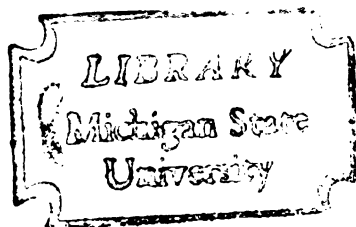




3 1293 10064 3299



This is to certify that the

thesis entitled

THE GEOHYDROLOGIC CHARACTERISTICS OF THE GLACIAL DRIFT
WITHIN THE WATER QUALITY MANAGEMENT PROJECT SITE
MICHIGAN STATE UNIVERSITY

presented by

Joseph Lovato

has been accepted towards fulfillment
of the requirements for

M.S. degree in Geology

Major professor

Date April 8, 1979



MSU

OVERDUE FINES ARE 25¢ PER DAY
PER ITEM

Return to book drop to remove
this checkout from your record.

JUL 21 '86
F 2

~~JUL 21 '86~~
JUL 21 '86
JUL 21 '86
JUL 21 '86

MAY 27 2000

132 --

THE GEOHYDROLOGIC CHARACTERISTICS OF THE GLACIAL DRIFT
WITHIN THE WATER QUALITY MANAGEMENT PROJECT SITE
MICHIGAN STATE UNIVERSITY

By

Joseph Lovato

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

Department of Geology

ABSTRACT

THE GEOHYDROLOGIC CHARACTERISTICS OF THE GLACIAL DRIFT WITHIN THE WATER QUALITY MANAGEMENT PROJECT SITE MICHIGAN STATE UNIVERSITY

A geohydrologic study of glacial sediments underlying the spray irrigation site of the Michigan State University Water Quality Management Project demonstrates that the site is underlain by both clay till deposits and interbedded gravel layers. Aquifer testing of the drift material indicates that the average transmissivity of the gravel units is approximately 4000 gpd/ft ($50 \text{ m}^3/\text{d m}$), while the vertical permeability of the clay units average 0.12 gpd/ft^2 ($5.7 \times 10^{-3} \text{ cm/sec}$). Observed infiltration rates (0.07 gpd/ft^2) at the site appear to be twice the rate (0.03 gpd/ft^2) calculated from the aquifer test data. The difference in the infiltration rates is primarily attributed to downward flow of water along the permeable gravel layers, which are, to some degree, hydraulically connected to the underlying Saginaw Formation.

ACKNOWLEDGMENTS

I would like to thank the many people who contributed to the preparation of this thesis; for without them it never would have been completed. Special thanks go to Dr. Grahame Larson who provided the topic and much assistance along the way, and to Dr. Stonehouse and Dr. Bennett who also gave their time and assistance. Thanks to James Heinzman, Allan Ostrander and Ronald Elowski who all helped in the collection of data and to the Water Research Institute for their financial support. Special thanks go to Catherine Moehring who spent many hours typing and retyping without compensation and finally, to my wife, Becky, who collected data, provided moral support and endured.

Table of Contents

	<u>Page</u>
INTRODUCTION	1
Description of Study Area	2
Geology of the Study Site	4
Geohydrology	8
THE GEOLOGY & GEOHYDROLOGY OF THE WQMP SITE	13
Glacial Drift and Bedrock	13
Water Table & Piezometric Surfaces	16
Long-Term Water Level Fluctuation	24
Short-Term Water Level Fluctuation	30
Aquifer Testing	33
Methods	34
Results	37
Significance	43
Recharge Potential for the Spray Irrigation Site	49
SUMMARY AND CONCLUSIONS	54
BIBLIOGRAPHY	57
APPENDIX A	
APPENDIX B	
APPENDIX C	

List of Tables

<u>Table No.</u>		<u>Page</u>
1	Description of soils at the aquifer test site	5

List of Figures

<u>Figure No.</u>		<u>Page No.</u>
1	Map showing location of Water Quality Management Project	3
2	Map of the WQMP Site showing distribution of soil types	5
3	Surface geology of the WQMP	7
4	Percent-grain size distribution of drift material underlying WQMP site	9
5	Piezometric surface of Saginaw Formation . .	11
6	Cross-sectional diagram showing geologic units underlying WQMP site	14
7	Map of WQMP site showing location and type of wells.	15
8	Map showing thickness of drift underlying WQMP site.	17
9	Map showing bedrock topography underlying WQMP site.	18
10	Map showing piezometric surface determined from wells penetrating the Saginaw Formation	19
11	Map showing the piezometric surface constructed from wells developed in drift. .	21
12	Water table contour of the WQMP	23
13	Drift wells that were monitored for long term and short term water level fluctuations	25
14	Water level fluctuations for the 1976-1977 water year	26

<u>Figure No.</u>		<u>Page No.</u>
15	Long-term water level fluctuations for the 1976-1977 water year	29
15a	Drift Well #37	29
15b	Mounding due to spray irrigation. . . .	29
15c	Drift Well #39	29
16	Aquifer test site location.	31
17	Water level fluctuation due to atmospheric pressure change	32
18	Graphic representation of geologic units and relative distances of the observation wells from production well #4	36
19	Logarithmic plot of drawdown versus time Observation Well #37	38
20	Logarithmic plot of drawdown versus time Observation Well C-3	40
21	Logarithmic plot of drawdown versus time Observation Well B-2	41
22	Observation Well B-3	42
23	Aquitard response in wells C-1 and B-1 . . .	44
24	Correlation of aquitard response to aquifer recharge	47

THE GEOHYDROLOGIC CHARACTERISTICS OF THE GLACIAL DRIFT
WITHIN THE WATER QUALITY MANAGEMENT PROJECT SITE
MICHIGAN STATE UNIVERSITY

Introduction

The Michigan State University Water Quality Management Project (WQMP) is an experimental facility designed to research the employment of natural processes to purify and recycle municipal wastewater. Basically, there are two natural systems being employed at the WQMP; one involves effluent removal by terrestrial and aquatic plantlife, the other involves wastewater infiltration and effluent assimilation by soil material. In the first system, evapotranspiration and plant assimilation are utilized to purify wastewater which is reintroduced into the hydrologic cycle. In the second system, wastewater is permitted to infiltrate into the underlying drift deposits where it can ultimately recharge into the local bedrock aquifer.

Due to the complex nature of the glacial drift underlying the WQMP, it has been difficult to define adequately the recharge and sub-surface flow patterns associated with the latter system. It is the purpose of this study, therefore, to examine objectively the hydrogeologic characteristics of the glacial drift underlying the facility and to estimate the potential recharge into the local bedrock aquifer.

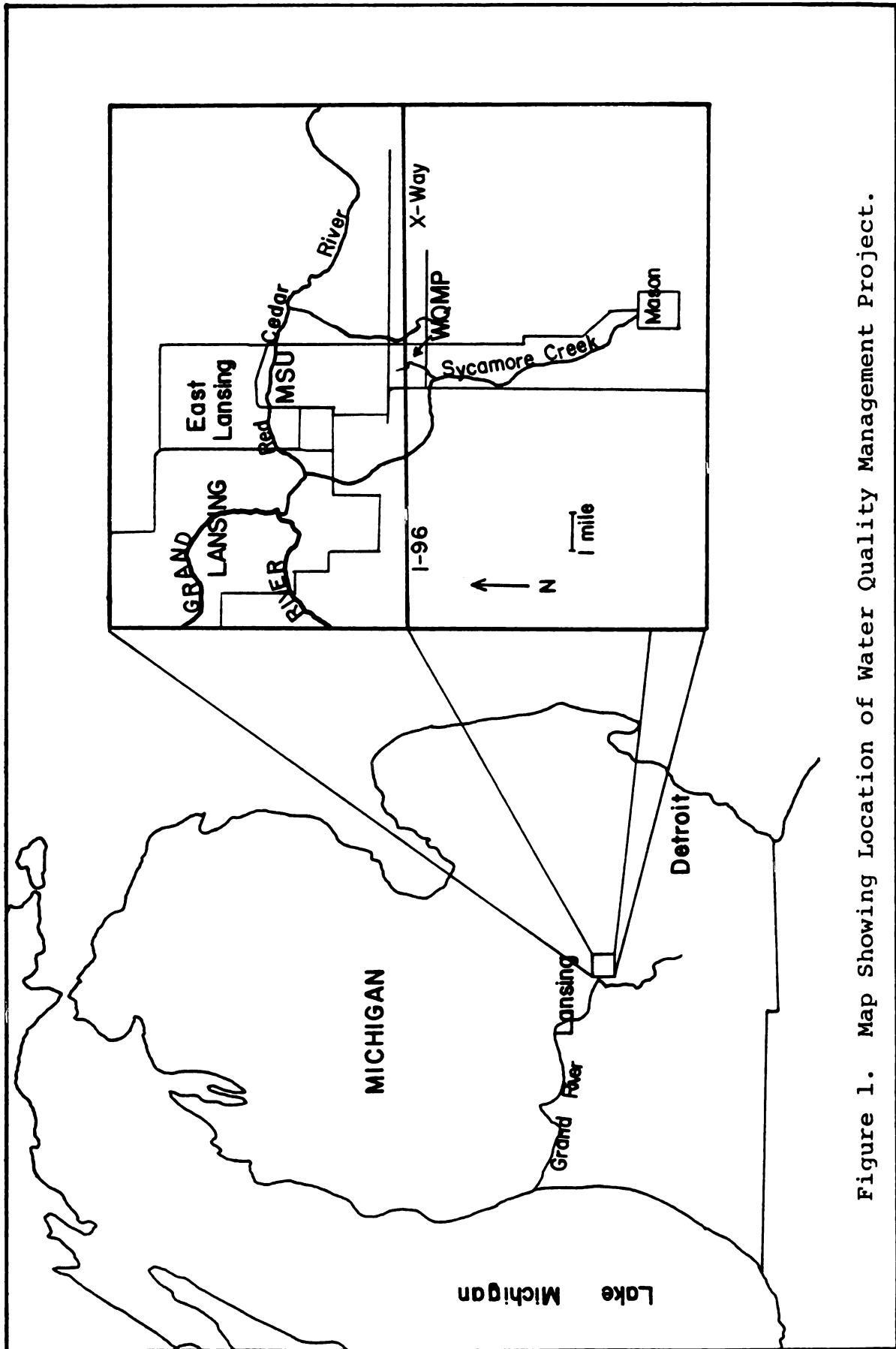
Two approaches are used in this hydrogeologic investigation. The first approach may be termed passive and involves analyzing data in the form of lithologic logs and water levels of observation wells to determine hydrogeologic correlations and groundwater fluctuations due to climatic and seasonal variations. The second approach involves aquifer testing by constant discharge pumpage of a test well. This method provides an active means of groundwater manipulation, where aquifer hydraulics are studied under controlled conditions.

Description of the Study Area

The area of study is situated in the south central portion of Michigan's Lower Peninsula, about four miles south of the center of the Michigan State University campus. The political location description is; the SE $\frac{1}{4}$ of Section 6, T3N, R1W, Alameda Township, Ingham County (Figure 1).

The climate for this area is that of a "modified" interior region; where the wide range of seasonal temperatures and the lack of precipitation of typical interior regions are moderated by the influence of the Great Lakes. The average precipitation for this area is approximately 31 inches (79 cm), 20 percent of which falls as snow, while nearly 65 percent of the total annual precipitation is lost to transpiration (U.S. Dept. of Commerce, 1976).

The research site is part of a 130 hectare tract of gently rolling farm land which has been fallow since the



early 1960's. The vegetative cover is essentially old-field grasses with second growth shrubs along the fence rows. Surface drainage of the research site is accommodated by a dredged water course known as Felton Drain. The drain enters Sycamore Creek which flows north into the Red Cedar River. The Red Cedar in turn flows into the Grand River which flows west to Lake Michigan.

The soils occurring on the WQMP site are extremely variable, with an average of 57 percent homogeneity within mapping units (Zobeck, 1976). A high intensity soils map is presented in Figure 2 and shows the soil types within a quarter mile radius of the center of the aquifer test site. From Figure 2 and Table 1, it is evident that 61 percent of the soil is of glacial till parent material. Topographic highs of the area are covered by soils designated as outwash over till (14%) while the closed depressions in the test site area contain mostly soils of lacustrine parent material (17%). The remaining 8 percent is mapped as soils of outwash parent material and seem to trend in valley lows. Approximately 83 percent of the soil in the study area is well drained, with the remaining 17 percent being poorly drained.

Geology of the Study Site

At the WQMP site, Pleistocene glacial deposits directly overlie alternating sandstones and shales of the Saginaw Formation (Pennsylvanian). The Saginaw Formation

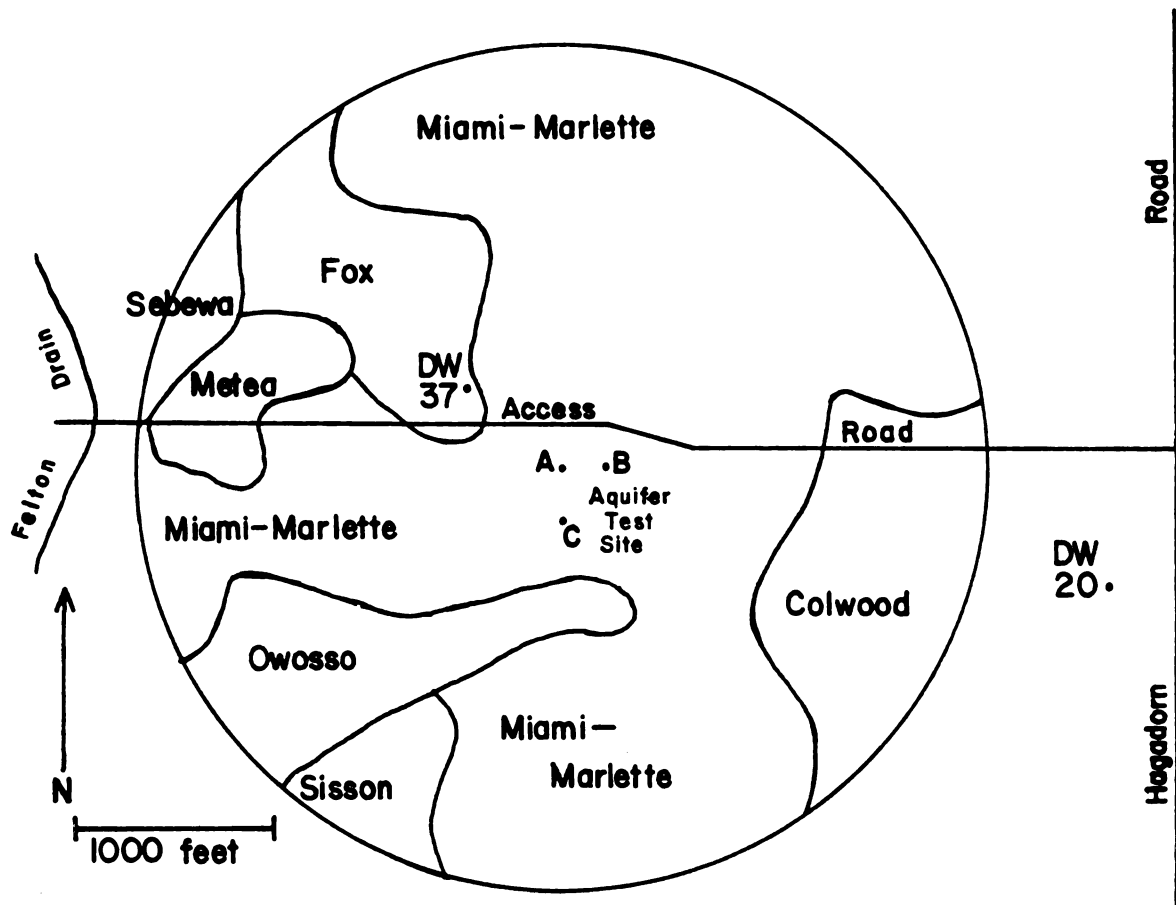


Figure 2. Map of the WQMP Site Showing Distribution of Soil Types.

Table 1

<u>Soil</u>	<u>Coverage %</u>	<u>Parent Material</u>	<u>Natural Drainage</u>	<u>Soil Description</u>
Fox	6	Outwash	Well	Sandy Loam
Sebewa	2	Outwash	Poor	Loam
Metea	4	Outwash/Till	Well	Sandy Loam
Owosso	10	Outwash/Till	Well	Sandy Loam
Colwood	15	Lacustrine	Poor	Calcareous Silt
Sisson	2	Lacustrine	Well	Loam
Miami- Marlette	61	Till	Well	Loam, Silt Loam or Silt Glacial Till

unconformitably overlies the Bayport and Michigan Formations which are Mississippian in age. The Saginaw Formation is composed of 300 to 350 feet (90-100 meters) of alternating beds of sandstones and shales with thin beds of coal and limestone. The formation was deposited by repetitive deposition of near shore deposits; sequences of sandstone, shale, coal, shale, limestone, et cetera, are typical throughout the formation. Local erosion of the upper portions of many of the sequences before deposits of later sequences has resulted in frequent breaks in the total deposition sequence and variations in bed thickness and extent (Kelly, 1936). The regional dip of the bedding planes in the Saginaw Formation is one and one-half degrees toward the northeast.

The Pleistocene deposits which overlie the Saginaw Formation were deposited during Wisconsin age glaciation, with the uppermost surface deposit being of the Cary substage (Thornbury, 1965). The 30 to 90 feet (9-27 meters) of glacial drift underlying the site has been mapped by Martin (1958) as recessional moraine and as intermorainal till plane (Figure 3). The intermorainal portion of the site has been described as "dead ice moraine" (Zobeck, 1976). "Dead ice moraine," which is actually hummocky ablation drift, is formed when a once active glacial front becomes stagnant, allowing the gradual lowering of glacial debris as the ice mass melts. This gradual process is accompanied by slump, debris flow, and solifluction, which

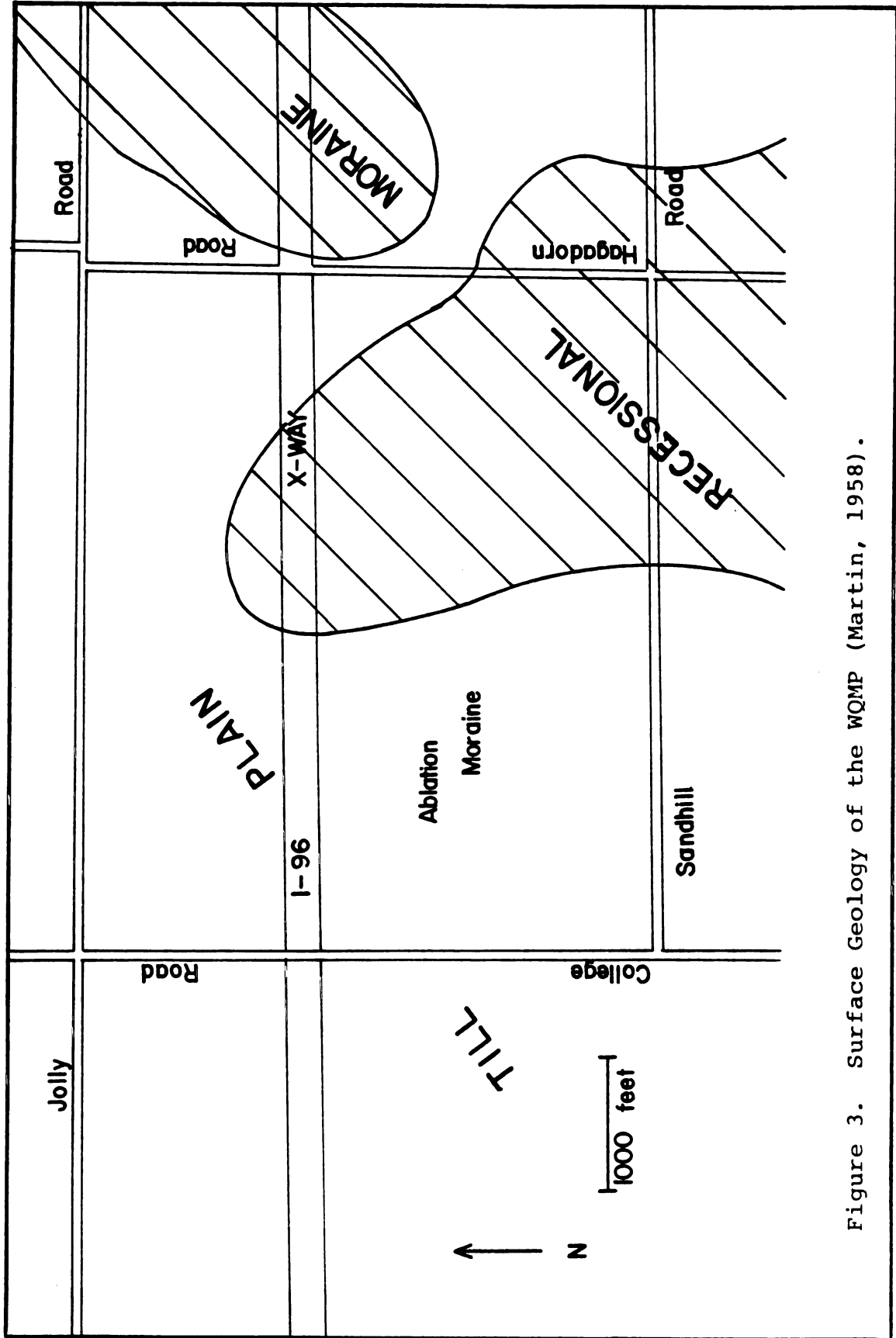


Figure 3. Surface Geology of the WQMP (Martin, 1958).

results in repeated redeposition before the load is finally deposited (Flint, 1971).

Soil samples taken in this area indicate the presence of flow tills, stratified sediments over clay tills, and lacustrine deposits in closed depressions (Zobeck, 1976). The glacial sediments and type of topographic relief found in the area confirms the presence of hummocky ablation drift.

The spray irrigation site east of Felton drain has been mapped by Martin (1958) as recessional (Lansing) moraine. Parent soil classifications, observation well records, as well as samples taken at the aquifer test site show the underlying drift to be principally of morainal type material. Figure 4 shows the mechanical analysis of samples at several intervals within the drift thickness and suggests a bimodal percent-grain size distribution, which is indicative of lodgment type till (Driemanis, 1969).

Geohydrology

The Saginaw Formation is the major groundwater aquifer for a large portion of the Lower Peninsula of Michigan. The greater Lansing area, including the WQMP site, is served exclusively by this confined sandstone aquifer.

