data

CALCULATIONS:

Q = 50 gpm

r = 8 feet

$T = \frac{264\ Q}{\Delta s}$ gpd/ft

$S = \frac{T\ to}{4790\ r^2}$

	Δs	to	T	S
•	0.92	1.5	14,300	0.07

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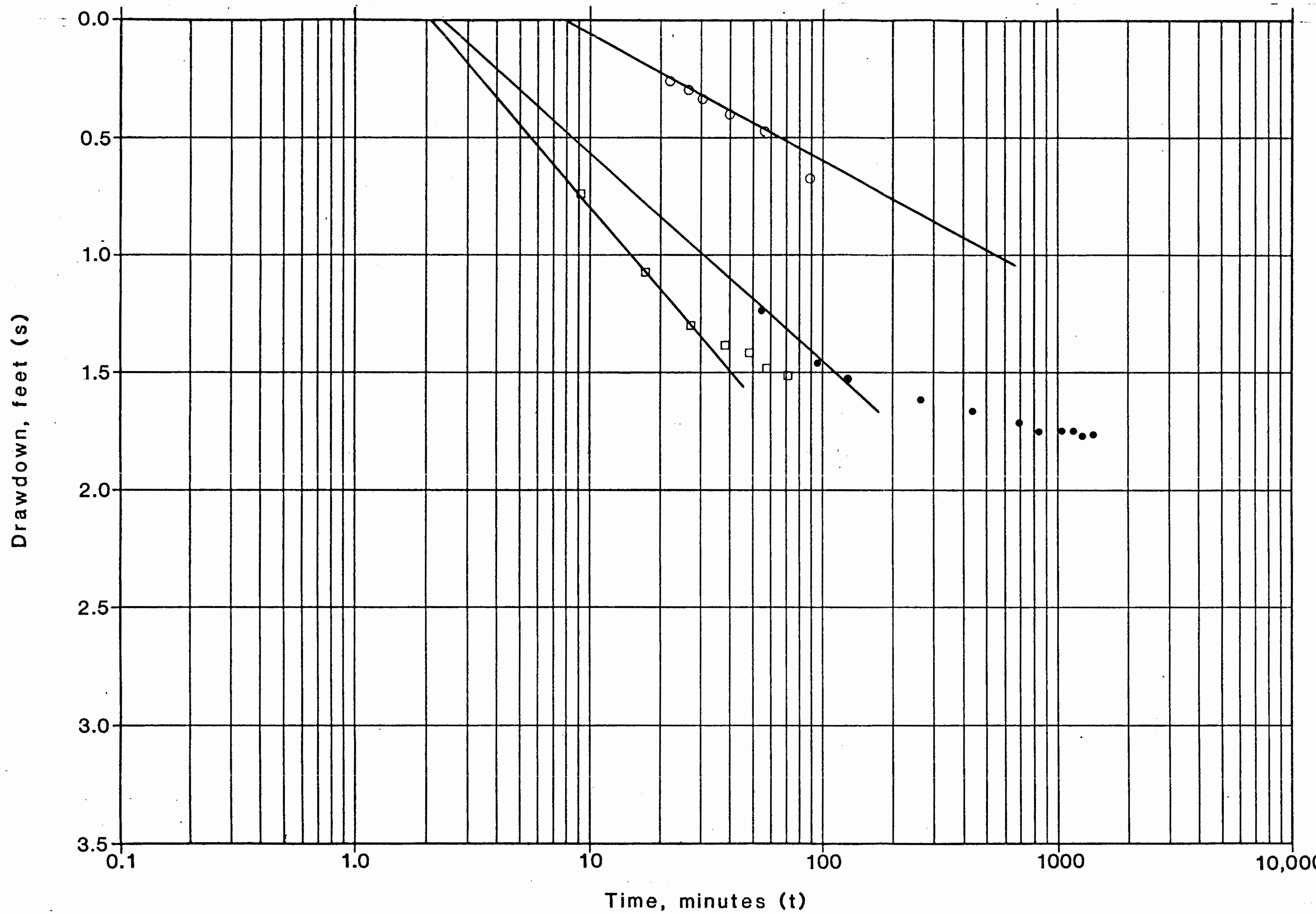
FIGURE E4