The permeabilities of the sandstone layers within the Saginaw Formation are relatively consistent, with values averaging about 100 g/d/ft^2 ($4 \text{ m}^3/\text{d m}^2$) (Wheeler, 1967). The shale layers within the formation are, for practical purposes, considered impermeable. The coal and limestone

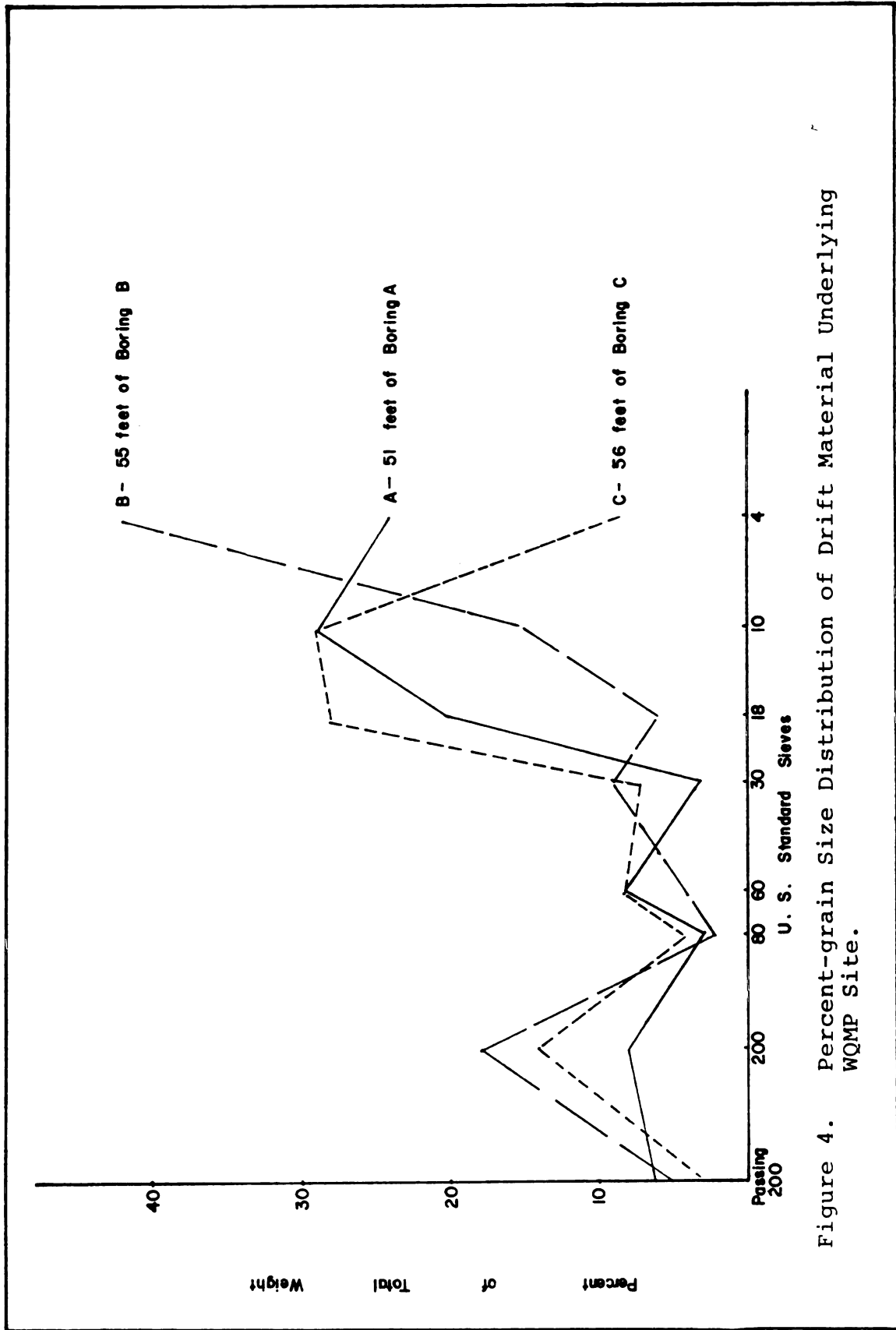


Figure 4. Percent-grain Size Distribution of Drift Material Underlying WQMP Site.

layers, although somewhat more permeable than the shale, may also be classified as aquicludes.

The Saginaw Formation is confined by clayey glacial deposits from above, and from below by inter-formational shale layers, and limestones of the Bayport Formation. Artesian pressures are generated by the head differential found within the confined aquifers. Regional formation dip, local formational irregularities, and impermeable glacial sediments confining inclined bedrock surfaces are situations where head differentials are generated (Mencenberg, 1963).

The transmissibility within the Saginaw Formation is dependent on the cumulative vertical thickness of sandstone (Stuart, 1945). Transmissibility figures at the WQMP range from an estimated 10,000 - 20,000 g/d/ft ($125-250 \text{ m}^3/\text{d m}$) (Vanlier and Wheeler, 1968). Groundwater yield, however, will vary with the amount of downward and lateral recharge entering the formation sandstones from overlying drift deposits (Stuart, 1945). The recharge potential of a particular area is dependent on the thickness and permeability of the glacial drift which overlies the aquifer. It is also dependent on whether or not the upper portions of the aquifer are free of impermeable shales layers, which retard vertical recharge. The lateral recharge of the Saginaw, in the vicinity of the WQMP, is from the southeast, with local groundwater flow direction shown in Figure 5.

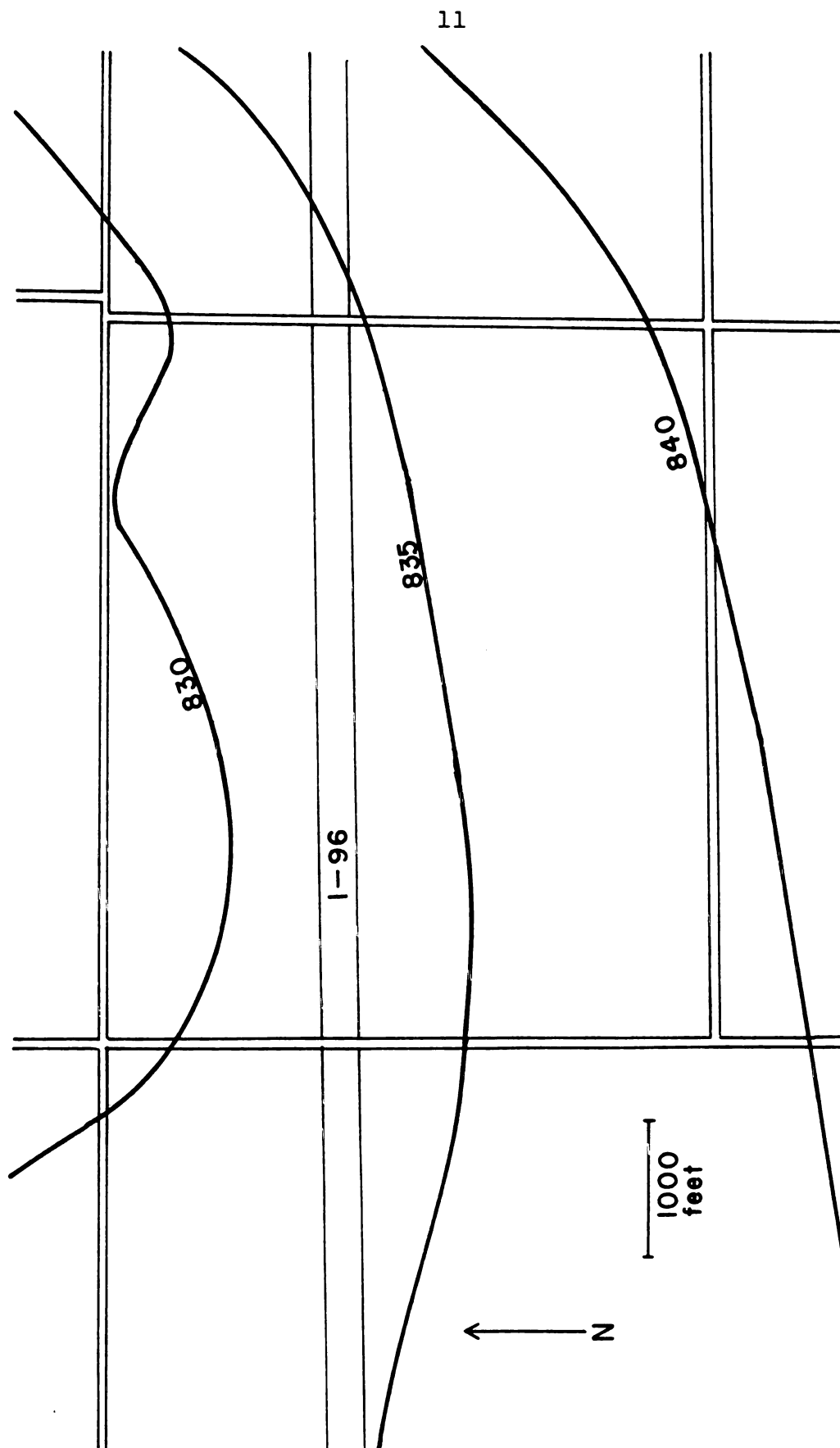


Figure 5. Piezometric Surface of Saginaw Formation (Van Til, 1977)

The hydrology of the overlying glacial deposits is quite varied, with perched and regular water tables, as well as artesian conditions present within a single vertical thickness of drift.

The main water table in the spray irrigation site lies entirely within the glacial drift and generally follows the contour of the surface topography (Figure 12, page 23). Artesian pressures are generated in permeable lenses within the drift and by hydraulic connection with the artesian Saginaw Formation. Vertical recharge rates through the glacial drift vary proportionately with the permeability of the saturated thickness of the glacial deposits and the head differences between water table and aquifer piezometric surface (Walton, 1970). Due to municipal pumpage of the Saginaw Formation to the north of the spray irrigation site, and a general increase in the permeability of glacial sediments from east to west, the recharge rate tends to increase from southeast to northwest across the project site. Preliminary studies of the recharge rates for the site indicate that the average flux is less than 0.1 ft/day (3.5×10^{-5} cm/sec) (IWR, 1971).

The Geology and Geohydrology of the WQMP Site

Glacial Drift and Bedrock

Figure 6 shows a cross section of the geologic units underlying the WQMP site. The diagram construction is based on lithologic logs from nine observation wells across the project site (Figure 7). Copies of the logs are included in Appendix A of this thesis and are also available in the files of the Michigan Department of Natural Resources. It appears from Figure 6 that the glacial drift underlying the site is very complex, with depositional units being of short lateral extent. Nevertheless, some general statements can be made regarding the degree of complexity within the spray irrigation site. The southeast corner of the site consists mainly of morainic material. Well logs within this area show that this material consists mainly of gravelly clay. On the other hand, in the central portion of the site the logs indicate mostly till, but also show several lenses or layers of sand and gravel. This trend continues throughout the northeastern portion of the site until sand and gravel makes up as much as half the drift thickness. From Figure 6 it is also evident that the glacial drift at the site rests primarily on clean white sandstone which include a few, thin layers of grey shale of variable areal extent. The extreme southeast and

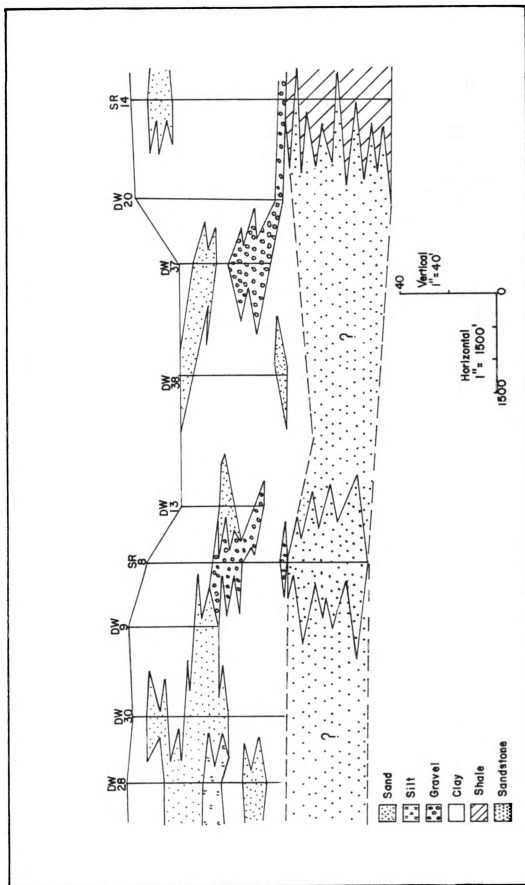


Figure 6. Cross-sectional Diagram Showing Geologic Units Underlying WQMP Site

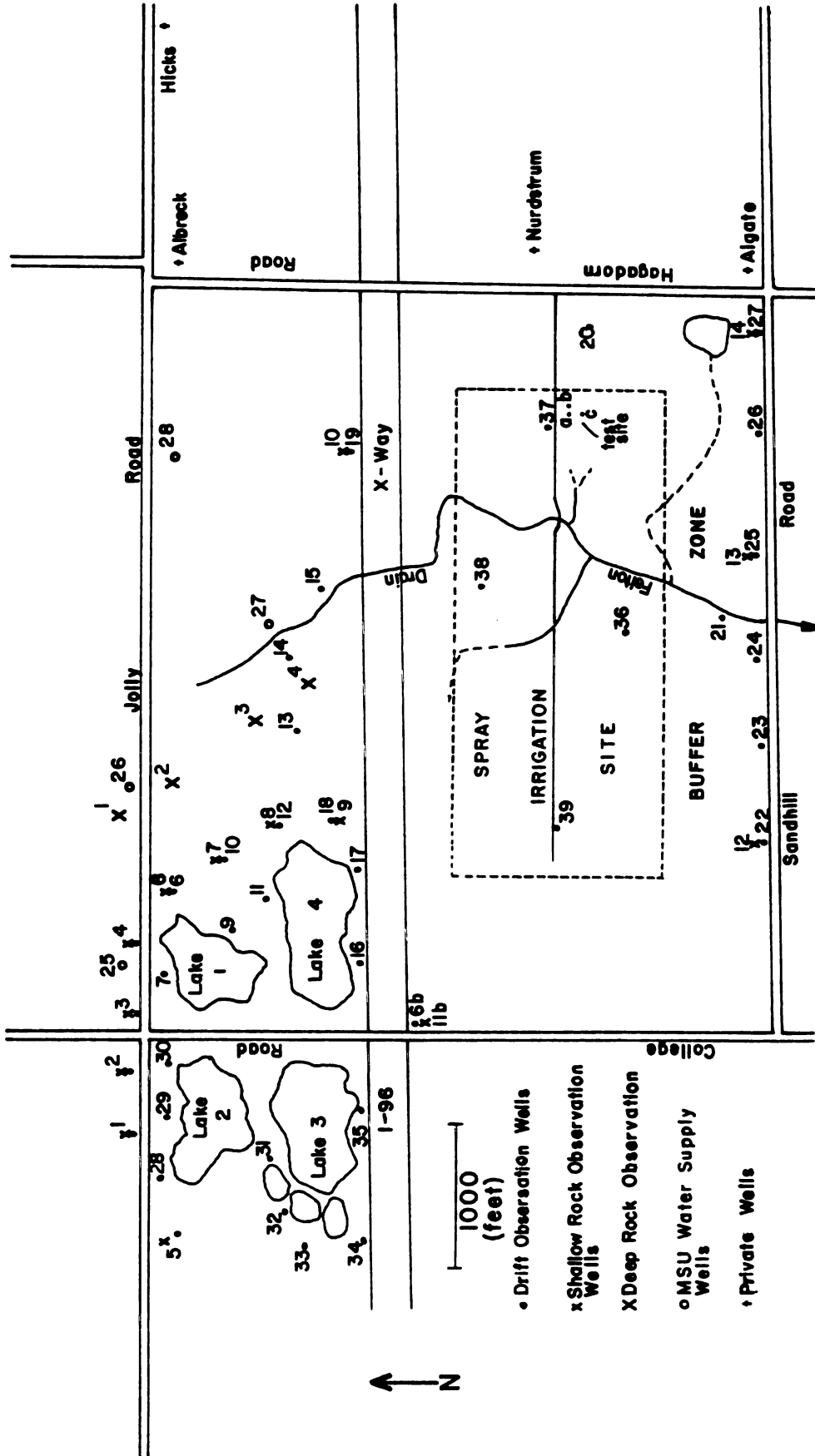


Figure 7. Map of WQMP Site Showing Location and Type of Wells

northwest corners of the site, where the bedrock elevation is highest, consist of relatively thick shales which lie directly under the glacial drift.

The glacial drift on the WQMP ranges in thickness from a little over 100 feet (30 meters) in the northeast corner of Section 6, to about 30 feet (9 meters) on the south central boundary of the spray irrigation site (Figure 8). The bedrock topography shown in Figure 9 is based on well log data and indicates the presence of a pre-glacial valley which trends NE through the center of the site. In addition, a small southeast trending tributary valley cuts a relatively narrow bedrock ridge, which forms the west slope of the larger buried valley. Both of these valleys appear to be part of a much larger pre-glacial river system which drained toward the northwest (Vanlier et al. 1973).

Water Table and Piezometric Surfaces

A map of the piezometric surface of the Saginaw Formation underlying the spray irrigation site is presented in Figure 10. The map is based on water level data taken from shallow bedrock observation wells and shows that groundwater flow within the Saginaw Formation is toward the north-northwest. The direction of flow in this particular area is greatly influenced by M.S.U. production well drawdown, which lowers the piezometric surface within the Saginaw Formation considerably. It must be pointed

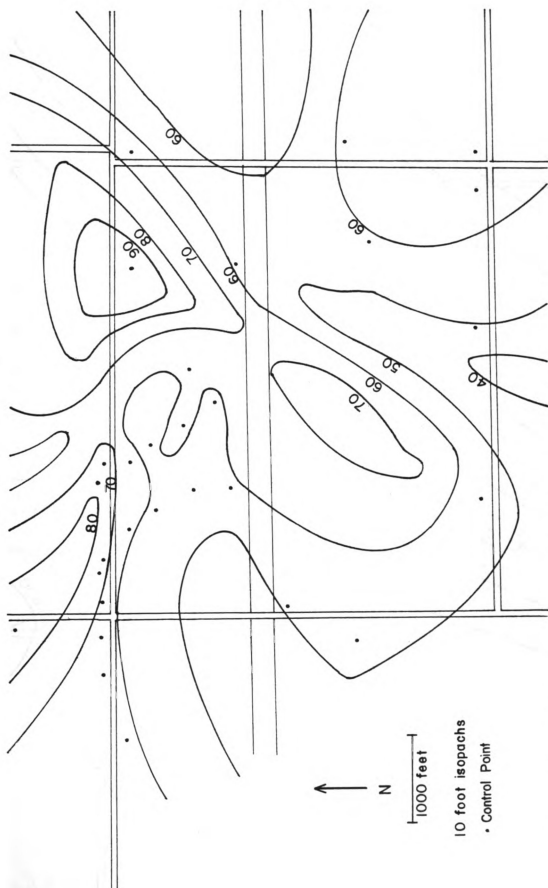


Figure 8. Map Showing Thickness of Drift Underlying WQMP Site

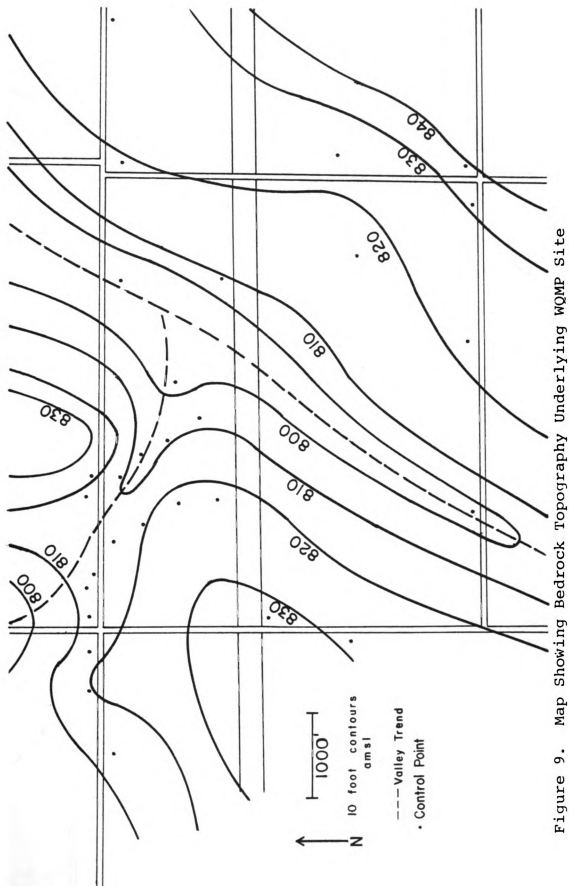


Figure 9. Map Showing Bedrock Topography Underlying WQMP Site

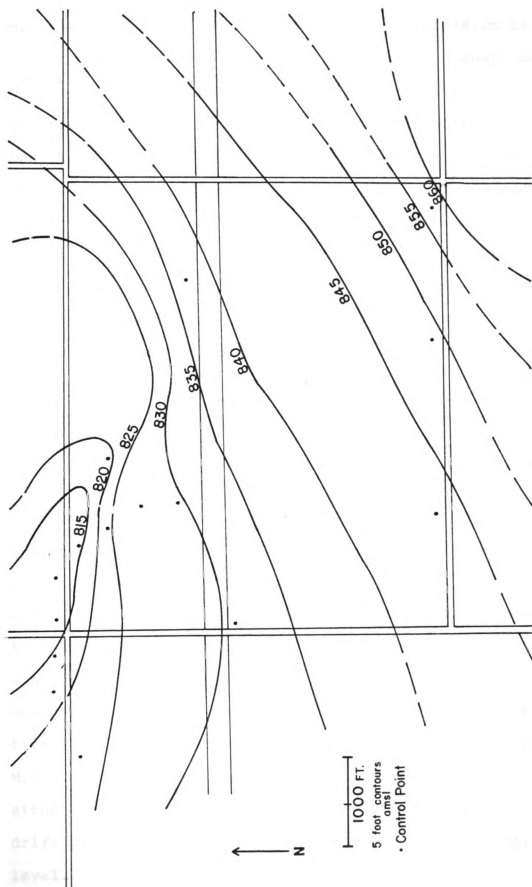


Figure 10. Map Showing Piezometric Surface Determined from Wells Penetrating the Saginaw Formation

out, however, that although the cone of depression is centered around M.S.U. Well #25, the specific shape and size of the cone changes with the rate, duration and schedule of pumpage of the individual production wells. Despite the fluctuation of the specific cone size and shape, the overall groundwater flow within the Saginaw Formation is always strongly toward the north with respect to the spray irrigation site.

Looking next at Figure 11, which is a piezometric contour map generated by water level data obtained from the drift wells, it becomes apparent that some areas within the drift are greatly affected by pumpage of the Saginaw Formation, while others are only slightly affected. The data used to generate this map was obtained from drift wells which are screened in the first waterbearing sand or gravel lens, within 5 meters of the water table. The wells vary in depth depending on the geology encountered while drilling. However, despite the variability of depth which implies varying hydraulic connection with the underlying Saginaw Formation, the resulting piezometric map shows a predictable groundwater flow pattern. For example, the observation wells in the spray irrigation area show relatively little response to the drawdown produced by the M.S.U. production wells, while the drift wells that are situated near the production wells reflect either a dry drift profile or indicate a marked decline in the water level.

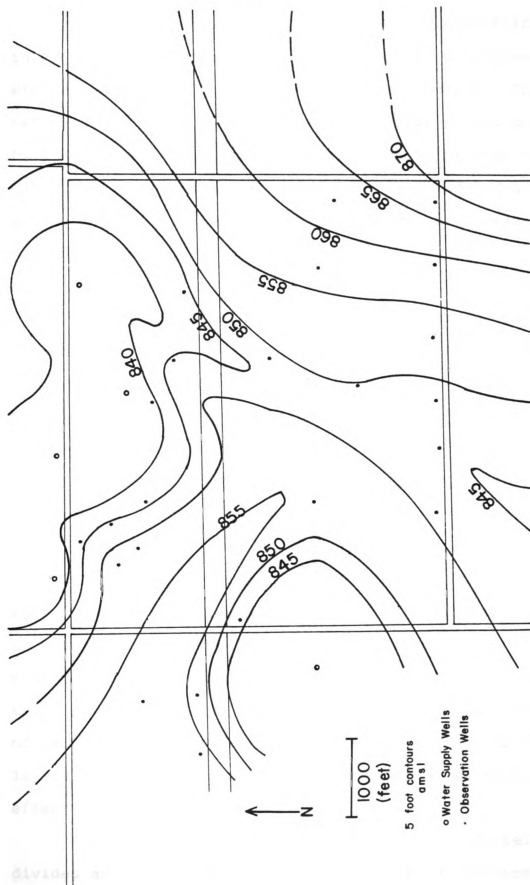


Figure 11. Map Showing the Piezometric Surface Constructed From Wells Developed in Drift

A major feature also evident on the piezometric map in Figure 11 is a groundwater trough, which coincides with the buried bedrock valley shown in Figure 9. The valley is situated on a line, between wells DW #23 and DW #15, and is filled predominately with relatively impermeable clay till, with lenses or layers of sand and gravel at the base. The valley is intersected by two areas of groundwater discharge, situated north and south of the spray irrigation site. The groundwater sink to the north is associated with M.S.U. production well drawdown, while groundwater flow to the south is the result of groundwater discharge into the Sycamore Creek drainage system which is at a lower elevation. The groundwater surface shown in Figure 11 clearly indicates that groundwater on the lower part of the drift flows into the bedrock valley and then either north toward the production wells or south toward Sycamore Creek.

In addition, Figure 11 shows an area of high groundwater levels directly beneath the WQMP lake system. It is uncertain whether this high is due to leakage from the lake system or whether the bedrock high in this area, which contains some shale lenses, is retarding the downward movement of groundwater. Another possible explanation is that clay layers in the glacial drift are producing a "perching effect" of the groundwater in this area.

Figure 12 shows the water table and groundwater divides as interpolated from surface water elevations

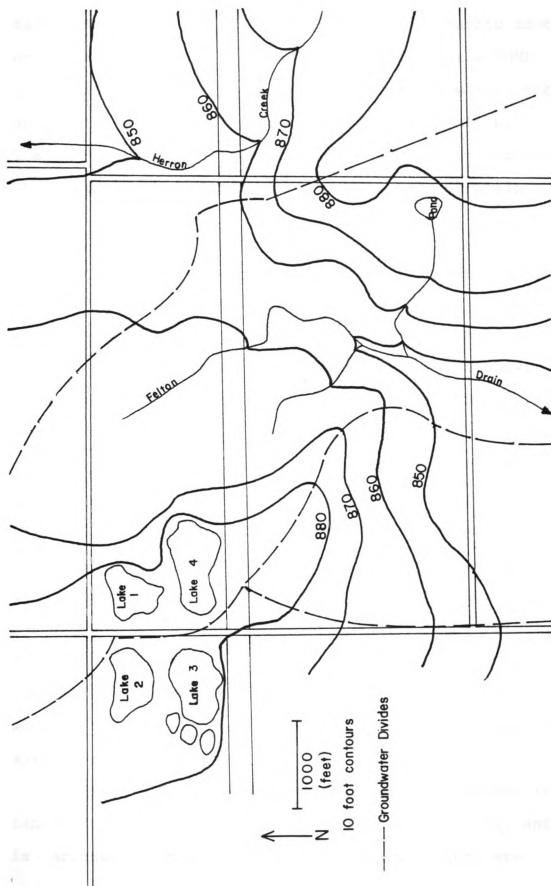


Figure 12. Water Table Contour of the WQMP

taken from the standard 7½ minute USGS topographic sheet, an aerial photograph produced contour map of the WQMP site, and various shallow boring information within the area. The water table contours coincide closely with that of the surface drainage in the WQMP, with roughly 75% of the area draining south into the Felton Drain.

Long-Term Water Level Fluctuation

From September 1976 to September 1977, monthly water levels were recorded for twelve drift observation wells in, and adjacent to, the spray irrigation site (Figure 13). A record of these fluctuations is shown in Appendix B. It must be pointed out that the rainfall record from the 1976-77 water year was 9.96 inches (25.3 cm) below the area 17 year normal, and is, therefore, considered to be a drought year. (NOA Climatological Data 1976-1977). The characterization of the water level records, therefore, applies only to the 76-77 water year or possibly to a period with similar precipitation patterns. The ten records representing seasonal fluctuations are divided into three groups with each group showing similar characteristics. The remaining two records show water level responses due mainly to pumpage and spray application.

A plot of the water level fluctuation recorded in ten of the observation wells is shown in Figure 14, and is arranged in three groups. The Group I plots are

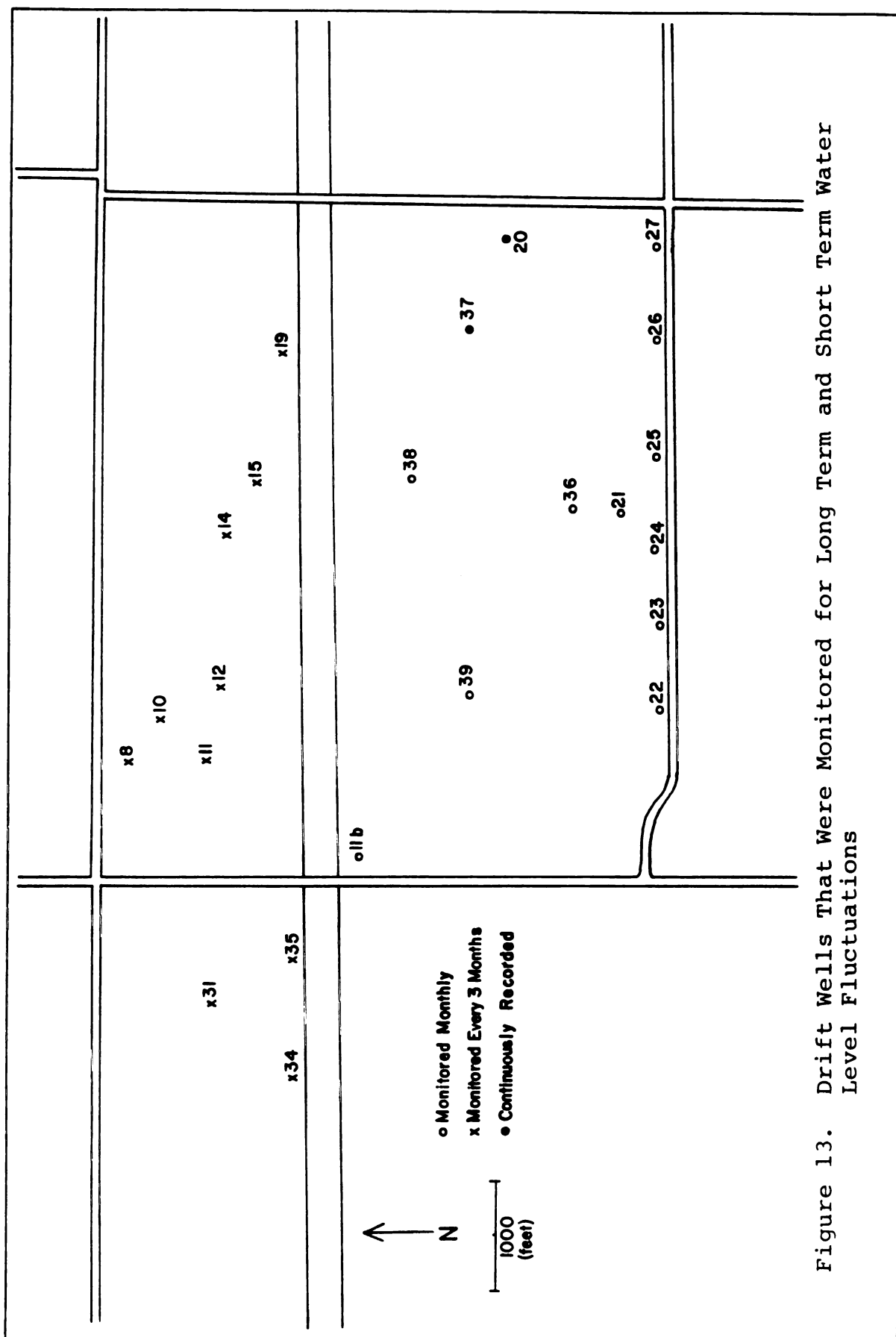


Figure 13. Drift Wells That Were Monitored for Long Term and Short Term Water Level Fluctuations

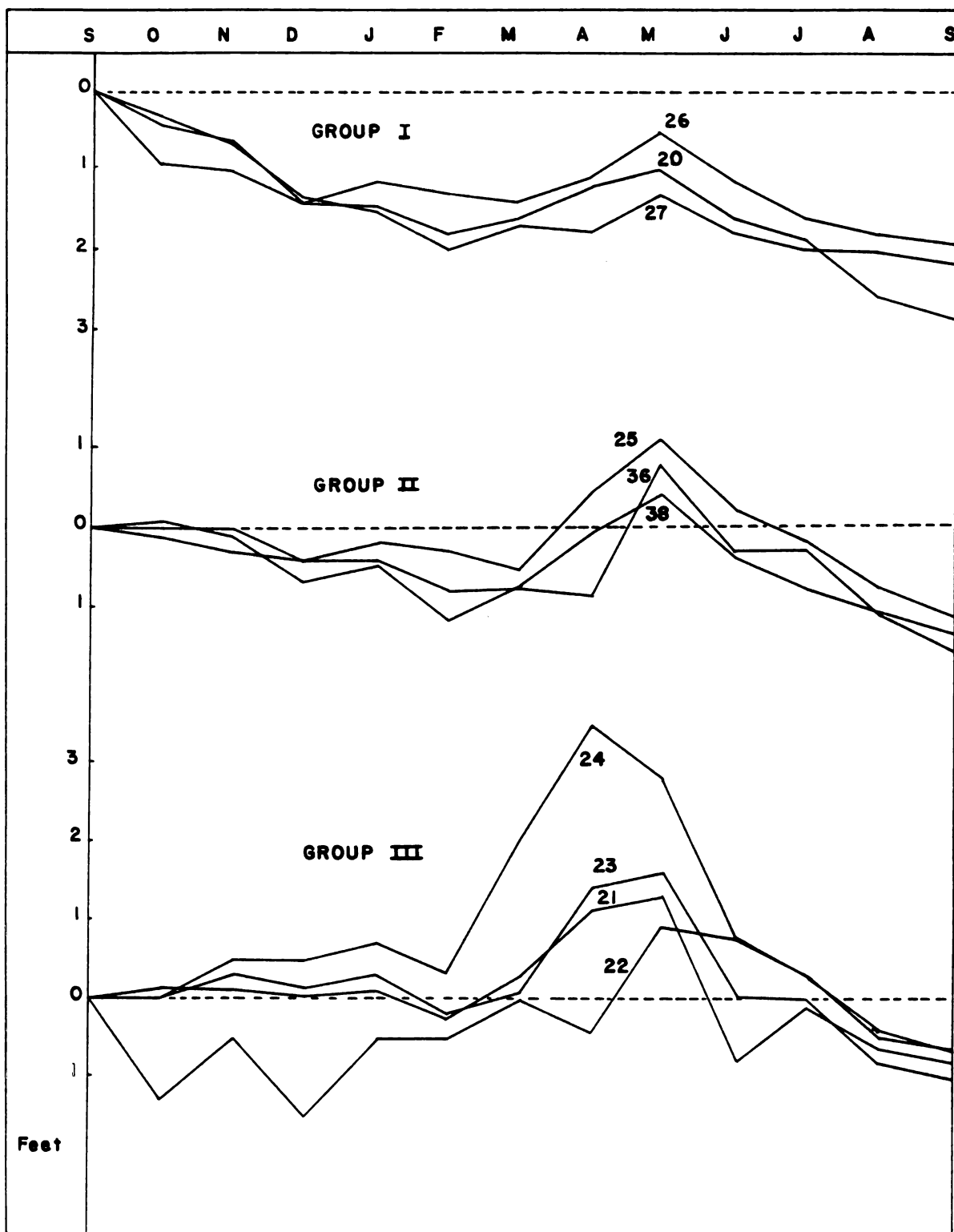


Figure 14. Water Level Fluctuations for the 1976-77 Water Year. Group I represents the type water level response in areas of piezometric highs. Group II represents the intermediate response of water levels lying between the highs and the piezometric lows which are represented in Group III.

typical of the wells which monitor points where ground-water flow is divergent and where the piezometric surface is relatively high (greater than 857 feet [261 meters] amsl). It is evident from these plots that the seasonal declining water level trend is only slightly interrupted by snow melt and heavy spring rain generally between early March and May. The maximum annual water level fluctuation for the Group I wells is approximately 2.25 feet (.68 meters) with the greatest fluctuation occurring in Well #20.

Group II well fluctuations are similar to Group I, but differ mainly in magnitude. The overall annual fluctuation of these wells is only about 1.5 feet (0.5 meters). In addition, the water level response to spring recharge is more pronounced than that of Group I, because they are located between piezometric highs and lows, and monitor the water level near or at points where groundwater flow is predominantly convergent.

The Group III type plots include wells that are located mainly adjacent to creeks and ponds. These surface features appear to directly affect the water table by buffering groundwater storage with influent flow which maintains a stable base water table. Deviations from the base flow are caused by increased groundwater storage due to increased recharge from higher surface water levels. A decrease in the minimum water levels, as seen in the last months of the 76-77 water year, is a result of the extreme drought conditions which lowered the base flow.

Figure 15a shows the water level fluctuations for Well #37 located within the spray irrigation zone. From August through October of 1976 and mid-April to September of 1977, the spray zone received approximately three inches (8 cm) of water per week. The record for Well #37 shows a marked decline in groundwater storage during the winter months when the site was not being irrigated and precipitation was immobilized in the form of snow and ice.

Groundwater mounding and mound delay equations, developed by Hantush (1967), can be used to separate that portion of groundwater storage which is the direct result of spray application. Figure 15a also shows the plot of the groundwater fluctuation with the calculated groundwater mound (Figure 15b) subtracted from it. (Computations in Appendix C). The plot of the calculated water level in the well represents theoretical groundwater fluctuations without the effect of the spray application. It can be seen from the data that the theoretical values fit into the Group II fluctuations as would be expected.

Observation well DW #39 is situated on the west end of the spray irrigation site, adjacent to the Horticulture Research facility. Throughout the summer growing months the facility operates an irrigation well, which is set in the Saginaw Formation. The seasonal water level plot of well #39 is shown in Figure 15c and suggests a hydraulic connection between the well and the

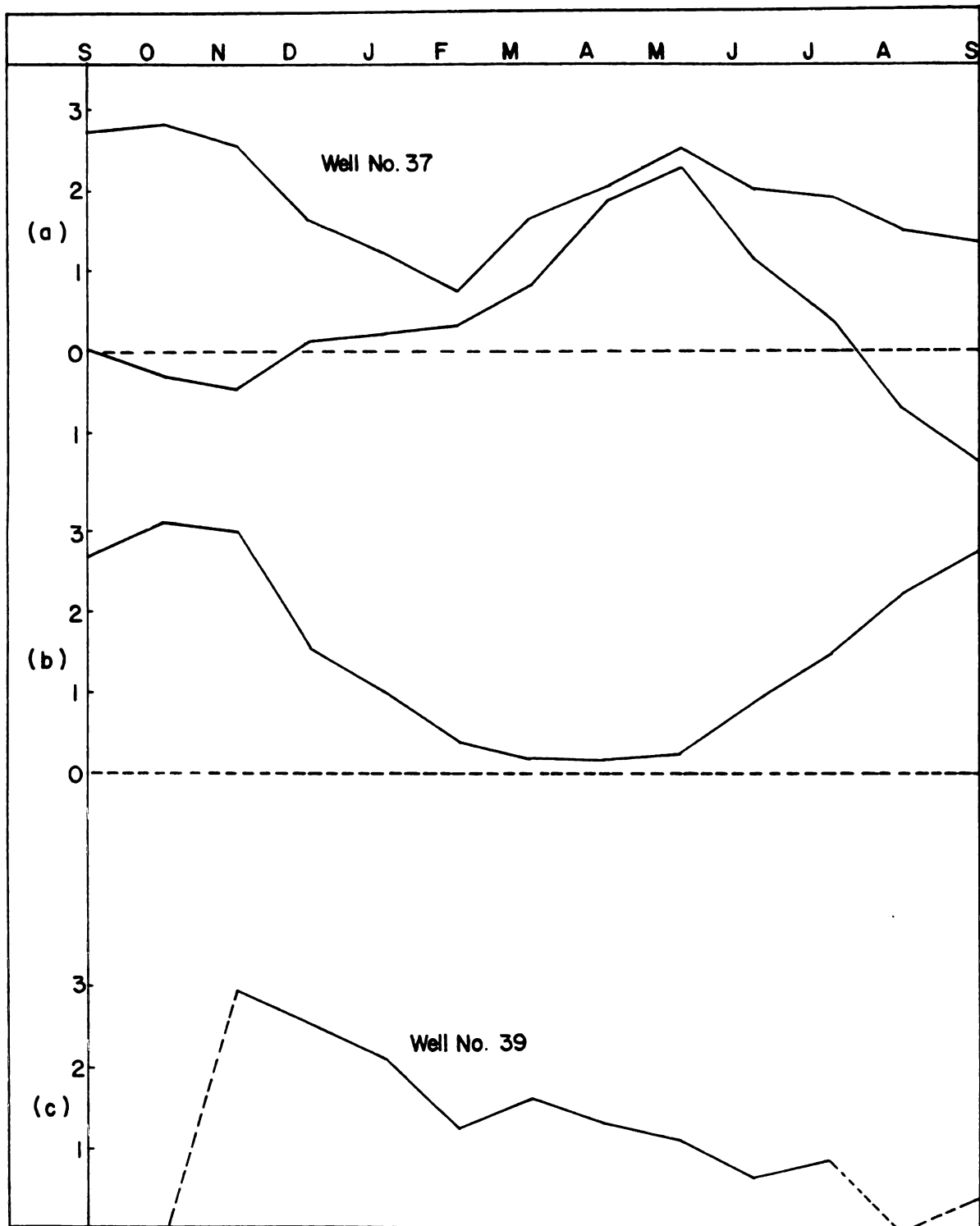


Figure 15. Long-term Water Level Fluctuations for the 1976-77 Water Year. 15a. The upper curve represents the observed 76-77 groundwater fluctuation for Well #37. The lower curve is the observed fluctuation minus the calculated mounding due to spray irrigation. 15b. The plot of the groundwater mounding and mound decay due to spray irrigation. 15c. The curve shows the increase in storage reflected at Well #39 following the termination of irrigation pumpage.

production well. This is evident from the rapid recovery records in well #39, which coincided with the end of the growing season.

Short-term Water Level Fluctuations

Short-term water level fluctuations are evident in wells #20 and #37, which lie on or adjacent to the spray irrigation plots 21, 22 and 23 shown in Figure 16. These plots receive 60% of the total effluent on the WQMP. Lithologic logs for these wells can be found in Appendix A.

In order to accurately monitor the short-term fluctuations in water levels, continuous recorders were set up on wells #27 and #20. Figure 17 shows the water level response recorded in the wells during a 20 day period from March 24 to April 12, 1977. This period was characterized by several frontal passages and extreme barometric pressure fluctuations. A record of both the precipitation and barometric pressure during this period is also presented in Figure 17.