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
LM	6310,013.12	DLB	1/11/85		



LEGEND:

- • Drawdown Data
- ○ Residual Drawdown Data
- □ Recovery Data

CALCULATIONS:

Q = 180 gpm

r = 314 feet

$T = \frac{264\ Q}{\Delta s}$ gpd/ft

$S = \frac{T\ to}{4790\ r^2}$

	Δs	to	T	S
•	0.78	2.3	61,000	0.00030
○	0.55	-	86,000	-
□	1.16	2.1	41,000	0.00018

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MW-10 PUMPING TEST DATA
Sparton Technology, Inc.
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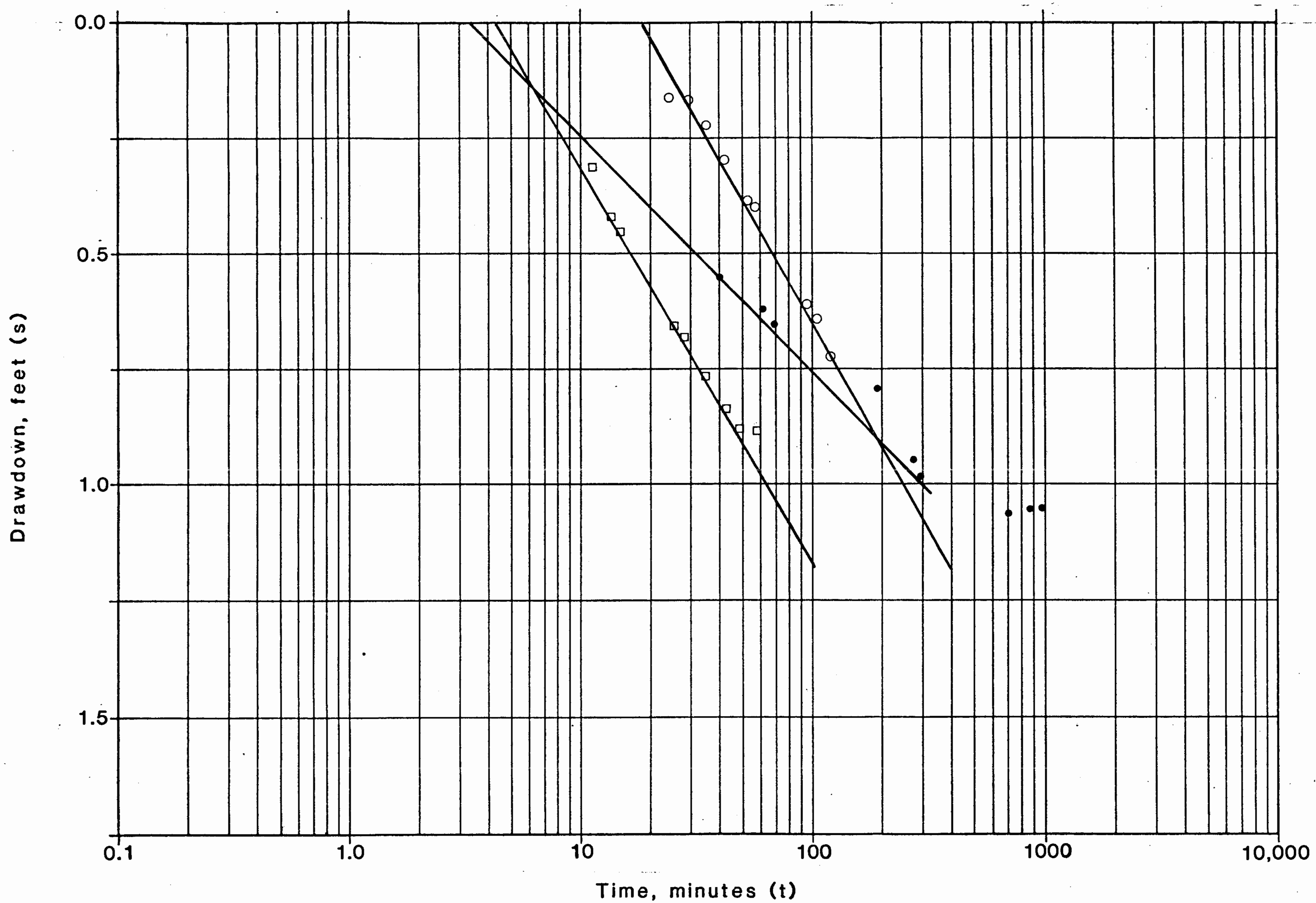
FIGURE E5