The recorded short-term water level fluctuations in wells #37 and #20 during the 20 day period clearly show a correlation with changes in the atmospheric pressure. The barometric efficiency for well #20 and well #37 calculated from the equation

$$BE = \frac{\Delta W}{\Delta B} \times 100$$

where BE = barometric efficiency, in percent

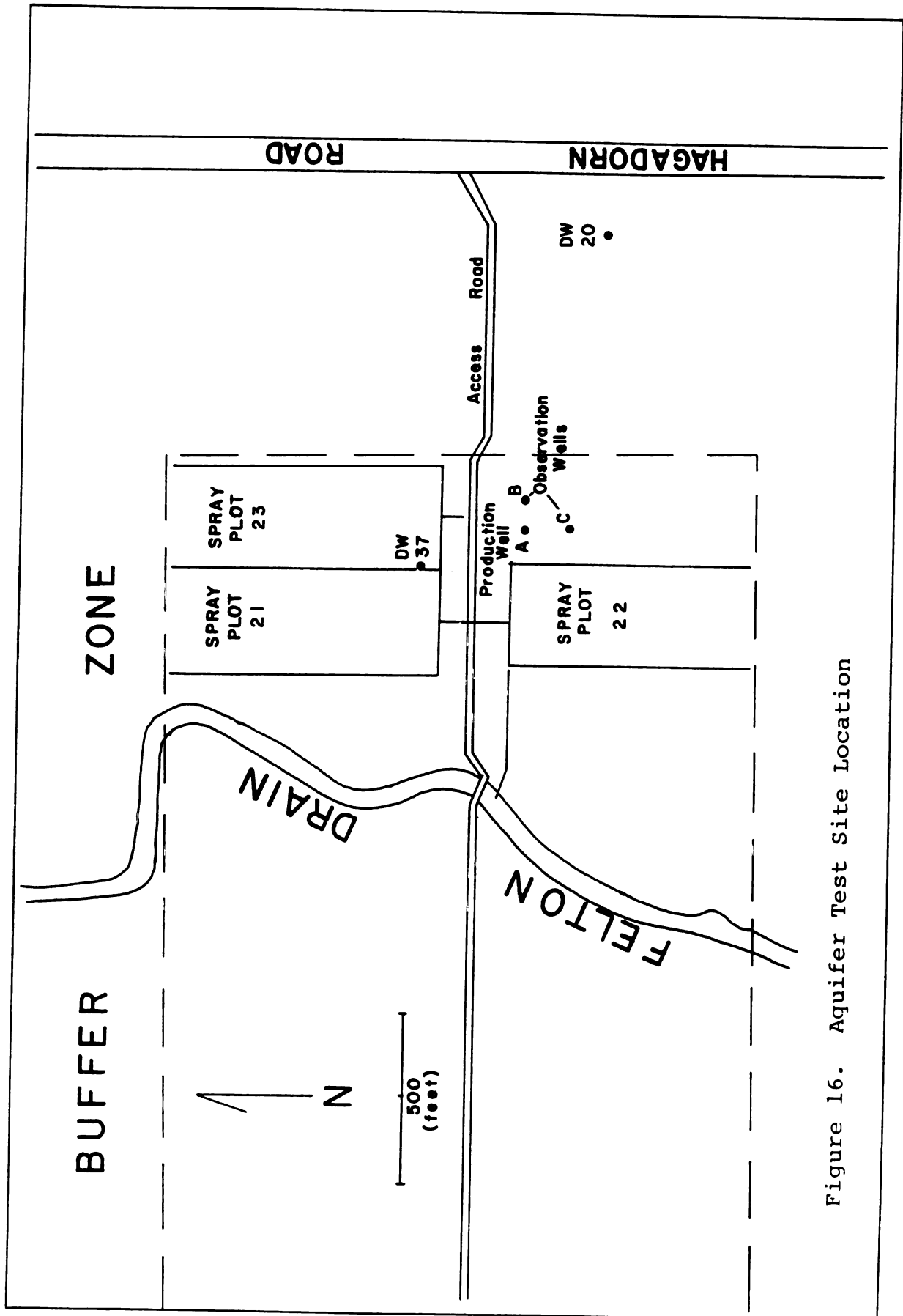


Figure 16. Aquifer Test Site Location

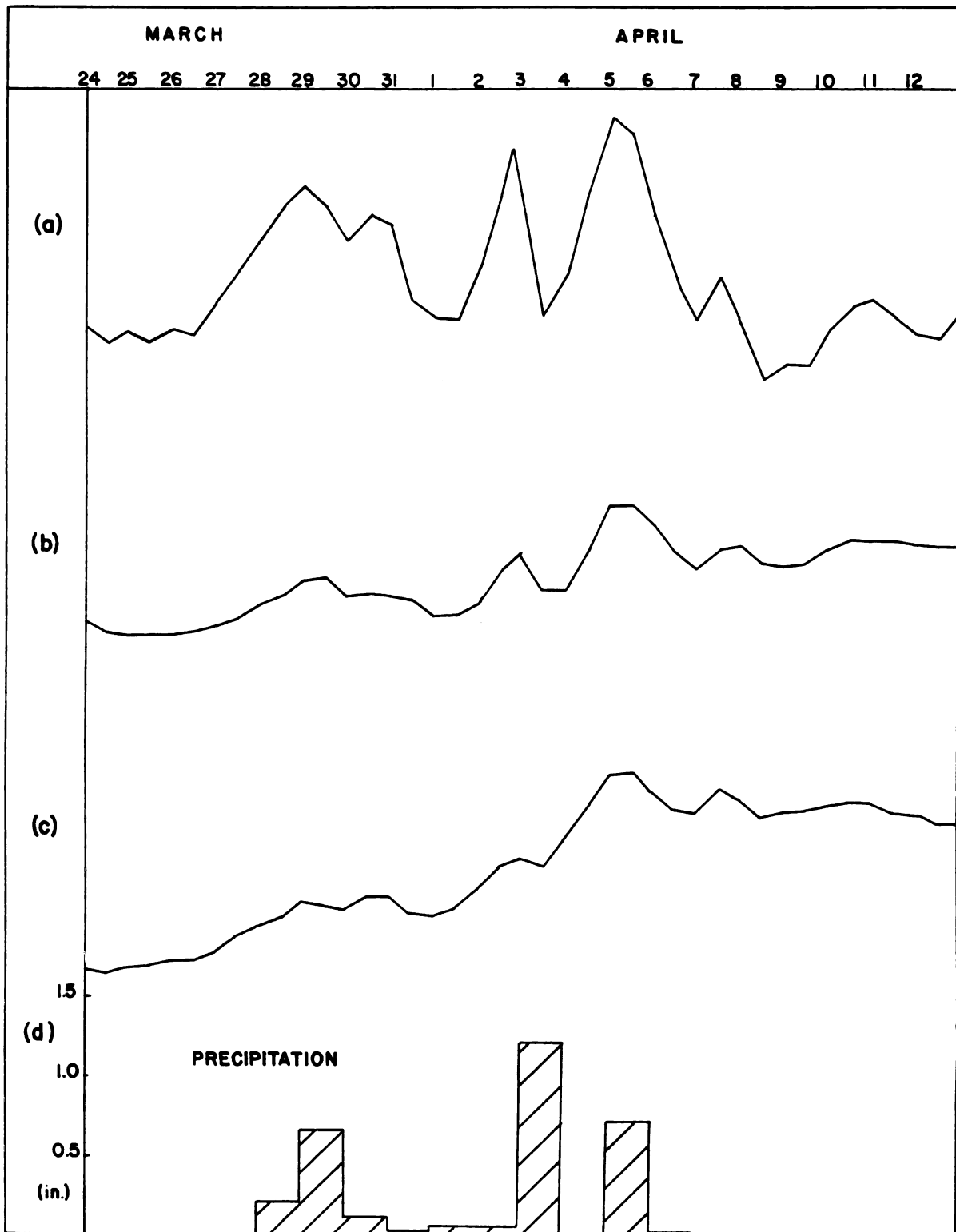


Figure 17. Water Level Fluctuation Due to Atmospheric Pressure Change. The curve shown in A is the atmospheric pressure represented in feet of water. Parts B & C show the corresponding barometric response of wells #20 and #37 respectively (in feet). Graph D represents the daily precipitation for the 20 day period in inches.

ΔW = change in water resulting from change
in atmospheric pressure, in feet

ΔB = change in atmospheric pressure, in feet

are 43 and 44 percent for the respective wells. These values represent only a moderately active barometric response (Chow, 1964) which is probably the result of the elastic nature of the silty unconsolidated gravel aquifers, and not to the lack of effective confining strata thickness.

Aquifer Testing

The hydrogeology properties of aquifers and aquitards can be analyzed by aquifer testing. This procedure normally involves applying a stimulus to an aquifer by means of constant pumpage of a test well, and recording the water level response in nearby observation wells. The resulting response is plotted against pumping time and analyzed using a series of equations and "type" curves to obtain, quantitatively, the hydraulic characteristics of the aquifer in the vicinity of the pumped well. Permeability (P), storage (S), transmissibility (T) and vertical permeability (P') are the major coefficients analyzed to describe the hydraulic characteristics of the aquifer and confining beds. The coefficients of permeability (P) and transmissibility (T) are defined as the rate of groundwater flow, in gallons per day, through a 1 foot square, and a 1 foot wide vertical strip through the aquifer

respectively, under a hydraulic gradient of 1 foot per foot. The coefficient of vertical permeability P' is a measure of the vertical leakage through a foot square horizontal cross section of a confining bed under an hydraulic gradient of 1 foot per foot. The coefficient of storage S is the volume of water the aquifer releases from or takes into storage per unit surface area per unit change in hydraulic head (Walton, 1962). These hydraulic properties provide the foundation for a quantitative assessment of an aquifer.

Methods:

The aquifer test site at the WQMP is located in the spray irrigation zone, roughly 100 meters S-SE of DW #37 (Figure 16, Page 31). The site consists of a production well (A), two observation well arrays (B and C) which contain three piezometers each, and a drift well (DW #37). The lithologic logs for all the wells except #37 shows primarily 15 feet (4.6 meters) of brown sandy clay directly beneath the surface, followed by 10 feet (3 meters) of gray clay/25 feet (7.6 meters) of gray clay and fine gravel/10 feet (3 meters) of fine gravel and coarse sand with clay followed by a foot (.3 meters) of black shale and then sandstone. The logs for each of the three wells as well as sieve analysis for the various units can be found in Appendix A.

Production well A is 62 feet (18.9 meters) deep and

consists of a 4 inch (10 cm) diameter plastic pipe, which is slotted throughout its entire length. The saturated thickness of the drift encountered is 40 feet (12 meters). The slotted "screen" portion at the base of the well was set in an 8 inch (20 cm) diameter hole, which was gravel packed. Above the screen the well was back-filled with bentonite clay sealer.

The observation well arrays B and C are 70 and 135 feet (21 and 41 meters) to the east and south of production well A, respectively. Each well array consists of three 2 inch (5 cm) plastic piezometers. Each piezometer is equipped with a 4 foot (1.2 meters) slotted "screen" segment set at depths 20, 40 and 60 feet (6, 12, and 18 meters) below surface. The screened portions of the piezometers were packed with gravel and were isolated from each other by bentonite fill. This piezometer array arrangement enabled the gathering of data from several drift horizons within a single drift boring.

Observation well DW #37, which is part of the established WQMP observation well system, was also used as a piezometer during the aquifer test. It consists of a 4 inch (10 meters) steel cased well with a 3 foot (1 meter) #10 slot screen, which is set in a sand and gravel layer 36 feet (11 meters) from the surface. A diagram of the production and observation well construction as well as the lithology encountered in the wells is included in Figure 18.

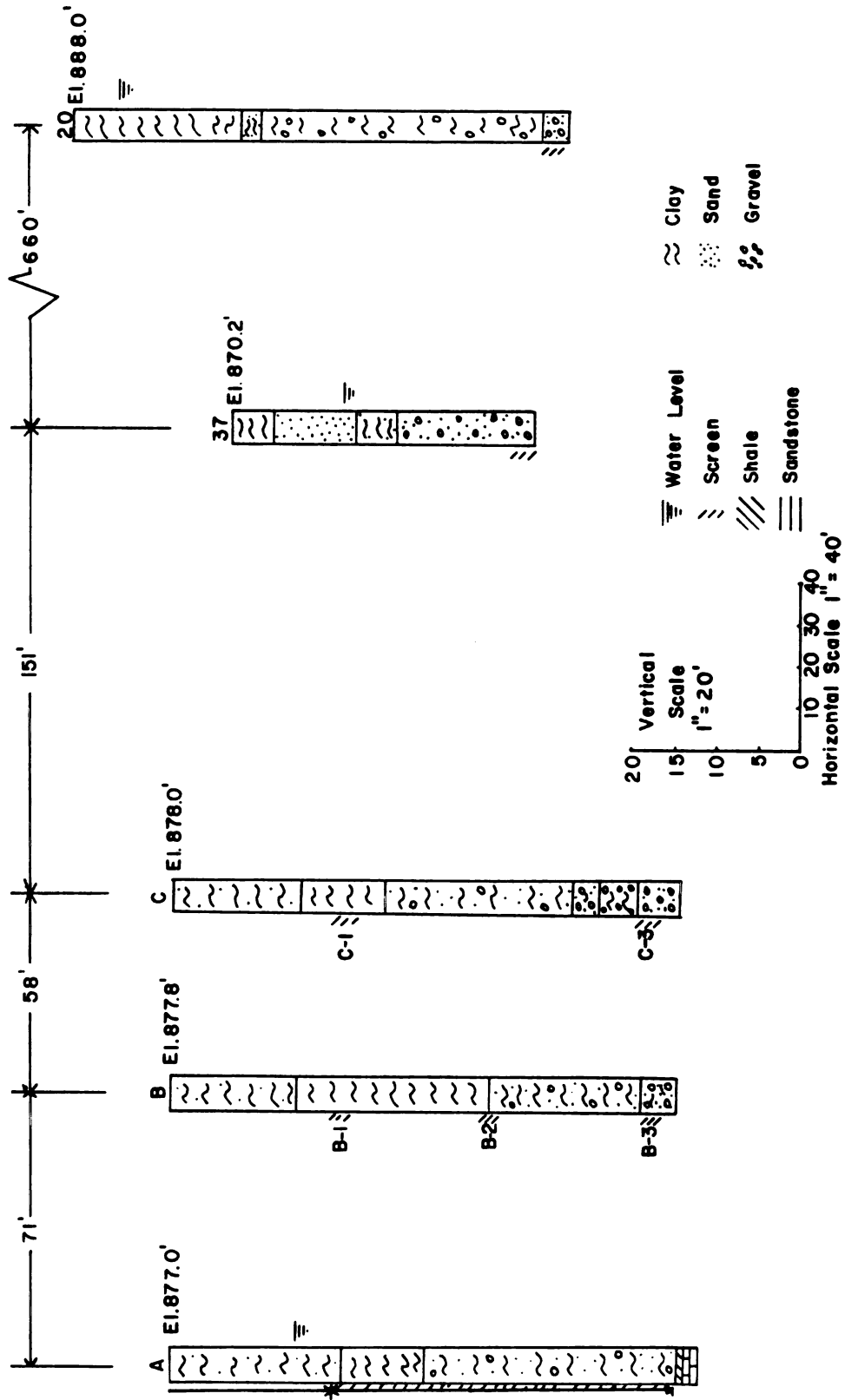


Figure 18. Graphic Representation of Geologic Units and Relative Distances of the Observation Wells from Production Well #4.

Pumpage of well A was accomplished by a submersible electric pump and portable generator setup, which provided a discharge of approximately 12 gallons (46 liters) per minute. The well discharge was channeled away from the aquifer test site by gravity flow through an existing irrigation pipe network, which empties into the Felton Drain about 300 meters to the west of the test site.

The drawdown measurements for aquifer test well A, and observation wells B and C were taken with electric water level sensors and steel measuring tapes (Johnson, 1977). The drawdown in wells #37 and #20 was recorded with the continuous water level recorders that were used to record short-level water level fluctuations.

Results:

The responses in the observation wells to the constant pumpage of production well A are shown in Figures 19 through 22. Figure 19 shows the response versus time curves for the drawdown and recovery recorded in observation well #37. These curves coincide well with the type curve for a leaky artesian aquifer without water being released for storage in the aquitard where $v/B = 0.35$ (Walton, 1962, plate 1). By superimposing the field data on the type curve, match-point coordinates were obtained for computation of the hydraulic coefficients defining the aquifer. The values of T , S , and P' calculated from both the drawdown as well as recovery data are very similar and average 4885

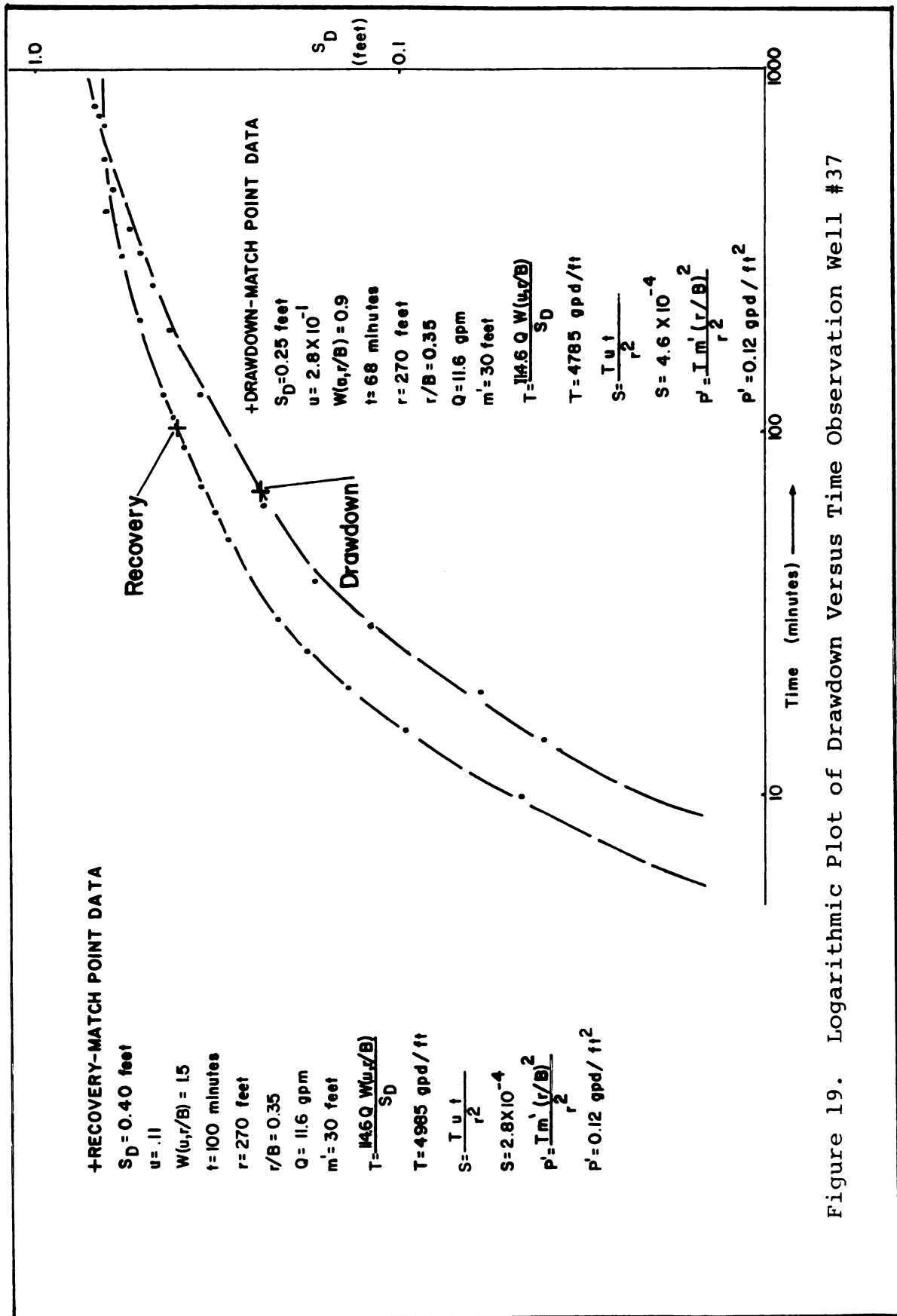


Figure 19. Logarithmic Plot of Drawdown Versus Time Observation Well #37

gpd/ft ($61 \text{ m}^3/\text{d m}$), 3.7×10^{-4} , and 0.12 gpd/ft^2 ($5.7 \times 10^{-3} \text{ cm/sec}$) respectively.

Figure 20 shows the drawdown from observation well C-3 which penetrates 60 feet of drift. The early data from C-3 is unreliable but the later data coincides very well with the non-leaky artesian aquifer type curve (Walton, 1962, plate 3). Using the match-point coordinates shown for the C-3 plot results in a T & S value of 4578 gpd/ft ($57.2 \text{ m}^3/\text{d m}$) and 3.1×10^{-4} respectively, which correspond very closely to those calculated for observation well #37. The vertical permeability values are absent because the non-leaky artesian aquifer curve implies that no water is being released from storage within the aquiclude and, therefore, vertical permeability is assumed to be zero.

Observation well B-2, which monitors the water level response for an interval 40 ft. (12 meters) from the surface in observation array B, shows a drawdown response which coincides also with the non-leaky type curve. Calculations for T & S from match-point coordinates produce values of 3172 gpd/ft ($39.6 \text{ m}^3/\text{d m}$) and 6.4×10^{-8} , which indicates material with less transmissibility and storage than that which intersects observation wells C or #37 (Figure 21).

Observation piezometer B-3 monitors the bottom interval of drift roughly 20 feet (6 meters) below the level of piezometer B-2. The B-3 time-drawdown plot was superimposed on the leaky artesian type curve, without water released from storage (Figure 22). The T & S values

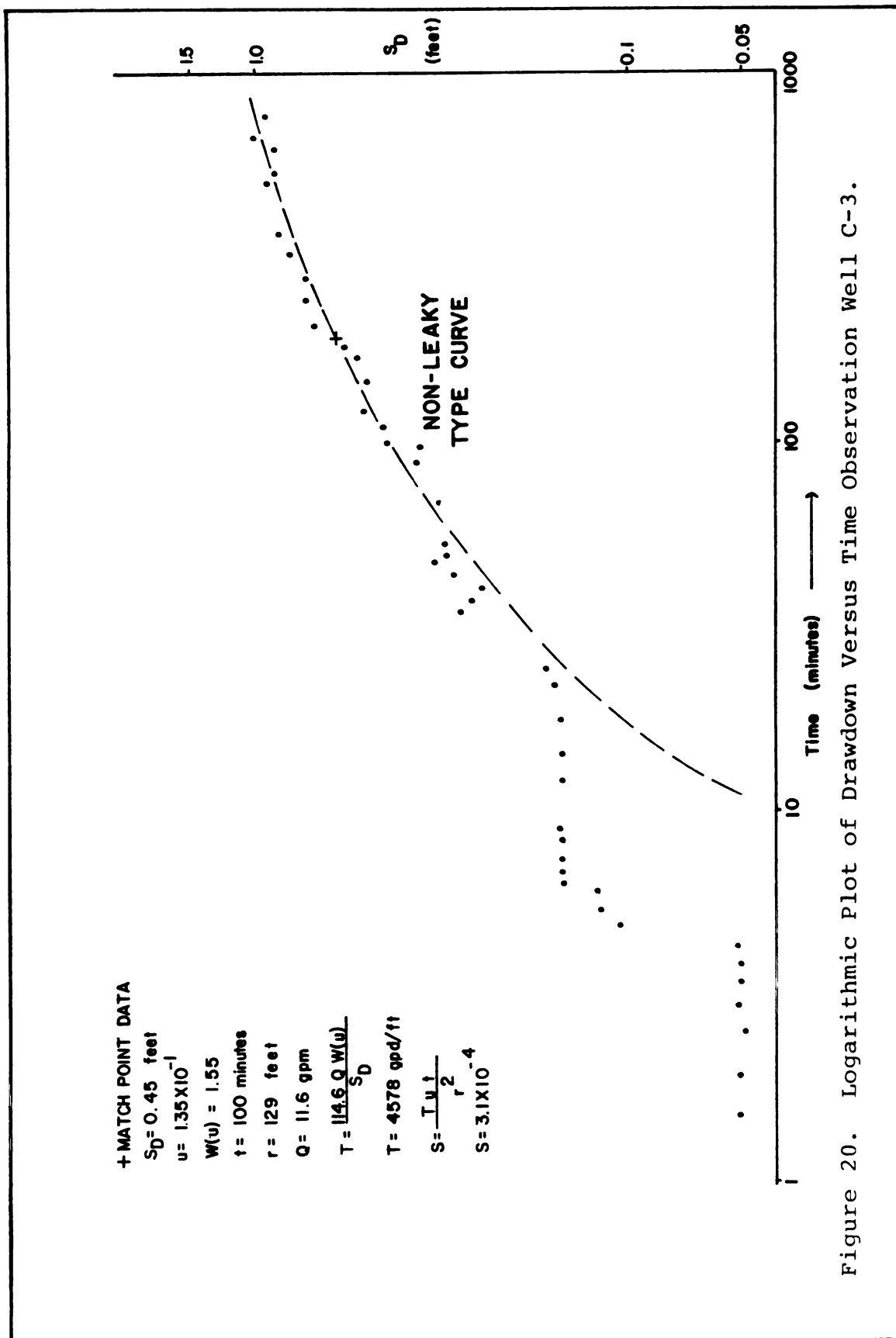


Figure 20. Logarithmic Plot of Drawdown Versus Time Observation Well C-3.

+ MATCH POINT DATA

$$u = 2.4 \times 10^{-1}$$

$$W(u) = 1.05$$

$$S_D = .44 \text{ feet}$$

$$t = 60 \text{ minutes}$$

$$Q = 11.6 \text{ gpm}$$

$$r = 71 \text{ feet}$$

$$T = \frac{1146 Q W(u)}{S_D}$$

$$T = 3172 \text{ gpd/ft}^2$$

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

$$S = 6.4 \times 10^{-8}$$

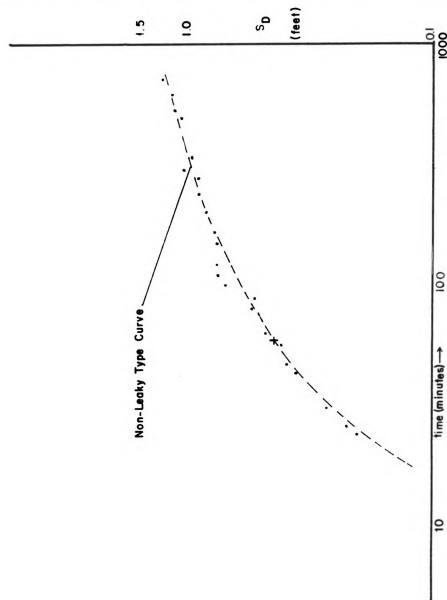


Figure 21. Logarithmic Plot of Drawdown Versus Time Observation Well B-2

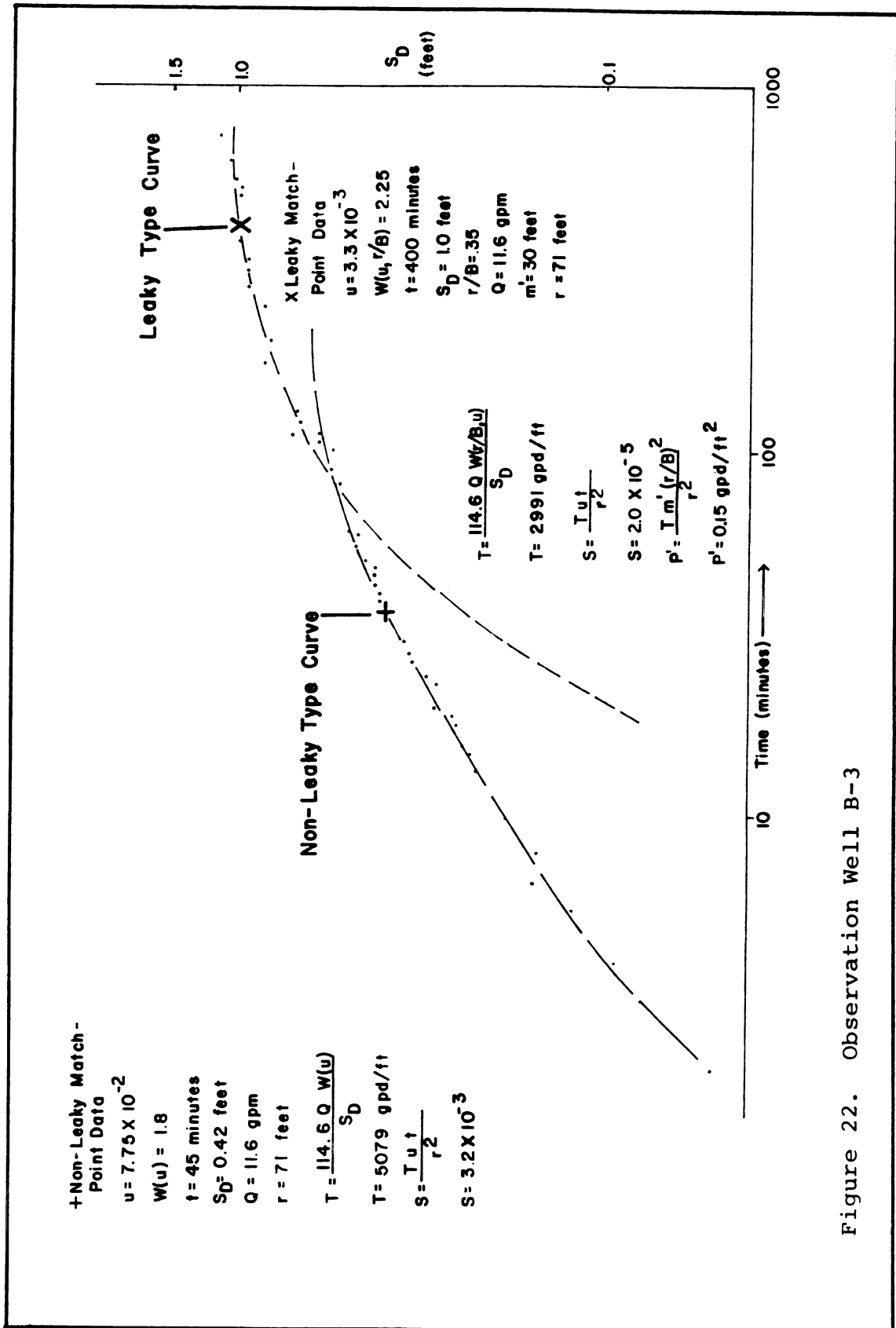


Figure 22. Observation Well B-3

calculated for well B-3 are 5079 gpd/ft ($63.5 \text{ m}^3/\text{d m}$) and 3.2×10^{-3} and are the highest values recorded for the aquifer. The vertical permeability, calculated from the response of piezometer B-3, is $.15 \text{ gpd/ft}^2$ ($7.1 \times 10^{-3} \text{ cm/sec}$) and is consistent with the values calculated from the response of observation well #37.

The shallow piezometers of observation well arrays B & C (Figure 23) show drawdown responses that do not follow any type curve configuration. The data does show, however, a delayed water level lowering probably caused by the decreasing piezometric pressure in the lower confined portion of the drift aquifer. This "aquitard response" pattern is characterized by three distinct phases of water level response. In phase 1, early in the test period, the water level is unresponsive to the drawdown which is acting on the aquifer beneath it. In the second phase, the water table response begins to deviate from the unresponsive portion, with irregularly rising and falling water levels that vary at equal magnitudes above and below the established water level. Finally, in the last phase, the water levels begin to decline at a relatively constant rate.

Significance:

The aquifer test data for the spray irrigation site shows that the glacial drift overlying the Saginaw Formation is not a homogeneous layer of unconsolidated material,

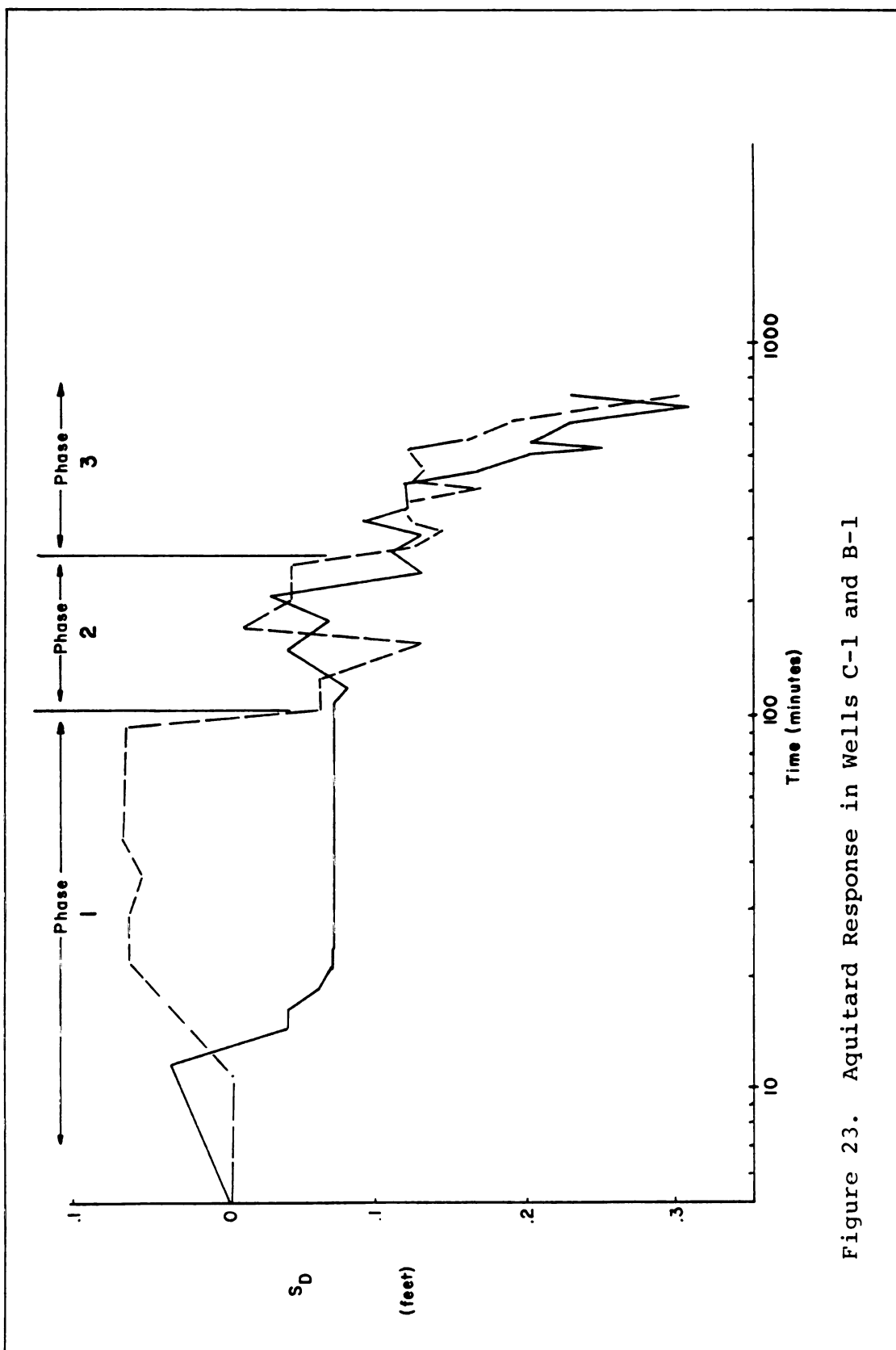


Figure 23. Aquitard Response in Wells C-1 and B-1

but rather, exhibits vertical and areal heterogeneous associations of clay till and relatively continuous gravel layers. From the test analysis it appears that the gravel layers in the drift vary only slightly in transmissivity, but do vary significantly in their hydraulic connection with the overlying aquitard material.

The aquifer tests also suggest that the transmissibility of the gravel in the drift lies within a moderate range of 3000 to 5000 gpd/ft ($37.5\text{--}62.5 \text{ m}^3/\text{d m}$) with little evidence to indicate any boundary effect due to the gravel pinching out. In addition, the test shows that the pumpage of the entire saturated drift thickness, which is most permeable near the base, produced responses throughout the entire saturated thickness of the drift. This would indicate that gravel units at different elevations are hydraulically interconnected and extend a relatively great distance. The drawdown analysis from the observation wells would also suggest that the hydraulic connection between the gravel units and clay units are not consistent and reflect indistinct boundary conditions (i.e. leaky to non-leaky).

The leaky type curve method of aquifer analysis also provides a means for the calculation of vertical permeabilities. The calculated values obtained from this method range from $0.12\text{--}0.15 \text{ gpd/ft}^2$ ($5.7 \times 10^{-3} - 7.1 \times 10^{-3} \text{ cm/sec}$) or roughly $3.8 \times 10^6 \text{ gpd/square mile}$ ($1.4 \times 10^3 \text{ m}^3/\text{d kilometer}$). These values are approximately 4

times higher than the 1.00×10^6 gpd/square mile value suggested by Firoosian (1963). The empirical method used by Firoosian to determine his vertical permeability values assumes a steady-state condition, where the vertical permeability rate is equated to the quantity of water leaving an area bounded by flow lines and piezometric contours. The method used in this investigation involves the analysis of the aquifer response curve.

The shifting from the fluctuating second phase to the constant declining drawdown of the third phase of the aquitard response curve shown in Figure 23 marks the point in time where the head difference between the water table and the aquifer potentiometric level generates enough pressure to induce a constant discharge through the aquitard. In observation well B-1, which monitors the water level in the aquitard, the shift occurs at the point in time when the drawdown levels in wells B-2 and B-3 show a recharge response (Figure 24). This situation indicates that the water table level in the aquitard has a hydraulic connection with the underlying gravel units. There is no indication, however, that the connection existed during the early phase of the aquifer test. The fact that no hydraulic connection existed prior to the test is recorded by the unresponsive period early in the test, which corresponds with a drawdown response in the deeper piezometer for the same time period. Therefore, a vertical connection between the water table aquitard and the deeper gravel

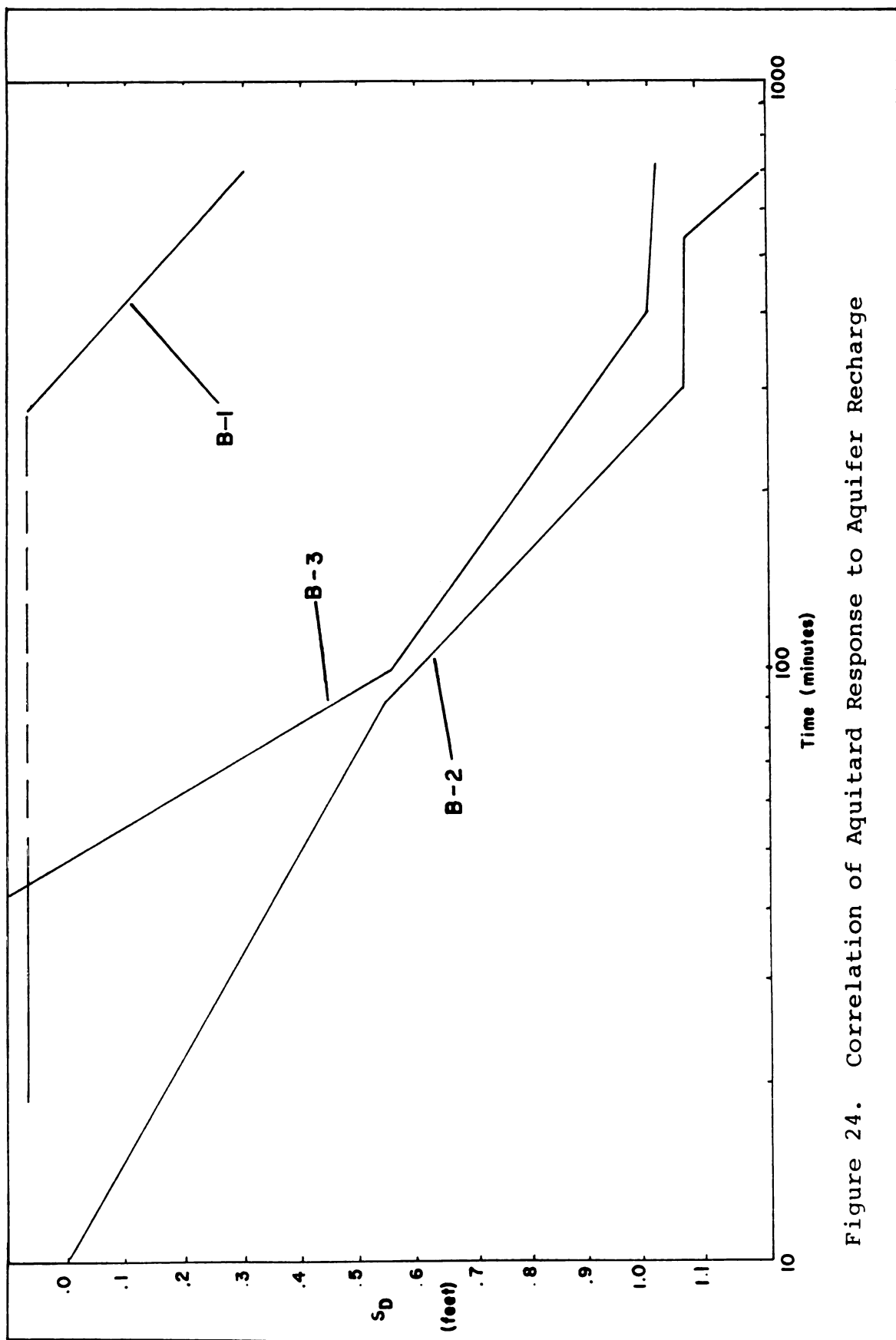


Figure 24. Correlation of Aquitard Response to Aquifer Recharge

units must have developed later during the aquifer test.

When a confined artesian aquifer responds to pumpage, it does so by compaction of the aquifer skeleton because of the release of the water pressure within it. The compaction results in a decrease in porosity within the aquifer as well as ground subsidence within the radius of influence (Ferris, 1962). In Figure 23 the "aquitard response" is probably the result of the subsidence due to pumpage. The initial phase of pumpage shows no response because the radius is small and the effect of subsidence is not yet felt at the piezometers. As the radius of influence expands to the point where it causes drawdown in the gravel, the subsidence may cause tension openings to develop within the aquitard material (Grisak et al., 1976). Initially, these openings provide an unstable hydraulic connection (represented by phase II) which later develop into defined avenues of recharge into the underlying gravel units. The development of the openings as recharge avenues into the aquifer is represented by the third phase of the aquitard response and the corresponding recharge effect in the underlying gravel units.

The analysis of the aquitard response has little practical importance in defining the hydrogeologic conditions of the site other than to account for the recharge effect in the late stages of aquifer test.

The recharge rate of the aquifer is related to the vertical permeability of the aquitard. The vertical

permeability values calculated from aquifer drawdown response are influenced, of course, by the condition of the aquitard. If the properties of the aquitard, however, are changed during pumpage, the vertical permeabilities obtained during those stages of the aquifer test have little value in an area that is not ordinarily subjected to pumpage.

The spray irrigation site is never subjected to the intensity of pumpage used during the aquifer test, and therefore, the resulting subsidence is not a natural occurring characteristic. The values obtained by the type curve method, therefore, are probably unreliable, except for calculating approximate potential vertical permeabilities.

Recharge Potential for the Spray Irrigation Site

The rate of recharge from the drift to the bedrock varies with drift and bedrock permeability, drift saturated thickness and the hydraulic head difference between drift and bedrock. The following equation shows the relationship of these variables to recharge rate (Walton, 1970).

$$\frac{Q}{A} = \frac{P'}{M'} \Delta h$$

where $\frac{Q}{A}$ = recharge rate, in gpd/sq. ft.

A' = coefficient of permeability of glacial deposits, in gpd/ft²

M' = saturated thickness of deposits, in feet

Δh = difference between the head in the aquifer and in source bed, above deposits through which leakage occurs, in feet.

From the above relationship, it can be seen that, for a constant areal permeability P' , the recharge rate is inversely proportional to the saturated drift thickness and directly proportional to the head difference. Within the WQMP site, the recharge potential for a given drift permeability increases from a minimum in the southern portion of the spray irrigation zone to a maximum in the northern portion near the lake research area. The maximum saturated drift thickness that exists near the southern boundary of the WQMP site grades into a condition of complete groundwater absence in parts of the drift near the northern boundary of the site. The increasing head difference (Δh) toward the northern boundary of the site is caused by drawdown due to pumpage in the M.S.U. production wells and results in an increased recharge potential toward the northern boundary.

The piezometric surface of the Saginaw Formation at spray irrigation plots #21 and #23 is at approximately 845 feet (258 meters) amsl, whereas the groundwater elevation in the drift is about 855 feet (261 meters) amsl. The head difference is 10 feet (3 meters) and the saturated thickness (M') is roughly 40 feet (12 meters) above the bedrock surface. Using permeability values for the "C" soil horizon, (parent soils), Walton's equation can be solved to obtain estimates of recharge. Since spray sites overlies soils of till parentage which have permeability values ranging from

.5 to 1 gpd/ft² (1.8×10^{-4} - 4.1×10^{-2} m³/d m²) (Zobeck, 1977), recharge into the bedrock aquifer, under these conditions, would range from .12 to .25 gallons per day per square foot (4.9×10^{-3} - 1.0×10^{-2} m³/d m²) or 13,500 to 27,000 gpd/hectare (51-102 m³/d/hectare).

The aquifer test data, however, indicates lower vertical permeabilities, which range from .12 - .15 gallons per day per square foot (4.9×10^{-3} - 1.6×10^{-3} m³/d m²) or 3375 - 4500 gpd/hectare (13-17 m³/d/hectare). The recharge rates obtained from the aquifer test data are low because they represent recharge through the clay till into the gravel layers, not into the bedrock. The recharge into the bedrock would also be facilitated by flow through the gravel layers. The recharge rate through the entire drift thickness, in the area of the spray irrigation site, would probably be greater than the aquifer test data suggests, but less than the soil hydraulic conductivity values would suggest.

Considering that an average of 134,000 gallons (509 m³) of wastewater (plus precipitation) is applied daily to a 5.4 hectares area, with little evidence of excessive runoff, it would seem reasonable to assume that the recharge rate would fall somewhere between the two sets of values. If evapotranspiration and runoff values for the spray irrigation site are about 14% and 19% respectively (Leland, 1977), the recharge rate for spray plots #21 and #23 would calculate

to be about 44,000 gallons per day ($167 \text{ m}^3/\text{d}$) or 8100 gallons per day per hectare ($31 \text{ m}^3/\text{d/hectare}$).

The recharge rate calculated from measured and empirical water budget data is approximately twice that calculated for the aquitard by the aquifer testing data. The gravel layers, within the less permeable drift material, must, therefore, account for the difference in recharge rates. The gravel aquifer characteristics, obtained from aquifer testing, substantiate this possibility. The average transmissivity of 4000 gpd per foot ($50 \text{ m}^3/\text{d m}$) of gravel aquifer thickness could easily transmit the volume of water needed to account for the difference in recharge rates.

It has been shown that the gravel layers have a direct effect on the recharge rates, within the aquifer test site of the spray irrigation zone. The gravel layers within the test site provide avenues of greater permeability that have a direct hydraulic connection with the bedrock aquifer.

The complexity of glacial deposition, within the WQMP, increases from the southeast to the northwest, which also implies an increase in the sand and gravel to till ratio. An increased sand and gravel content, within the drift, suggests increased permeability and, therefore, recharge potential.

If the recharge potential, due to permeability, increases from southeast to northwest and the recharge

potential, due to drift-bedrock aquifer head difference and drift saturated thickness, increases from south to north across the WQMP site, then the resultant recharge potential must increase from the south-southeast to the north-northwest.

Summary and Conclusions

The results of the investigation provide hydrogeologic information for the WQMP site in general, and more specific information regarding the hydrogeology of the spray irrigation site. The investigation shows that the WQMP is underlain by about 50-60 feet of glacial drift, which increases in lithologic complexity from the southeast to the northwest. Water table conditions, as well as artesian conditions exist within the drift. Shallow groundwater flow, in the upper part of the drift, generally follows surface drainage patterns, while flow in the lower part of the drift is toward a N-NE trending buried bedrock valley which underlies the center of the spray irrigation site. A groundwater divide diverts the groundwater flow into the buried valley, toward the south into Sycamore Creek and north toward the M.S.U. water supply wells.

The regional groundwater flow, within the Saginaw Formation in the vicinity of the WQMP, is in a north-northwest direction. Drawdown due to MSU pumpage, however, has altered the regional flow and has lowered the piezometric surface in both the bedrock and in parts of the drift. Also, the vertical groundwater flow in the drift, and that of the Saginaw Formation is one of widespread recharge with the groundwater pressure gradient decreasing with depth.

Lithologic log analysis indicates increased sand and gravel content, within the drift, from southeast to the northwest, which implies also a corresponding increase in vertical permeability. In addition, the effect of MSU water supply well drawdown on the drift saturated thickness and the water table - bedrock piezometric surface head difference, increases the recharge potential from the south to the north, toward the production wells. The overall hydraulic effect of the production wells, therefore, causes a general increase in recharge potential from the southeast to the northwest across the WQMP site.