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
LM	6310,013.12	DLB	1/11/85		



LEGEND:

- • Drawdown Data
- ○ Residual Drawdown Data
- □ Recovery Data

CALCULATIONS:

Q = 180 gpm

r = 488 feet

$T = \frac{264\ Q}{\Delta s}$ gpd/ft

$S = \frac{T\ t_o}{4790\ r^2}$

	Δs	to	T	S
•	0.52	3.6	91,000	0.00029
○	0.89	-	53,000	-
□	0.83	4.7	57,000	0.00023

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MW-11 PUMPING TEST DATA
Sparton Technology, Inc.
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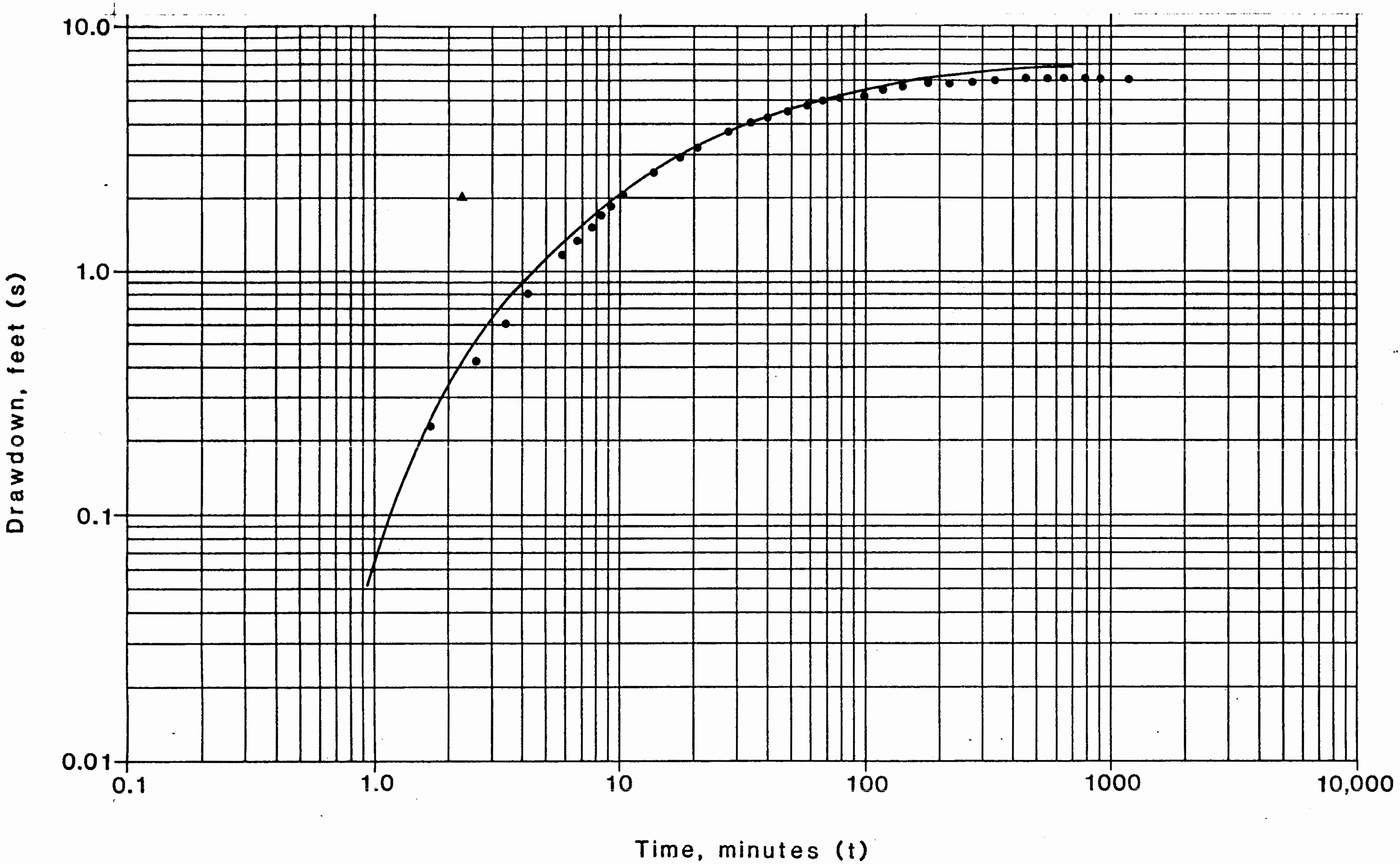
FIGURE
E6