The specific conclusions, as drawn from data obtained by aquifer testing at the spray irrigation site are as follows:

1. Gravel units within the glacial drift form a network which is of relatively large areal extent. (Greater than a 1000 foot radius)
2. The average transmissivity for the gravel units is approximately 4000 gpd/ft ($50 \text{ m}^3/\text{d m}$).
3. The vertical permeability for the clay units at the test site is calculated to be 0.12 gpd/ft² ($5.7 \times 10^{-3} \text{ cm/sec.}$).
4. The recharge rate calculated from observed spray application volumes is twice the 0.03 gpd/ft² calculated from the vertical permeability obtained for the clay units by aquifer testing.

5. The difference between the observed and calculated recharge rates at the spray site is attributed to infiltration along the gravel units.

Localized hydrogeologic features, such as irregular bedrock topography and glacial deposition complexity, make it exceedingly difficult to accept studies which treat soil to bedrock material as a homogeneous, isotropic medium. The suitability of the underlying material can make the difference between wastewater land application as a viable alternative or a costly mistake and, therefore, deserves much more consideration than in the past.

BIBLIOGRAPHY

Bibliography

- Chow, V. T., (ed). 1964. Handbook of Hydrology. New York: McGraw-Hill.
- Dreimanis, A., and Vagners, U. J. 1969. "Lithological Relation of Till to Bedrock." National Academy Science Publication 1701.
- Ferris, J. G.; Knowles, D. B; Brown, R. H; and Stollman, R. W. 1962. "Theory of Aquifer Tests." Water Supply Paper 1536-E, United States Geologic Survey.
- Fletcher, Paul. 1975. "Drift Well Survey." In-house Report, Department of Engineering, Michigan State University.
- Firouzian, Assadolah. 1963. "Hydrological Studies of the Saginaw Formation in the Lansing, Michigan Area. 1962 MS Thesis, Michigan State University, Dept. of Geology.
- Flint, Richard Foster. 1971. Glacial and Quaternary Geology. New York: John Wiley and Sons, Inc.
- Grisak, G. E.; Cherry, T. A.; Vonhot, J. A.; and Bluele, J. P. 1976. Hydrogeologic and Hydrochemical Properties of Fractured Till in the Interior Plains Region - Glacial Till. The Royal Society of Canada Special Publications, No. 12, Edited by Robert F. Legget.
- Hantush, M. S. 1967. Growth and Decay of Groundwater Mounds in Response to Uniform Percolation." Water Resources Res., Volume 3, No. 1.
- Institute of Water Research. 1971. "Wastewater Treatment Plant Engineering Report for Water Quality Management Facility." Addendum, Groundwater Surveillance Program, Michigan State University.
- Kelly, William A. 1936. "Pennsylvanian System of Michigan." Michigan Geological Survey, Publication 40, Geological Series 34.

- Johnson, Thomas L. 1977. Pumping Tests Provide Useful Data. The Johnson Driller's Journal, Johnson Division, Universal Oil Products Company.
- Leland, David Earl. 1977. "Winter Spray Irrigation with Secondary Municipal Effluent in South Central Michigan." Thesis, Michigan State University.
- Martin, H. M. 1958. "Outline of Geologic History of Ingham County, Michigan. Geological Survey, Michigan Department of Conservation.
- Mencenberg, Fred. 1963. "Groundwater Geology of the Saginaw Group in the Lansing, Michigan Area." Thesis, Michigan State University.
- U. S. Department of Commerce. 1976. "Climatological Data, Annual Summary." National Oceanic and Atmospheric Administration.
- Stuart, W. T. 1945. "Progress Report on the Groundwater Resources of the Lansing Area, Michigan." Michigan Department of Conservation, Geological Survey Division, Progress Report 13.
- Thornbury, William P. 1965. Regional Geomorphology of the U.S. Department of Geology, Indiana University. Wiley and Sons, Inc.
- Vanlier, K. E. and Wheeler, M. L. 1968. "Analog Simulation of Groundwater Development of the Saginaw Formation, Lansing Metropolitan Area, Michigan." Prepared by U.S.G.S. in cooperation with Tri-County Planning Commission and Michigan Geological Survey.
- Vanlier, K. E.; Wood, N. W.; and Brunett, J. O. 1973. Water-Supply Development and Management Alternatives for Clinton, Eaton, and Ingham County, Michigan. Water Supply Paper 1969, United States Geologic Survey.
- Van Til, Ronald. 1977. An Analysis of Hydrologic Simulation and Groundwater Withdrawal Patterns in Eastern Lansing, Michigan. Thesis, Michigan State University.
- Walton, W. C. 1970. Ground Resource Evaluation. New York: McGraw Hill Book Company.
- Walton, W. C. 1962. "Selected Analytical Methods for Well and Aquifer Evaluation." Illinois State Water Survey Bulletin 49.

Wheeler, M. L. 1967. "Electric Analog Mode Study of the Hydrology of the Saginaw Formation in the Lansing, Michigan Area." M.S. Thesis, Michigan State University.

Zobeck, Ted. 1976. The Characterization and Interpretation of a Complex Soil Landscape in South Central Michigan." M.S. Thesis, Michigan State University.

APPENDIX A

[illegible]

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

DA7d 100M (Rev. 12-68)

WELL OWNER COPY

□

--	--	--	--	--	--	--	--	--

AL 1248 PA 1248

PUBLIC HEALTH

END

100M (Rev. 12-68)

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE NO. WATER WELL RECORD
ACT 294 PA 1965MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		
County Ingham	Township Name Meridian	Fraction 31
Section Number 4		
Town Number 1		
Range Number 1		
Distance And Direction from Road Intersections Michigan State University		
Street address & City of Well Location Water Quality Management Facility		
Locate with "X" in section below X Sketch Map: D. W. #3		
4 WELL DEPTH (completed) Date of Completion 43 ft. 9-13-73		
5 ☒ Cable tool ☐ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☐ Bored ☐		
6 USE: ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring		
7 CASING: Threaded ☒ Welded ☐ Height: Above/Below Diam. 4 in. to 40 ft. Depth 11 lbs./ft. in. to 43 ft. Depth Drive Shoe? Yes ☒ No ☐		
8 SCREEN: Type: Stainless Dia.: 4" Slot/Groove 10 Length 3' Set between 40 ft. and 43 ft. Fittings: Standard		
9 STATIC WATER LEVEL no water - 62' in nearby well ft. below land surface		
10 PUMPING LEVEL below land surface ft. after 0 hrs. pumping 0 p.m. ft. after 0 hrs. pumping 0 p.m.		
11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____		
12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade		
13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ Depth: from 0 ft. to 21 ft.		
14 Nearest Source of possible contamination _____ feet _____ Direction _____ Type _____ Well disinfected upon completion ☐ Yes ☐ No		
15 PUMP: ☒ Not installed Manufacturer's Name _____ Model Number _____ HP _____ Volts _____ Length of Drop Pipe _____ ft. capacity _____ G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating		
16 Remarks, elevation, source of data, etc. 888.4		
17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co., Inc. 26 REGISTERED BUSINESS NAME REGISTRATION NO. Address 7215 W. M-59 Howell Signed <i>Keith L. Thompson</i> Date 10-9-73 AUTHORIZED REPRESENTATIVE		

D&W

100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

[illegible]

ACT 294 PA 1969

OF
PUBLIC HEALTH

D47d

100M (Rev. 12-68)

WELL OWNER COPY

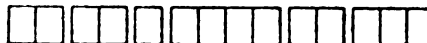
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

PLD

100M (Rev. 12-88)

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE No. WATER WELL RECORD
ACT 294 PA 1965MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL																																						
County Ingham	Township Name Alaiedon	Fraction $\frac{1}{4}$ $\frac{1}{2}$ $\frac{3}{4}$ 1																																				
Section Number 6		Range Number 1 E.W.																																				
Distance And Direction from Road Intersections Michigan State University																																						
Street address & City of Well Location Locate with "X" in section below Sketch Map: D.W. #6B D.W. #6-Abandon		3 OWNER OF WELL Water Quality Management Facility Address																																				
2 FORMATION <table border="1" style="width: 100%; border-collapse: collapse;"><thead><tr><th style="width: 60%;">FORMATION</th><th style="width: 20%;">THICKNESS OF STRATUM</th><th style="width: 20%;">DEPTH TO BOTTOM OF STRATUM</th></tr></thead><tbody><tr><td>Brown Clay & Gravel</td><td>10</td><td>10</td></tr><tr><td>Brown Clay & Gravel</td><td>10</td><td>20</td></tr><tr><td>Clay</td><td>17</td><td>37</td></tr><tr><td>Gray Gravel</td><td>3</td><td>40</td></tr><tr><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td></tr></tbody></table>		FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM	Brown Clay & Gravel	10	10	Brown Clay & Gravel	10	20	Clay	17	37	Gray Gravel	3	40																						4 WELL DEPTH: (completed) Date of Completion 40 ft. 9-13-73
		FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM																																		
		Brown Clay & Gravel	10	10																																		
		Brown Clay & Gravel	10	20																																		
		Clay	17	37																																		
Gray Gravel	3	40																																				
5 ☒ Cable tool ☐ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☐ Bored ☐ _____		6 USE: ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring																																				
7 CASING: Threaded ☒ Welded ☐ Height: Above/Below Surface _____ ft. Diam. _____ in. to _____ in. Depth _____ ft. Weight _____ lbs./ft. Drive Shoe? Yes ☒ No ☐		8 SCREEN: Type: Stainless Dia.: 4" Slot/Grit 10 Length 3' Set between 37 ft. and 40 ft. Fittings: Standard																																				
9 STATIC WATER LEVEL no water _____ ft. below land surface		10 PUMPING LEVEL below land surface _____ ft. after _____ hrs. pumping _____ g.p.m. _____ ft. after _____ hrs. pumping _____ g.p.m.																																				
11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____		12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade																																				
13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ _____ Depth: From 0 ft. to 21 ft.		14 Nearest Source of possible contamination _____ feet _____ Direction _____ Type _____ Well disinfected upon completion ☐ Yes ☐ No																																				
15 PUMP: ☒ Not installed Manufacturer's Name _____ Model Number _____ HP _____ Volts _____ Length of Drop Pipe _____ ft. capacity _____ G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating		16 Remarks, elevation, source of data, etc. 863.4																																				
17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co., Inc. 26 REGISTERED BUSINESS NAME REGISTRATION NO. Address 7215 W. M-59 Howell Signed <i>Kurt L. Thompson</i> Date 10-9-73 AUTHORIZED REPRESENTATIVE																																						

D67d

100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

11

[illegible]

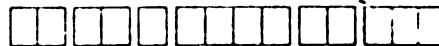
61 294 PA 1965

PUBLIC HEALTH

D474

100M (Rev. 12-68)

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE No. WATER WELL RECORD
ACT 294 PA 1965MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		
County Ingham	Township Name Alaiedon	Fraction 6 3 1
Distance And Direction from Road Intersections Michigan State University		
Street Address & City of Well Location Locate with "X" in section below		
Sketch Map D. W. #8 1 MILE		
3 OWNER OF WELL Water Quality Management Facility		
4 WELL DEPTH (Completed) Date of Completion 39 ft. 9-11-73		
5 ☒ Casing ☐ Rotary ☐ Driven ☐ Jetted ☐ Hollow Rod ☐ Jetted ☐ Bored		
6 USE: ☐ Domestic ☐ Public Supply ☐ Industrial ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring		
7 CASING: Threaded ☒ Welded ☐ Height: Above/Below Surface Diam. 4 in. to 39 ft. Depth Weight 11 lbs./ft. Drive Shoe? Yes ☒ No ☐		
8 SCREEN: Type: Stainless Dia.: 4" Slot: XX 10 Length 3' Set between 36 ft. and 39 ft. Fittings: Standard		
9 STATIC WATER LEVEL no water ft. below land surface		
10 PUMPING LEVEL below land surface ft. after ___ hrs. pumping ___ g.p.m. ft. after ___ hrs. pumping ___ g.p.m.		
11 WATER QUALITY in Parts Per Million: Iron (Fe) ___ Chlorides (Cl) ___ Hardness ___ Other ___		
12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pigless Adapter ☒ 12" Above Grade		
13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ ___ Depth: From 0 ft. to 21 ft.		
14 Nearest Source of possible contamination ___ feet ___ Direction ___ Type ___ Well disinfected upon completion ☐ Yes ☐ No		
15 PUMP: ☒ Not installed Manufacturer's Name ___ Model Number ___ HP ___ Volts ___ Length of Drop Pipe ___ ft. capacity ___ G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating		
16 Remarks, elevation, source of data, etc. 887.5		
17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co., Inc. 26 REGISTERED BUSINESS NAME REGISTRATION NO. Address 7215 W. M-59 Howell Signed <i>Kenneth L. Thayer</i> Date 10-9-73 AUTHORIZED REPRESENTATIVE		

D67d

100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE NO.

--	--	--	--	--	--	--	--	--	--

WATER WELL RECORD

ACT 294 PA 1965

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		
County Ingham	Township Alaiedon	Range 6 Township 3 Range 1
Distance And Direction from Road Intersections Michigan State University		
Street Address & City of Well Location Locate with "X" in Section below Sketch Map D. W. #9		
3 Label of Well Water Quality Management Facility		
4 WELL D.P.M. Date of Completion 37 ft. 9-11-73		
5 ☒ Cable tool ☐ Rotary ☐ Driven ☐ Jet ☐ Hollow rod ☐ Jetted ☐ Bored ☐ Other		
6 USE ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring		
7 CASING Threaded ☒ Welded ☐ Height Above/Below Surface 4 in. to 33 ft. Depth Weight 11 lbs. ft. in. to ft. Depth Drive Shoe? Yes ☒ No ☐		
8 SCREEN Type: Stainless Dia.: 4" Slot: XX 10 Length: 3' Set between 33 ft. and 36 ft. Fittings: Standard		
9 STATIC WATER LEVEL no water _____ ft. below land surface		
10 PUMPING LEVEL below land surface _____ ft. after _____ hrs. pumping _____ G.P.M. _____ ft. after _____ hrs. pumping _____ G.P.M.		
11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____		
12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade		
13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ Other Depth: From 0 ft. to 21 ft.		
14 Nearest Source of possible contamination _____ feet Direction _____ Type _____ Well disinfected upon completion ☐ Yes ☐ No		
15 PUMP: ☒ Not installed Manufacturer's Name _____ Model Number _____ HP _____ Volts _____ Length of Drop Pipe _____ ft. capacity _____ G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating		
16 Remarks, elevation, source of data, etc. 890.5		
17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co., Inc. 26 REGISTERED BUSINESS NAME REGISTRATION NO. Address 7215 W. M-59 Howell Signed <i>Keith L. Thompson</i> Date 10-9-73 AUTHORIZED REPRESENTATIVE		

D67d

100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

NOV 07 1973

WATER WELL RECORD

ACT 294 PA 1965

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		COUNTY		TOWNSHIP NAME		FRACTION		SECTION NUMBER		TOWN NUMBER		RANGE NUMBER	
Ingham		Alaiedon						6		3 N/2		1 W/4	
2 DISTANCE AND DIRECTION FROM ROAD INTERSECTIONS													
Michigan State University													
3 OWNER OF WELL: Water Quality Management Facility													
4 WELL DEPTH: (completed) Date of Completion													
36 ft. 9-11-73													
5 ☒ Cable tool ☐ Rotary ☐ Driven ☐ Dug													
☐ Hollow rod ☐ Jetted ☐ Bored ☐													
6 USE: ☐ Domestic ☐ Public Supply ☐ Industry													
☐ Irrigation ☐ Air Conditioning ☐ Commercial													
☐ Test Well ☒ Monitoring													
7 CASING: Threaded ☒ Welded ☐ Height: Above/Below													
Diam. _____ Surface _____ ft.													
_____ in. to 33 ft. Depth _____ Weight 11 lbs./ft.													
_____ in. to _____ ft. Depth _____ Drive Shoe? Yes ☒ No ☐													
8 SCREEN:													
Type: Stainless Dia.: 4"													
Slot/Grit _____ 10 Length 3'													
Set between 33 ft. and 36 ft.													
Fittings: Standard													
9 STATIC WATER LEVEL no water													
_____ ft. below land surface													
10 PUMPING LEVEL below land surface													
_____ ft. after _____ hrs. pumping _____ g.p.m.													
_____ ft. after _____ hrs. pumping _____ g.p.m.													
11 WATER QUALITY in Parts Per Million:													
Iron (Fe) _____ Chlorides (Cl) _____													
Hardness _____ Other _____													
12 WELL HEAD COMPLETION: ☐ In Approved Pit													
☐ Pitless Adapter ☐ 12" Above Grade													
13 Well Grouted? ☒ Yes ☐ No													
☒ Neat Cement ☐ Bentonite ☐													
Depth: From 0 ft. to 21 ft.													
14 Nearest Source of possible contamination													
_____ feet _____ Direction _____ Type _____													
Well disinfected upon completion ☐ Yes ☐ No													
15 PUMP: ☒ Not installed													
Manufacturer's Name _____													
Model Number _____ HP _____ Volts _____													
Length of Drop Pipe _____ ft. capacity _____ G.P.M.													
Type: ☐ Submersible													
☐ Jet ☐ Reciprocating													
16 REMARKS, ELEVATION, SOURCE OF DATA, ETC.													
17 WATER WELL CONTRACTOR'S CERTIFICATION:													
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.													
Brown Drilling Co., Inc. 26													
REGISTERED BUSINESS NAME REGISTRATION NO.													
Address 7215 W. M-59 Howell													
Signed _____ Date 10-9-73													

2479 100M (7-12-69)

GEOLOGICAL SURVEY COPY

GEOLOGICAL SURVEY SAMPLE No. WATER WELL RECORD
ACT 254 PA 1965MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL County: <u>Ingham</u> Township: <u>Alaledon</u> Range: <u>3 N</u> Meridian: <u>1 W</u> Distance and Direction from Road Intersections: <u>Michigan State University</u> Street address & City of Well Location: Locate with "X" in Section Below X Sketch Map <u>D. W. #11</u>			3 Name of Well <u>Water Quality Management Facility</u> Address: _____ _____ _____																																																		
2 FORMATION <table border="1" style="width: 100%; border-collapse: collapse;"><thead><tr><th style="width: 40%;">FORMATION</th><th style="width: 10%;">THICKNESS OF STRATUM</th><th style="width: 10%;">DEPTH TO BOTTOM OF STRATUM</th></tr></thead><tbody><tr><td><u>Brown Clay</u></td><td><u>14</u></td><td><u>14</u></td></tr><tr><td><u>Sand</u></td><td><u>6</u></td><td><u>20</u></td></tr><tr><td><u>Red Sand</u></td><td><u>5</u></td><td><u>25</u></td></tr><tr><td><u>Gray Sand</u></td><td><u>5</u></td><td><u>30</u></td></tr><tr><td><u>Gray Sand some Clay</u></td><td><u>5</u></td><td><u>35</u></td></tr><tr><td><u>Gray Sand some clay</u></td><td><u>1</u></td><td><u>36</u></td></tr><tr><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td></tr></tbody></table>			FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM	<u>Brown Clay</u>	<u>14</u>	<u>14</u>	<u>Sand</u>	<u>6</u>	<u>20</u>	<u>Red Sand</u>	<u>5</u>	<u>25</u>	<u>Gray Sand</u>	<u>5</u>	<u>30</u>	<u>Gray Sand some Clay</u>	<u>5</u>	<u>35</u>	<u>Gray Sand some clay</u>	<u>1</u>	<u>36</u>																												4 WELL DEPTH Completed: <u>36</u> ft. Date of Completion: <u>9-11-73</u> 5 ☒ Cased ☐ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☐ Bored 6 USE ☐ Domestic ☐ Public Supply ☐ Industrial ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring 7 CASING Threaded ☒ Welded ☐ Height: Above _____ Below _____ Diam. _____ Surface _____ ft. _____ Weight _____ lbs. _____ ft. _____ Drive Shoe? Yes ☒ No ☐ 8 SCREEN: Type <u>Stainless</u> Dia: <u>4"</u> Slot: <u>10</u> Length: <u>3'</u> Set between <u>33</u> ft. and <u>36</u> ft. Fittings: <u>Standard</u> 9 STATIC WATER LEVEL <u>no water</u> _____ ft. below land surface 10 PUMPING LEVEL below land surface _____ ft. after _____ hrs. pumping _____ g.p.m. _____ ft. after _____ hrs. pumping _____ g.p.m. 11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____ 12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade 13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ _____ Depth: From <u>0</u> ft. to <u>2</u> ft. 14 Nearest Source of possible contamination _____ feet _____ Direction _____ Type _____ Well disinfected upon completion ☐ Yes ☐ No 15 PUMP: ☒ Not installed Manufacturer's Name _____ Model Number _____ HP _____ Volts _____ Length of Drop Pipe _____ ft. capacity _____ G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating USE A 2ND SHEET IF NEEDED		
FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM																																																			
<u>Brown Clay</u>	<u>14</u>	<u>14</u>																																																			
<u>Sand</u>	<u>6</u>	<u>20</u>																																																			
<u>Red Sand</u>	<u>5</u>	<u>25</u>																																																			
<u>Gray Sand</u>	<u>5</u>	<u>30</u>																																																			
<u>Gray Sand some Clay</u>	<u>5</u>	<u>35</u>																																																			
<u>Gray Sand some clay</u>	<u>1</u>	<u>36</u>																																																			
16 Remarks, elevation, source of data, etc. <u>881.5</u>			17 WATER WELL CONTRACTOR'S CERTIFICATION This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. <u>Brown Drilling Co., Inc.</u> <u>26</u> REGISTERED BUSINESS NAME _____ REGISTRATION NO. _____ Address: <u>7215 W. F-59</u> <u>Howell</u> Signed: <u>[Signature]</u> Date <u>10-9-73</u> AUTHORIZED REPRESENTATIVE																																																		

D67d

100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE No. WATER WELL RECORD
ACT 294 PA 1965MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		
County Ingham	Township Name Alaiedon	Fraction 6 3 N 1 E
Distance And Direction from Road Intersections: Michigan State University		
Street address & City of Well Location Locate with "X" in fraction below X Sketch Map: D. W. #12		
2 FORMATION		
Brown Sand	THICKNESS OF STRATUM 15	DEPTH TO BOTTOM OF STRATUM 15
Brown Sand	20	35
Gray Clay	1	36
3 CATCH OF WELL Water Quality Management Facility		
4 WELL DEPTH Completed: 36 ft. Date of Completion: 9-12-73		
5 ☒ Cable tool ☐ Rotary ☐ Driven ☐ Dig ☐ Hollow rod ☐ Jetted ☐ Bored ☐		
6 USE: ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring		
7 CASING: Threaded ☒ Welded ☐ Height: Above/Below Surface 11 ft. Diam. 4 in. to 39 ft. Depth 11 lbs./ft. Drive Shoe? Yes ☒ No ☐		
8 SCREEN: Type: Stainless Dia.: 4" Slot/Grit: 10 Length: 3' Set between 33 ft. and 36 ft. Fittings: Standard		
9 STATIC WATER LEVEL No water _____ ft. below land surface		
10 PUMPING LEVEL below land surface _____ ft. after _____ hrs. pumping _____ g.p.m. _____ ft. after _____ hrs. pumping _____ g.p.m.		
11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____		
12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade		
13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ Depth: From 0 ft. to 21 ft.		
14 Nearest Source of possible contamination _____ feet _____ Direction _____ Type _____ Well disinfected upon completion ☐ Yes ☐ No		
15 PUMP: ☒ Not installed Manufacturer's Name _____ Model Number _____ HP _____ Volts _____ Length of Drop Pipe _____ ft. capacity _____ G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating		
16 Remarks, elevation, source of data, etc. 883.1		
17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co., Inc. 26 REGISTERED BUSINESS NAME REGISTRATION NO. Address 7215 W. M-59 Howell Signed <i>K. L. Thompson</i> Date 10-9-73 AUTHORIZED REPRESENTATIVE		

D67d

100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE No. 