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
LM	6310,013.12	DLB	1/11/88		



LEGEND:

- ● Drawdown Data
- ▲ Match Point

CALCULATIONS:

$v = 0.1$

$L(u,v) = 1$

$1/u = 1$

$s = 2.01$ feet

$t = 0.22$ minutes

$Q = 189$ gpm

$r = 44$ feet

$T = \frac{114.6\ Q}{s} * L(u,v)$ gpd/ft

$T = 10{,}800$ gpd/ft

$S = \frac{T\ t\ u}{2963\ r^2}$

$S = 0.00046$

$K'/b' = \frac{T\ v^2}{1.87\ r^2}$ 1/day

$K'/b' = 0.03$/day

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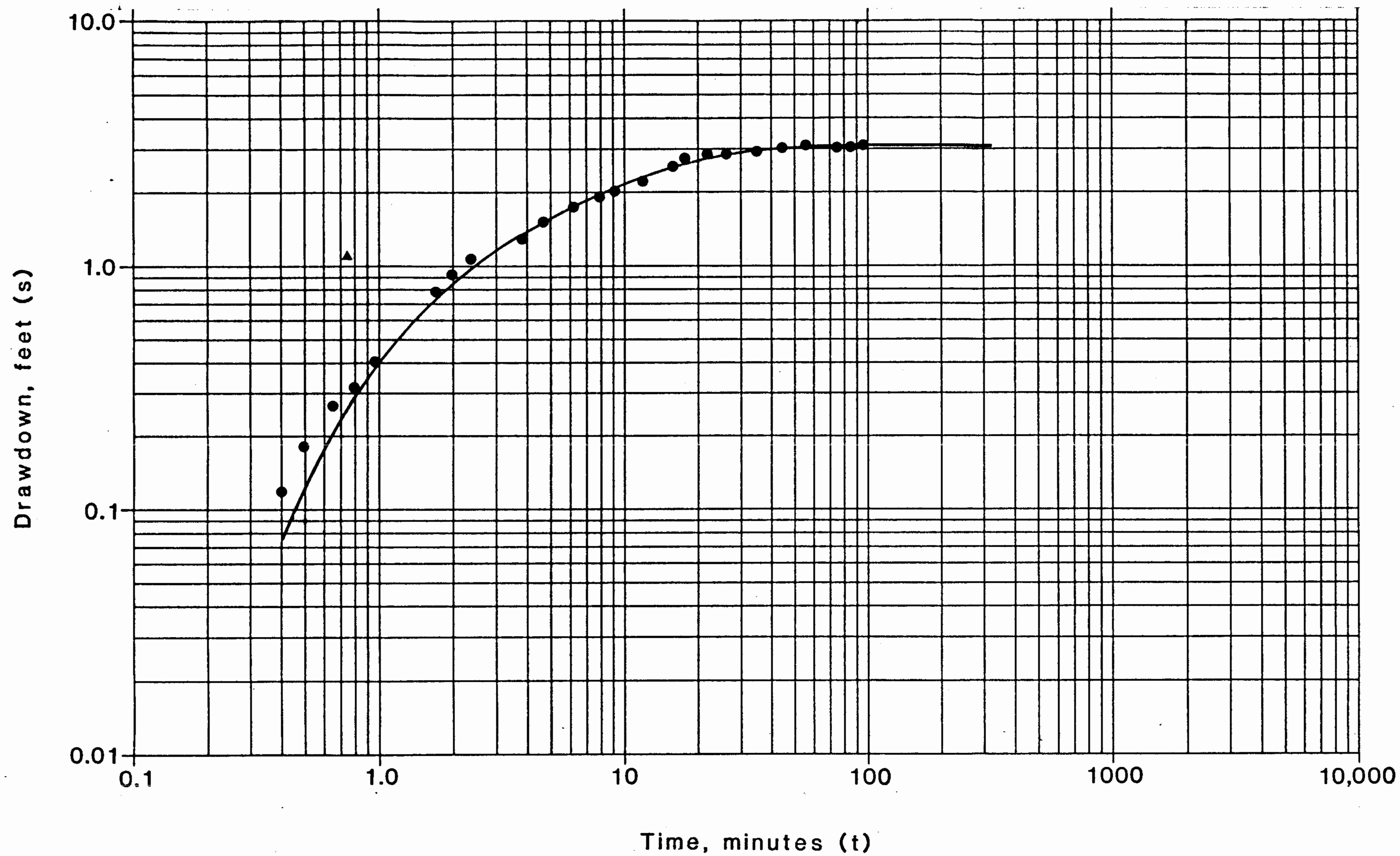
MW-12 PUMPING TEST DATA
Sparton Technology, Inc.
Albuquerque, New Mexico