WATER WELL RECORD

ACT 204 PA 1964

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		
County Ingham	Township Name Alaiedon	Range 2 Twp. 1 N.W.
Distance And Direction from Nearest Intersections Michigan State University		
Street address & City of Well Location Locate with 1/4" in section below D. W. #13		
3 Location of Well Water Quality Management Facility		
4 WELL DPTH Completion 9-12-73		
5 ☒ Cable Tool ☐ Rotary ☐ Driven ☐ Log ☐ Jetting ☐ Jetted ☐ Bored ☐		
6 USE ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring		
7 CASING Threaded ☒ Welded ☐ Height Above Below Ground ☐ Surface 11 ft. 4 in. to 29 ft. Depth 11 ft. Depth in. to ft. Depth Drive Shoe? Yes ☒ No ☐		
8 SCREEN Type Stainless Dia. 4" Slot XXe 10 Length 3' Set between 29 ft. and 32 ft. Fittings: Standard		
9 STATIC WATER LEVEL no water ft. below land surface		
10 PUMPING LEVEL below land surface ft. after hrs. pumping G.P.M. ft. after hrs. pumping G.P.M.		
11 WATER QUALITY in Parts Per Million: Iron (Fe) Chlorides (Cl) Hardness Other		
12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade		
13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ Depth From 0 ft. to 2' ft.		
14 Nearest Source of possible contamination ft. Direction Type Well disinfected upon completion ☐ Yes ☐ No		
15 PUMP: ☒ Not installed Manufacturer's Name Model Number HP Volts Length of Drop Pipe ft. capacity G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating		
16 Remarks, elevation, source of data, etc. 850.5		
17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co., Inc. 26 REGISTERED BUSINESS NAME REGISTRATION NO. Address 7215 W. N-59 Howell Signed <i>[Signature]</i> Date 10-9-73 AUTHORIZED REPRESENTATIVE		

D67d

100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE NO.

WATER WELL RECORD

ACT 244 PA 1105

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

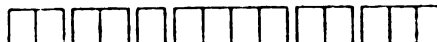
1 LOCATION OF WELL			County: <u>Ingham</u> Township: <u>Alaiedon</u>	
Distance and Direction from Road Intersections			Address: <u>Michigan State University</u>	
Street Address & City of Well Location Indicate with "X" in section below			Section Map: <u>D. W. #14</u>	
			Water Quality Management Facility 4 WELL DEPTH: <u>35</u> ft. Date of Completion: <u>9-12-73</u> 5 ☐ Solid Rod ☐ Relay ☐ Driven ☐ Drilled ☐ Hollow Rod ☐ Jetted ☐ Bored 6 USE: ☐ Domestic ☐ Public Supply ☐ Industrial ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring 7 CASING: ☒ Encased ☐ Wellhead ☐ Height Above Ground Depth: <u>4</u> in. to <u>32</u> ft. Depth Weight: <u>21</u> lbs. ft. in. to <u> </u> ft. Depth Drive Shaft: Yes ☒ No ☐	
2	FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM	
	Clay	20	20	
	Clay	7	27	
	Clay	7 1/2	34 1/2	
	Sand Gravel		34 1/2	
			8 SCREEN: Type <u>Stainless</u> Dia. <u>4"</u> Slot <u>10</u> Length <u>3'</u> Set between <u>32</u> ft. and <u>35</u> ft. Fittings: <u>Standard</u>	
			9 STATIC WATER LEVEL <u>no water</u> ft. below land surface	
			10 PUMPING LEVEL below land surface ft. after <u> </u> hrs. pumping <u> </u> g.p.m. ft. after <u> </u> hrs. pumping <u> </u> g.p.m.	
			11 WATER QUALITY in Parts Per Million: Iron (Fe) <u> </u> Chlorides (Cl) <u> </u> Hardness <u> </u> Other <u> </u>	
			12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade	
			13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ Depth From <u>5</u> ft. to <u>21</u> ft.	
			14 Nearest Source of possible contamination: <u> </u> feet <u> </u> Direction <u> </u> Type <u> </u> Well disinfected upon completion ☐ Yes ☐ No	
			15 PUMP: ☒ Not installed Manufacturer's Name <u> </u> Model Number <u> </u> HP <u> </u> Volts <u> </u> Length of Drop Pipe <u> </u> ft. capacity <u> </u> G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating	
16 Remarks, elevation, source of data, etc. <u>860.9</u>			17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. <u>Brown Drilling Co., Inc.</u> <u>26</u> REGISTERED BUSINESS NAME REGISTRATION NO. Address: <u>7215 N. W-59</u> <u>Howell</u> Signed <u>Kurt L. Thompson</u> Date <u>10-9-73</u> AUTHORIZED REPRESENTATIVE	

D67d

100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE NO. WATER WELL RECORD
ACT 294 PA 1965MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		
County Ingham	Township Name Alaledon	Range Township 6 N. 3 W. 1 E.
Distance And Direction from Road Intersections Michigan State University		
Street address & City of Well Location Locate with "X" in section below X Sketch Map: D. W. #15		
2 FORMATION		
Clay	THICKNESS OF STRATUM 10	DEPTH TO BOTTOM OF STRATUM 10
Sandy Clay	15	25
Sand & Gravel	7	32
Sand Rock		32
3 OWNER OF WELL		
Water Quality Management Facility Address _____		
4 WELL DEPTH: (complete) Date of Completion 32 ft. 9-12-73		
5 ☒ Cable tool ☐ Rotary ☐ Driven ☐ Dig ☐ Hollow rod ☐ Jetted ☐ Bored ☐ _____		
6 USE: ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring		
7 CASING: Threaded ☒ Welded ☐ Height: Above/Below Diam. _____ Surface 11 ft. 4 in. to 29 ft. Depth Weight 11 lbs./ft. _____ in. to _____ ft. Depth Drive Shoe? Yes ☒ No ☐		
8 SCREEN:		
Type: Stainless Dia.: 4"		
Slot/Screen 10 Length 3'		
Set between 29 ft. and 32 ft.		
Fittings: Standard		
9 STATIC WATER LEVEL 25' _____ ft. below land surface		
10 PUMPING LEVEL below land surface _____ ft. after _____ hrs. pumping _____ g.p.m. _____ ft. after _____ hrs. pumping _____ g.p.m.		
11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____		
12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☐ 12" Above Grade		
13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ _____ Depth: From 0 ft. to 21 ft.		
14 Nearest Source of possible contamination _____ feet _____ Direction _____ Type _____ Well disinfected upon completion ☐ Yes ☐ No		
15 PUMP: ☒ Not installed Manufacturer's Name _____ Model Number _____ HP _____ Volts _____ Length of Drop Pipe _____ ft. capacity _____ G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating		
16 Remarks, elevation, source of data, etc. 861.3 Depth to bedrock 32' Elevation 861.3		
17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co., Inc. 26 REGISTERED BUSINESS NAME REGISTRATION NO. Address 7215 W. Y-59 Howell Signed <i>Kim L. Thompson</i> Date 10-9-73 AUTHORIZED REPRESENTATIVE		

D67d

100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE NO. WATER WELL RECORD
ACT 294 PA 1965MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		
County Ingham	Township Name Alaledon	Range Number 6 Township 3 N Section 1
Distance and Direction from Road Intersections Michigan State University		
Street address & City of Well Location Locate with "X" in section below Sketch Map: X D. W. #16		
3 OWNER OF WELL Water Quality Management Facility Address		
4 WELL DEPTH Completed Date of Completion 45 ft. 9-11-73		
5 ☒ Cable tool ☐ Rotary ☐ Driven ☐ Dig ☐ Hollow tool ☐ Jetted ☐ Bored ☐ Other		
6 USE ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring		
7 CASING Threaded ☒ Welded ☐ Height: Above/Below Diam. Surface _____ ft. 4 in. to 42 ft. Depth Weight 11 lbs./ft. _____ in. to _____ ft. Depth Drive Shank? Yes ☒ No ☐		
8 SCREEN: Type Stainless Dia. 4" Slot/Grit 10 Length 3' Set between 42 ft. and 45 ft. Fittings: Standard		
9 STATIC WATER LEVEL no water _____ ft. below land surface		
10 PUMPING LEVEL below land surface _____ ft. after _____ hrs. pumping _____ g.p.m. _____ ft. after _____ hrs. pumping _____ g.p.m.		
11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____		
12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade		
13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite _____ Depth: From 0 ft. to 21 ft.		
14 Nearest Source of possible contamination _____ feet Direction _____ Type _____ Well disinfected upon completion ☐ Yes ☐ No		
15 PUMP: ☒ Not installed Manufacturer's Name _____ Model Number _____ HP _____ Volts _____ Length of Drop Pipe _____ ft. capacity _____ G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating		
16 Remarks, elevation, source of data, etc. 878.7		
17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co., Inc. 26 REGISTERED BUSINESS NAME REGISTRATION NO. Address 7015 W. W-59 Howell Signed <i>Kurt L. Thompson</i> Date 10-9-73 AUTHORIZED REPRESENTATIVE		

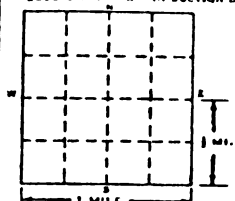
D67d

100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

WATER WELL RECORD
ACT 294 PA 1965MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL			3 OWNER OF WELL		
County	Township Name	Fraction	Well Number	Range Number	Section Number
Ingham	Alaledon		6	3 N.E.	1 E.W.
Distance And Direction from Road Intersections Michigan State University			Address Water Quality Management Facility		
Street address & City of Well Location Locate with "X" in section below  Sketch Map: D.W. #17			4 WELL DEPTH: (Completed) Date of Completion 47 ft. 9-12-73		
2 FORMATION			5 ☒ Cable tool ☐ Rotary ☐ Driven ☐ Dug		
			☐ Hollow rod ☐ Jetted ☐ Bored		
FORMATION			6 USE ☐ Domestic ☐ Public Supply ☐ Industry		
			☐ Irrigation ☐ Air Conditioning ☐ Commercial		
THICKNESS OF STRATUM			☐ Test Well ☒ Monitoring		
			7 CASING: Threaded ☒ Welded ☐ Height: Above/Below Surface 11 ft.		
DEPTH TO BOTTOM OF STRATUM			8 SCREEN: Type: Stainless Dia.: 4"		
			Slot/Size 10 Length 3'		
Sandy Clay			Set between 44 ft. and 47 ft.		
Sand-Gravel-Clay			Fittings: Standard		
Sand & Gravel			9 STATIC WATER LEVEL no water		
			10 PUMPING LEVEL below land surface		
			ft. after ___ hrs. pumping ___ a.p.m.		
			ft. after ___ hrs. pumping ___ a.p.m.		
			11 WATER QUALITY in Parts Per Million:		
			Iron (Fe) ___ Chlorides (Cl) ___		
			Hardness ___ Other ___		
			12 WELL HEAD COMPLETION: ☐ In Approved Pit		
			☐ Pitless Adapter ☒ 12" Above Grade		
			13 Well Grouted? ☒ Yes ☐ No		
			☒ Neat Cement ☐ Bentonite ☐ ___		
			Depth: From 0 ft. to 21 ft.		
			14 Nearest Source of possible contamination		
			___ feet ___ Direction ___ Type		
			Well disinfected upon completion ☐ Yes ☐ No		
			15 PUMP: ☒ Not installed		
			Manufacturer's Name ___		
			Model Number ___ HP ___ Volts ___		
			Length of Drop Pipe ___ ft. capacity ___ G.P.M.		
			Type: ☐ Submersible ☐ Jet ☐ Reciprocating		
16 Remarks, elevation, source of data, etc.			17 WATER WELL CONTRACTOR'S CERTIFICATION:		
			This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.		
			Brown Drilling Co., Inc. 26		
			REGISTERED BUSINESS NAME REGISTRATION NO.		
			Address 7215 W. M-59 Howell		
			Signed <i>Kurt L. Thayer</i> Date 10-10-73		
			AUTHORIZED REPRESENTATIVE		

IMPORTANT: File with deed.

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE No. 

WATER WELL RECORD

ACT 294 PA 1965

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		
County Ingham	Township Name Alaiedon	Fraction Sec. 1 to 36 Range 1 to 36 3 N. 1/2 1 P.W.
Distance and Direction from Road Intersections Michigan State University		
Street address & City of Well Location Locate with "X" in section below X Sketch Map D. W. #18		
3 OWNER OF WELL Water Quality Management Facility Address _____		
4 WELL DEPTH (completed) Date of Completion 40 ft. 9-11-73		
5 ☒ Cable tool ☐ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☐ Bored ☐ _____		
6 USE ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring		
7 CASING: Threaded ☒ Welded ☐ Height: Above/Below Diam. _____ Surface _____ ft. 4 in. to 32 ft. Depth Weight 11 lbs./ft. _____ in. to _____ ft. Depth Drive Shoe? Yes ☒ No ☐		
2 FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Brown Clay	12	12
Grey Clay	8	20
Clay	15 1/2	35 1/2
Sand & Gravel	4 1/2	40
Clay		+40
8 SCREEN. Type: Stainless Dia.: 4" Slot/Grit: 10 Length 3' Set between 37 ft. and 40 ft. Fittings: Standard		
9 STATIC WATER LEVEL no water _____ ft. below land surface		
10 PUMPING LEVEL below land surface _____ ft. after _____ hrs. pumping _____ g.p.m. _____ ft. after _____ hrs. pumping _____ g.p.m.		
11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____		
12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade		
13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ _____ Depth: From 0 ft. to 21 ft.		
14 Nearest Source of possible contamination _____ feet _____ Direction _____ Type _____ Well disinfected upon completion ☐ Yes ☐ No		
15 PUMP. ☒ Not installed Manufacturer's Name _____ Model Number _____ HP _____ Volts _____ Length of Drop Pipe _____ ft. capacity _____ G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating		
16 Remarks, elevation, source of data, etc. 882.5		
17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co., Inc. 26 REGISTERED BUSINESS NAME REGISTRATION NO. Address 7215 W. M-59 Howell Signed <i>Kenneth L. Thompson</i> Date 10-10-73 AUTHORIZED REPRESENTATIVE		

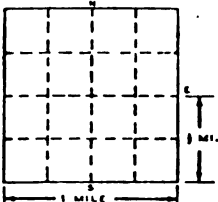
D67d

100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE NO. WATER WELL RECORD
ACT 294 PA 1965MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL					
County Ingham	Township Name Alaledon	Fraction	Section Number 6	Range Number 3	Twp. Number 14
Distance And Direction from Road Intersections Michigan State University			3. LOCATION OF WELL Water Quality Management Facility Address		
Street Address & City of Well Location Locate with "X" in section below  D. W. #19			4. WELL DEPTH (Completed) Date of Completion 49 ft. 9-12-73		
			5. ☒ Cable tool ☐ Rotary ☐ Driven ☐ Dig ☐ Hollow rod ☐ Jetted ☐ Bored ☐		
			6. USE ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring		
			7. CASING: Threaded ☒ Welded ☐ Height Above/Below Diam. Surface 4 in. to 46 ft. Depth Weight 11 lbs./ft. in. to ft. Depth Drive Shoe? Yes ☒ No ☐		
			8. SCREEN: Type: Stainless Dia.: 4" Slot/Groove 10 Length 3' Set between 46 ft. and 49 ft. Fittings: Stainless		
2. FORMATION			9. STATIC WATER LEVEL no water ft. below land surface		
Brown Sand	10	10	10. PUMPING LEVEL below land surface ft. after hrs. pumping g.p.m.		
Gray Clay	10	20	ft. after hrs. pumping g.p.m.		
Gray Clay & Gravel	26	46	11. WATER QUALITY in Parts Per Million: Iron (Fe) Chlorides (Cl) Hardness Other		
Gray Gravel	3	49	12. WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☐ 12" Above Grade		
			13. Well Grouted: ☒ Yes ☐ No 13 bags ☒ Neat Cement ☐ Bentonite Depth: From 0 ft. to 21 ft.		
			14. Nearest Source of possible contamination feet Direction Type Well disinfected upon completion ☐ Yes ☐ No		
			15. PUMP: ☒ Not installed Manufacturer's Name Model Number HP Volts Length of Drop Pipe ft. capacity G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating		
16. Remarks; elevation, source of data, etc. 863.0			17. WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co., Inc. 26 REGISTERED BUSINESS NAME REGISTRATION NO. Address 7215 W. M-59 Howell Signed <i>[Signature]</i> Date 10-10-73 AUTHORIZED REPRESENTATIVE		

D47d

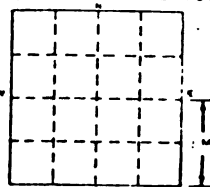
100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

WATER WELL RECORD ACT 294 PA 1965

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

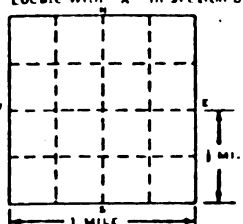
1 LOCATION OF WELL		
County Ingham	Township Name Alaledon	Range 6
Distance And Direction from Road Intersections		Range North 3 N
Michigan State University Street Address & City of Well Location Locate with "X" in section below  Sketch Map: D. W. #20		Water Quality Management Facility Address 4 WELL DEPTH (feet) 59 Date of Completion 9-21-73 5 ☒ Cable tool ☐ Rotary ☐ Driven ☐ Aug ☐ Hollow rod ☐ Jetted ☐ Bored ☐ 6 USE: ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring 7 CASING: Threaded ☒ Welded ☐ Height: Above/Below Diam. 4 in. to 59 ft. Depth 11 lbs./ft. Drive Shoe? Yes ☒ No ☐ 8 SCREEN: Type: Stainless Dia.: 4" Slot/Cage 10 Length 3' Set between 56 ft. and 59 ft. Fittings: Standard 9 STATIC WATER LEVEL 43 ft. below land surface little water 10 PUMPING LEVEL below land surface _____ ft. after _____ hrs. pumping _____ g.p.m. _____ ft. after _____ hrs. pumping _____ g.p.m. 11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____ 12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade 13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ Depth: From 0 ft. to 21 ft. 14 Nearest Source of possible contamination _____ feet _____ Direction _____ Type Well disinfected upon completion ☐ Yes ☐ No 15 PUMP: ☒ Not installed Manufacturer's Name _____ Model Number _____ HP _____ Volts _____ Length of Drop Pipe _____ ft. capacity _____ G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating 16 Remarks, elevation, source of data, etc. 888.0 17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co., Inc. 26 REGISTERED BUSINESS NAME REGISTRATION NO. Address 7215 W. M-59 Howell Signed <i>[Signature]</i> Date 10-10-73 AUTHORIZED REPRESENTATIVE

D47d 100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

WATER WELL RECORD
ACT 294 PA 1965MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

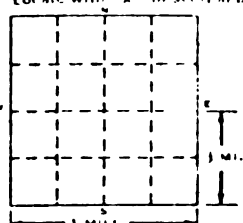
1 LOCATION OF WELL			3 OWNER OF WELL		
County Ingham	Township Name Alaiedon	Section Number 6	Range Number 3 N.	Section Number 1	Range Number 4 W.
Distance and Direction from Road Intersections Michigan State University			Address Water Quality Management Facility		
Street address & City of Well Location Locate with "X" in section below 			4 WELL DEPTH: (in completed) Date of Completion 30 ft. 9-13-73		
2 FORMATION			5 ☒ Cable tool ☐ Rotary ☐ Driven ☐ Dig ☐ Hollow rod ☐ Jetted ☐ Bored ☐		
			6 USE ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring		
			7 CASING: Threaded ☒ Welded ☐ Height: Above/Below Diam. 4 in. to 27 ft. Depth Surface 11 ft. Weight 11 lbs./ft. Drive Shoe? Yes ☒ No ☐		
			8 SCREEN: Type: Stainless Dia.: 4 in Slot/Grate 10 Length 3' Set between 27 ft. and 30 ft. Fittings: Standard		
Top Soil			9 STATIC WATER LEVEL 5 ft. below land surface		
Brown Sand			10 PUMPING LEVEL below land surface ft. after hrs. pumping 5 to 10 a.m.		
Gray Sand			11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____		
Sandrock Gravel-Gray Clay			12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☐ 12" Above Grade		
			13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ Depth: From 0 ft. to 21 ft.		
			14 Nearest Source of possible contamination ft. Direction _____ Type _____ Well disinfected upon completion ☐ Yes ☐ No		
			15 PUMP: ☒ Not installed Manufacturer's Name _____ Model Number _____ HP _____ Volts _____ Length of Drop Pipe _____ ft. capacity _____ G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating		
16 Remarks, elevation, source of data, etc. 852.6			17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co., Inc. 26 REGISTERED BUSINESS NAME REGISTRATION NO. Address 7215 W. N-59 Howell Signed <i>Keith L. Thym</i> Date 10-10-73 AUTHORIZED REPRESENTATIVE		

IMPORTANT: File with deed.