FIGURE E7

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
[illegible]	6310,013.12	DCB	[illegible]		



LEGEND:

● Drawdown Data

▲ Match Point

CALCULATIONS:

v = 0.15

L(u,v) = 1

1/u = 1

s = 0.77 feet

t = 1.07 minutes

Q = 189 gpm

r = 138 feet

$T = \frac{114.6\ Q}{s} * L(u,v)$ gpd/ft

T = 20,200 gpd/ft

$S = \frac{T\ t\ u}{2963\ r^2}$

S = 0.00028

$K'/b' = \frac{T\ v^2}{1.87\ r^2}$ 1/day

K'/b' = 0.013/day

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MW-13 PUMPING TEST DATA
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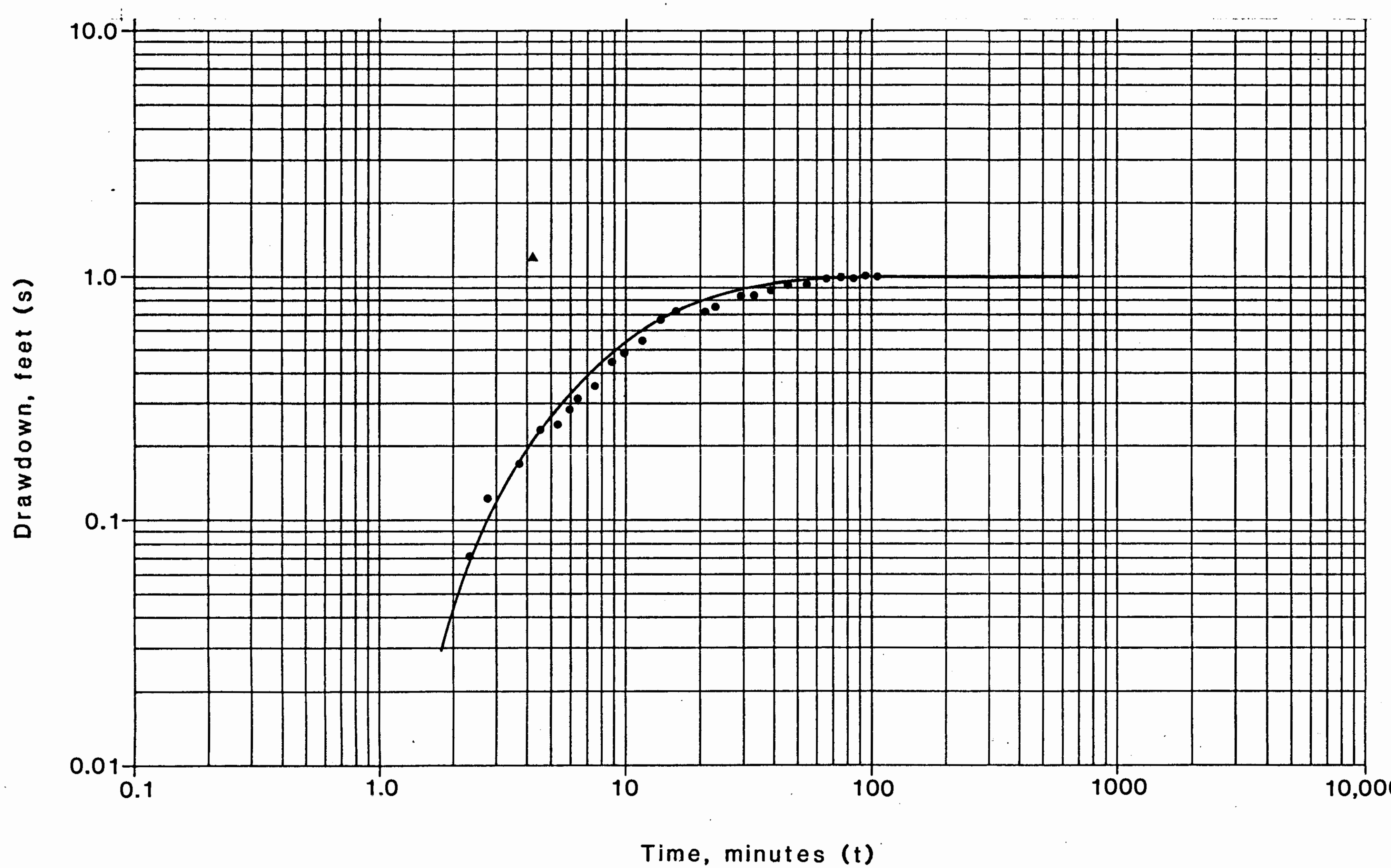
Albuquerque, New Mexico

FIGURE
E8

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
[illegible]	6310,013.12	[illegible]	[illegible]		



LEGEND:

- • Drawdown Data
- ▲ Match Point

CALCULATIONS:

$v = 0.5$

$L(u,v) = 1$

$1/u = 1$

$s = 0.51$ feet

$t = 2.9$ minutes

$Q = 189$ gpm

$r = 345$ feet

$$T = \frac{114.6\ Q}{s} * L(u,v) \text{ gpd/ft}$$

$T = 18{,}000$ gpd/ft

$$S = \frac{T\ t\ u}{2963\ r^2}$$

$S = 0.00023$

$$K'/b' = \frac{T\ v^2}{1.87\ r^2} \text{ 1/day}$$

$K'/b' = 0.0018$/day

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MW-14 PUMPING TEST DATA
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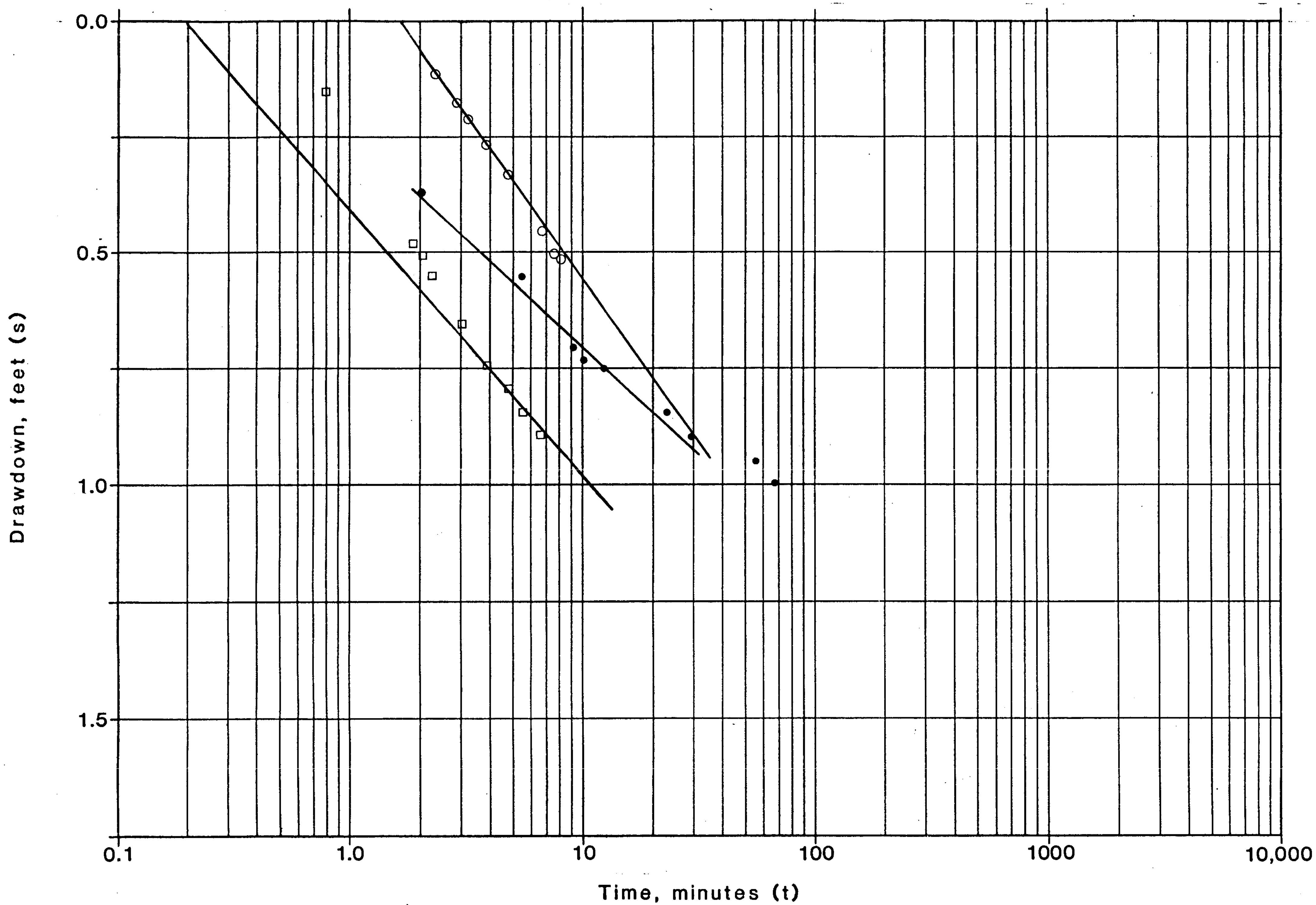
Albuquerque, New Mexico

FIGURE E9

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
AM	6310,013.12	DUB	1/11/88		



LEGEND:

- • Drawdown Data
- ○ Residual Drawdown Data
- □ Recovery Data

CALCULATIONS:

Q = 180 gpm

r = 456 feet

$T = \frac{264\ Q}{\Delta s}$ gpd/ft

$S = \frac{T\ to}{4790\ r^2}$

	Δs	to	T	S
•	0.46	3.4	103,300	0.00035
○	0.70	-	68,000	-
□	0.68	2.1	70,000	0.00015

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MW-15 PUMPING TEST DATA
Sparton Technology, Inc.
Albuquerque, New Mexico

FIGURE E10

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
LM	6310,013.12	DMB	1/11/85		