WELL OWNER COPY

WATER WELL RECORD ACT 294 PA 1105

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

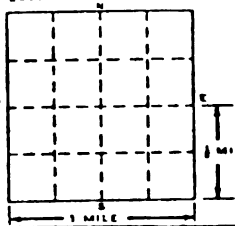
1 LOCATION OF WELL			2 FORMATION		3 WATER QUALITY MANAGEMENT FACILITY	
County <u>Ingham</u> Township <u>Albion</u>			Thickness of Stratum Top Soil <u>1</u> Brown Sand Gravel <u>29</u> Gray Sand Gravel <u>4</u> Gray Clay <u>34</u>		Date of Completion <u>9-13-73</u> 4 WELL DEPTH <u>34</u> ft. 5 ☒ Cable tool ☐ Rotary ☐ Driven ☐ Jet 6 USE ☐ Domestic ☐ Public Supply ☐ Industrial ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☒ Monitoring 7 CASING: Threaded ☒ Welded ☐ Height Above Below Ground <u>11</u> ft. Surface <u>11</u> ft. Drive Shaft <u>2</u> ft.	
Distance And Direction from Road Intersections <u>Michigan State University</u> Street Address & City of Well Location Locate with 1/4" in section below Sketch Map 			Depth to Bottom of Stratum Top Soil <u>1</u> Brown Sand Gravel <u>30</u> Gray Sand Gravel <u>34</u> Gray Clay <u>34</u>		8 SCREEN Type <u>Stainless</u> Dia. <u>4"</u> Slot <u>10</u> Length <u>3'</u> Set between <u>31</u> ft. and <u>34</u> ft. Fittings: <u>Standard</u> 9 STATIC WATER LEVEL <u>10'</u> ft. below land surface 10 PUMPING LEVEL below land surface _____ ft. after _____ hrs. pumping _____ G.P.M. _____ ft. after _____ hrs. pumping _____ G.P.M. 11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____ 12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade 13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ Depth: From <u>5</u> ft. to <u>21</u> ft. 14 Nearest Source of possible contamination _____ feet _____ Direction _____ Type _____ Well disinfected upon completion ☐ Yes ☐ No 15 PUMP: ☒ Not installed Manufacturer's Name _____ Model Number _____ HP _____ Volts _____ Length of Drop Pipe _____ ft. capacity _____ G.P.M. Type ☐ Submersible ☐ Jet ☐ Reciprocating	
16 Remarks, elevation, source of data, etc. <u>855.0</u>			17 WATER WELL CONTRACTOR'S CERTIFICATION This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. <u>Brown Drilling Co., Inc.</u> <u>26</u> REGISTERED BUSINESS NAME REGISTRATION NO. Address <u>7215 W. N-50</u> <u>Howell</u> Signed <u>[Signature]</u> Date <u>10-10-73</u> AUTHORIZED REPRESENTATIVE			

D67d 100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

WATER WELL RECORD
ACT 294 PA 1965MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		3 OWNER OF WELL			
County Ingham	Township Name Alaledon	Section Number 6	Range Number 1 N.W.		
Distance And Direction from Road Intersections Michigan State University		Address Water Quality Management Facility			
Street address & City of Well Location Locate with "X" in section below 		4 WELL DEPTH: Completed: 29 ft. Date of Completion: 9-14-73			
2 FORMATION		5 ☒ Cable tool ☐ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☐ Bored ☐			
		6 USE: ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring			
		7 CASING: Threaded ☒ Welded ☐ Height: Above: Below Diam. _____ ft. Surface _____ ft. Weight 11 lbs./ft. Drive Shoe? Yes ☒ No ☐			
Brown Clay		10	10	8 SCREEN: Type: Stainless Dia.: 4" Slot/Grit: 10 Length: 3' Set between 26 ft. and 29 ft. Fittings: Standard	
Gray Clay		10	20	9 STATIC WATER LEVEL 12' _____ ft. below land surface	
Gray Sand some Gravel		5	25	10 PUMPING LEVEL below land surface _____ ft. after _____ hrs. pumping _____ g.p.m. _____ ft. after _____ hrs. pumping _____ g.p.m.	
Gray Sand Gravel		4	29	11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____	
				12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade	
				13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ Depth: From 6 ft. to 21 ft.	
				14 Nearest Source of possible contamination _____ feet _____ Direction _____ Type _____ Well disinfected upon completion ☐ Yes ☐ No	
				15 PUMP: ☒ Not installed Manufacturer's Name _____ Model Number _____ HP _____ Volts _____ Length of Drop Pipe _____ ft. capacity _____ G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating	
16 Remarks, elevation, source of data, etc. 855.5		17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co., Inc. 26 REGISTERED BUSINESS NAME REGISTRATION NO. Address 7215 W. M-59 Howell Signed <i>Kenneth L. Thompson</i> Date 10-10-73 AUTHORIZED REPRESENTATIVE			

D&J

100M (Rev. 12-68)

IMPORTANT: File with deed.**WELL OWNER COPY**

WATER WELL RECORD

ACT 294 PA 1965

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL			3 LOCATION OF WELL																	
County Ingham	Township Name Alaledon	Range Number 3 N. X	Section Number 1 X W.																	
Distance And Direction from Road Intersections Michigan State University			Address Water Quality Management Facility																	
Street address & City of Well Location Locate with 1/4" in section below			Sketch Map: D. W. #24																	
<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th style="width:40%;">2 FORMATION</th> <th style="width:10%;">THICKNESS OF STRATUM</th> <th style="width:10%;">DEPTH TO BOTTOM OF STRATUM</th> </tr> <tr> <td>Brown Clay</td> <td>5</td> <td>5</td> </tr> <tr> <td>Clay & Gravel mixed</td> <td>15</td> <td>20</td> </tr> <tr> <td>Brown Sand Gravel</td> <td>3</td> <td>23</td> </tr> <tr> <td>Gray Clay Gravel</td> <td></td> <td>23</td> </tr> </table>			2 FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM	Brown Clay	5	5	Clay & Gravel mixed	15	20	Brown Sand Gravel	3	23	Gray Clay Gravel		23	4 WELL DEPTH Completed Date of Completion 22 ft. 9-14-73		
			2 FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM															
			Brown Clay	5	5															
			Clay & Gravel mixed	15	20															
			Brown Sand Gravel	3	23															
Gray Clay Gravel		23																		
			5 ☒ Cable tool ☐ Rotary ☐ Driven ☐ Jet ☐ Hollow rod ☐ Jetted ☐ Bored ☐																	
			6 USE: ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring																	
			7 CASING: Threaded ☒ Welded ☐ Height Above/Below Surface _____ ft. 4 in. to 20 ft. Depth Weight 11 lbs. ft. in. to _____ ft. Depth Drive Shoe? Yes ☒ No ☐																	
			8 SCREEN: Type: Stainless Dia.: 4" Slot: 10 Length: 3' Set between 20 ft. and 23 ft. Fittings: Standard																	
			9 STATIC WATER LEVEL 12' _____ ft. below land surface																	
			10 PUMPING LEVEL below land surface _____ ft. after _____ hrs. pumping _____ o.p.m. _____ ft. after _____ hrs. pumping _____ o.p.m.																	
			11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____																	
			12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade																	
			13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ Depth: From 2 ft. to 18 ft.																	
			14 Nearest Source of possible contamination _____ feet _____ Direction _____ Type _____ Well disinfected upon completion ☐ Yes ☐ No																	
			15 PUMP: ☒ Not installed Manufacturer's Name _____ Model Number _____ HP _____ Volts _____ Length of Drop Pipe _____ ft. capacity _____ G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating																	
16 Remarks, elevation, source of data, etc. 855.0 USE A 2ND SHEET IF NEEDED			17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co., Inc. 26 REGISTERED BUSINESS NAME REGISTRATION NO. Address 7215 W. M-59 Howell Signed <i>Kurt L. Taylor</i> Date 10-16-73 AUTHORIZED REPRESENTATIVE																	

D67d

100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

11

461,344 Pa. 1990

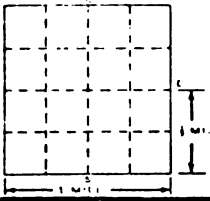
PUBLIC HEALTH

100M (Rev. 12-68)

WELL OWNER COPY

WATER WELL RECORD

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

County Ingham		Township Name Alaledon		Section Number 6		Town Number 3 N/8		Range Number 1 P.W.																																														
1. Locality and Location from Road Intersections: Michigan State University Street Address S.A. City of Well Location: Locate well "X" in section below:  Section Map: D. W. #26				3. OWNER OF WELL: Water Quality Management Facility Address:																																																		
2. FORMATION <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>FORMATION</th> <th>THICKNESS OF STRATUM</th> <th>DEPTH TO BOTTOM OF STRATUM</th> </tr> </thead> <tbody> <tr><td>Top Soil & Clay</td><td>5</td><td>5</td></tr> <tr><td>Brown Clay</td><td>10</td><td>15</td></tr> <tr><td>Gray Clay</td><td>20</td><td>35</td></tr> <tr><td>Gray Clay with Gravel</td><td>4</td><td>39</td></tr> <tr><td>Gray Sand with Gravel</td><td>4</td><td>43</td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> </tbody> </table>				FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM	Top Soil & Clay	5	5	Brown Clay	10	15	Gray Clay	20	35	Gray Clay with Gravel	4	39	Gray Sand with Gravel	4	43																												4. WELL DEPTH: (Completed) Date of Completion 43 ft. 9-19-73					
				FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM																																																
Top Soil & Clay	5	5																																																				
Brown Clay	10	15																																																				
Gray Clay	20	35																																																				
Gray Clay with Gravel	4	39																																																				
Gray Sand with Gravel	4	43																																																				
5. ☒ Cable tool ☐ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☐ Bored						6. USE: ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring																																																
7. CASING: Threaded ☒ Welded ☐ Diam. 4 in. to 43 ft. Depth Surface 11 lbs./ft. Drive Shoe? Yes ☒ No ☐				8. SCREEN Type: Stainless Dia.: 4" Slot/Grate 10 Length 3' Set between 40 ft. and 43 ft. Fittings: Standard																																																		
				9. STATIC WATER LEVEL no water ft. below land surface																																																		
10. PUMPING LEVEL below land surface ft. after ___ hrs. pumping ___ g.p.m. ft. after ___ hrs. pumping ___ g.p.m.				11. WATER QUALITY in Parts Per Million: Iron (Fe) ___ Chlorides (Cl) ___ Hardness ___ Other ___																																																		
				12. WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade																																																		
13. Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ Depth: From 0 ft. to 2' ft.				14. Nearest Source of possible contamination ___ feet ___ Direction ___ Type Well disinfected upon completion ☐ Yes ☐ No																																																		
				15. PUMP: ☒ Not installed Manufacturer's Name ___ Model Number ___ HP ___ Volts ___ Length of Drop Pipe ___ ft. capacity ___ G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating																																																		
16. Remarks, elevation, source of data, etc. 881.8				17. WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co., Inc. 26 REGISTERED BUSINESS NAME REGISTRATION NO. Address 7215 W. E-59 Howell Signed <i>Kurt L. Thayer</i> Date 10-10-73 AUTHORIZED REPRESENTATIVE																																																		

D67d 100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE NO. **WATER WELL RECORD**
ACT 254 PA 1965MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		
County Ingham	Township Name Alaiedon	Range 3 N / Township 1 W
Distance And Direction from Road Intersections Michigan State University		
Street address & City of Well Location Local with "X" in Section Below X Sketch Map D. W. #27		
3 LOCATION OF WELL Water Quality Management Facility Address _____		
4 WELL DEPTH Completed _____ Date of Completion 2-20-73		
5 ☐ Cased ☐ Bored ☐ Driven ☐ Dug ☐ Jetted ☐ Piled ☐ _____		
6 USE ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring		
7 CASING Threaded ☒ Welded _____ Height Above Surface _____ Diam. _____ Surface _____ ft. 4 in. to 23 ft. Depth Weight 11 lbs./ft. _____ in. to _____ ft. Depth Drive Shoe? Yes ☐ No ☒		
2 FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Brown Sand	0	27
8 SCREEN: Type: Stainless Dia.: 4" Slot Size XX 10 Length 2' Set between 23 ft. and 26 ft. Fittings: Standard		
9 STATIC WATER LEVEL _____ ft. below land surface no water		
10 PUMPING LEVEL below land surface _____ ft. after _____ hrs. pumping _____ g.p.m. _____ ft. after _____ hrs. pumping _____ g.p.m.		
11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____		
12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade		
13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ _____ Depth: From 0 ft. to 21 ft.		
14 Nearest Source of possible contamination _____ feet _____ Direction _____ Type _____ Well disinfected upon completion ☐ Yes ☐ No		
15 PUMP: ☒ Not installed Manufacturer's Name _____ Model Number _____ HP _____ Volts _____ Length of Drop Pipe _____ ft. capacity _____ G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating		
16 Remarks, elevation, source of data, etc. 893.6		
17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co., Inc. 26 REGISTERED BUSINESS NAME REGISTRATION NO. Address 7215 W. F-59 Howell Signed <i>[Signature]</i> Date 10-10-73 AUTHORIZED REPRESENTATIVE		

D67d

100M (Rev. 12-68)

IMPORTANT: File with deed.**WELL OWNER COPY**

[illegible]

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

DA74 100M (Rev. 12-68)

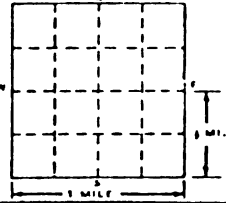
WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE NO.

WATER WELL RECORD

ACT 294 PA 1965

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

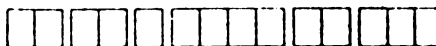
1 LOCATION OF WELL			3 WATER QUALITY	
County Ingham	Township Name Delhi	Section 1	Water Quality Management Facility	
Distance And Direction from Road Intersection Michigan State University			Address	
Street address & City of Well Location Locate with "X" in section below			4 WELL DEPTH: _____ ft. Date of Completion: 9-7-73	
Sketch Map  D. W. #29			5 ☒ Cable tool ☐ Rotary ☐ Drive in ☐ D.S. ☐ Jetted ☐ Jettied ☐ Bored ☐ D.S.	
			6 USE ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring	
			7 CASING: Threaded ☒ Welded ☐ Height Above/Below Surface _____ ft. Drum ☒ none ☐ Weight 11 lbs./ft. ☒ in. to _____ ft. Depth ☐ in. to _____ ft. Depth Drive Shaft? Yes ☐ No ☐	
2 FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM	8 SCREEN No Screen--Abandon Type: _____ Dia: _____ Slot/Gauge _____ Length _____ Set between _____ ft. and _____ ft. Fittings: _____	
Clay	5	5	9 STATIC WATER LEVEL _____ ft. below land surface No water	
Clay	5	10	10 PUMPING LEVEL below land surface _____ ft. after _____ hrs. pumping _____ g.p.m.	
Sand	5	15	_____ ft. after _____ hrs. pumping _____ g.p.m.	
Sand	5	20	11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____	
Brown Sand	4	24	12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☐ 12" Above Grade	
Brown Clay	4	28	13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ Depth: From 0 ft. to 60 ft.	
Gray Sand	7	35	14 Nearest source of possible contamination _____ feet _____ Direction _____ Type _____ Well disinfected upon completion ☐ Yes ☐ No	
Gray Clay & Sand	2	37	15 PUMP: ☒ Not installed Manufacturer's Name _____ Model Number _____ HP _____ Volts _____ Length of Drop Pipe _____ ft. capacity _____ G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating	
Gray Clay	21	58		
Gray Clay & Gravel	2	60		
16 Remarks, elevation, source of data, etc.			17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co., Inc. 26 REGISTERED BUSINESS NAME REGISTRATION NO. Address 7215 W. M-59 Howell Signed <i>Keith L. Thompson</i> Date 10-10-73 AUTHORIZED REPRESENTATIVE	

D67d

100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE No. **WATER WELL RECORD**
ACT 254 PA 1965MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		
County Ingham	Township Name Delhi	Fraction 1 2 N.E.
Distance And Direction from Road Intersections		
Michigan State University		
Street address & City of Well Location Locate with "X" in section below		
Sketch Map: D. W. #29-A		
2 FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Brown Clay	15	15
Sand	5	20
Brown Sand	16	36
3 OWNER OF WELL Water Quality Management Facility		
4 WELL DEPTH: (completion) Date of Completion 36 ft. 9-21-73		
5 ☒ Cable tool ☐ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☐ Bored ☐ _____		
6 USE: ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring		
7 CASING: Threaded ☒ Welded ☐ Height: Above/Below Surface _____ ft. 4 in. to 36 ft. Depth Weight 11 lbs./ft. _____ in. to _____ ft. Depth Drive Shoe? Yes ☒ No ☐		
8 SCREEN: Type: Stainless Dia.: 4" Slot/GXX: 10 Length 3' Set between 33 ft. and 36 ft. Fittings: Standard		
9 STATIC WATER LEVEL no water _____ ft. below land surface		
10 PUMPING LEVEL below land surface _____ ft. after _____ hrs. pumping _____ g.p.m. _____ ft. after _____ hrs. pumping _____ g.p.m.		
11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____		
12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade		
13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ _____ Depth: From 2 ft. to 31 ft.		
14 Nearest Source of possible contamination _____ feet Direction _____ Type _____ Well disinfected upon completion ☐ Yes ☐ No		
15 PUMP: ☒ Not installed Manufacturer's Name _____ Model Number _____ HP _____ Volts _____ Length of Drop Pipe _____ ft. capacity _____ G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating		
16 Remarks, elevation, source of data, etc.		
17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co., Inc. 26 REGISTERED BUSINESS NAME REGISTRATION NO. Address 7215 W. M-59 Howell Signed <i>Kurt L. Thayer</i> Date 10-10-73 AUTHORIZED REPRESENTATIVE		

D67d

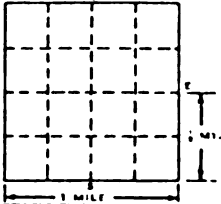
100M (Rev. 12-68)

IMPORTANT: File with deed.**WELL OWNER COPY**

GEOLOGICAL SURVEY SAMPLE NO.

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

WATER WELL RECORD
ACT 294 PA 1965MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		
County Ingham	Township Name Delhi	Fraction 1
Distance And Direction from Road Intersections Michigan State University		Section Number 3 N.E.
Street address & City of Well Location Locate with "X" in section below		Range Number 2 E.W.
Sketch Map:  D. W. #30 Abandon		Water Quality Management Facility Andrus
2 FORMATION		4 WELL DEPTH (Completed) 9-7-73 Date of Completion
THICKNESS OF STRATUM		5 ☒ Casing too ☐ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☐ Bored
DEPTH TO BOTTOM OF STRATUM		6 USE ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well
Topsoil 5 5		7 CASING: Threaded ☐ Welded ☐ Diam. none Height: Above/Below Surface none ft. Weight none lbs./ft. Drive Shoe? Yes ☐ No ☐
Sand 5 10		8 SCREEN: Type: _____ Dia.: _____ Slot/Gauze _____ Length _____ Set between _____ ft. and _____ ft. Fittings: _____
Sand 5 15		9 STATIC WATER LEVEL _____ ft. below land surface
Sand 6 21		10 PUMPING LEVEL below land surface _____ ft. after _____ hrs. pumping _____ G.P.M. _____ ft. after _____ hrs. pumping _____ G.P.M.
brown sand 14 35		11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____
" " 5 40		12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☐ 12" Above Grade
grus clay and gravel 20 60		13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite Depth: From 0 ft. to 60 ft.
		14 Nearest Source of possible contamination _____ feet _____ Direction _____ Type _____ Well disinfected upon completion ☐ Yes ☐ No
		15 PUMP: ☐ Not installed Manufacturer's Name _____ Model Number _____ HP _____ Volts _____ Length of Drop Pipe _____ ft. capacity _____ G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating
16 Remarks, elevation, source of data, etc.		17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co. Inc. 26 REGISTERED BUSINESS NAME REGISTRATION NO. Address 7215 W. K1-59 Howell Signed Knut H. Thompson Date 10-10-73 AUTHORIZED REPRESENTATIVE

D67d

100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

□

[illegible]

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		TOWNSHIP		RANGE		PUBLIC HEALTH	
County	Township Name	Section	Range Number	County	Township Name	Section	Range Number
Ingham	Delhi	1	3 N.W.				2 E.W.
Distance And Direction from Road Intersections				3 OWNER OF WELL			
Michigan State University Street address & City of Well Location Locate with "X" in section below				Water Quality Management Facility			
				Address			
Sketch Map: 				4 WELL DEPTH: (Completed) Date of Completion			
				42 ft. 9-21-73			
2 FORMATION				5 USE: ☐ Domestic ☐ Public Supply ☐ Industry			
				☐ Irrigation ☐ Air Conditioning ☐ Commercial			
THICKNESS OF STRATUM DEPTH TO BOTTOM OF STRATUM				6 CASING: Threaded ☒ Welded ☐ Height: Above/Below			
				4 in. to 42 ft. Depth 11 lbs./ft. Drive Shoe? Yes ☒ No ☐			
Brown Clay 5 5				8 SCREEN:			
				Type: Stainless Dia.: 4" Slot: 10 Length: 3' Set between: 39 ft. and 42 ft. Fittings: Standard			
Sand 10 15				9 STATIC WATER LEVEL no water			
				ft. below land surface			
Brown Sandy Clay 5 20				10 PUMPING LEVEL below land surface			
				ft. after hrs. pumping g.p.m.			
Brown Sand 22 42				11 WATER QUALITY in Parts Per Million:			
				Iron (Fe) Chlorides (Cl) Hardness Other			
USE A 2ND SHEET IF NEEDED				12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade			
				13 Well Grouted? ☒ Yes ☐ No Neat Cement ☐ Bentonite ☐ Depth: From 0 ft. to 21 ft.			
16 Remarks, elevation, source of data, etc.				14 Nearest Source of possible contamination			
				feet Direction Type Well disinfected upon completion ☐ Yes ☐ No			
17 WATER WELL CONTRACTOR'S CERTIFICATION:				15 PUMP: ☒ Not installed			
				Manufacturer's Name Model Number HP Volts Length of Drop Pipe ft. capacity G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating			
Address 2215 W. M-59 Howell				Signed K. H. L. Thym Date 10-10-73			
				Registered Business Name REGISTRATION NO. 26			

100M (Rev. 12-68)

WELL OWNER COPY

WATER WELL RECORD ACT 294 PA 1965

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL			2 FORMATION		3 WELL DATA	
County Ingham	Township Name Delhi	Range Number 1 N. 2 E. 2	Thickness of Stratum 10	Depth to Bottom of Stratum 10	Water Quality Management Facility 4 WELL DEPTH: 28 ft. Date of Completion: 9-16-77 5 USE: ☒ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Test Well ☒ Monitoring 6 USE: ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Test Well ☒ Monitoring 7 CASING: Threaded ☒ Welded ☐ Material: Above Below Surface 11 ft. Drive Shaft? Yes ☒ No ☐	
Distance And Direction from Road Intersections: Michigan State University Street Address & City of Well Location: Locate with 1/4" grid in sketch below: D. W. #31			8 SCREEN: Stainless 4" Type: 4" Slot: 10' Length: 3' Set between: 35 ft. and 38 ft. Fittings: Standard			
9 STATIC WATER LEVEL: No water ft. below land surface 10 PUMPING LEVEL below land surface: _____ ft. after _____ hrs. pumping _____ g.p.m. _____ ft. after _____ hrs. pumping _____ g.p.m.						
11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____			12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade			
13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ Depth: From 2 ft. to 21 ft.			14 Nearest Source of possible contamination: _____ feet _____ Direction: _____ Type _____ Well disinfected upon completion ☐ Yes ☐ No			
15 PUMP: ☒ Not installed Manufacturer's Name _____ Model Number _____ HP _____ Volts _____ Length of Drop Pipe _____ ft. capacity _____ G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating			16 Remarks, elevation, source of data, etc.			
17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co., Inc. 26 REGISTERED BUSINESS NAME REGISTRATION NO. Address 7215 W. M-50 Howell Signed <i>Kurt L. Thompson</i> Date 10-16-77 AUTHORIZED REPRESENTATIVE			16 Remarks, elevation, source of data, etc.			

D67d

100M (Rev. 12-68)

IMPORTANT: File with deed.

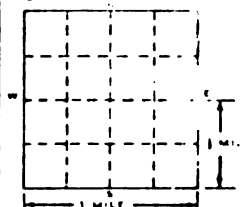
WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE No. 

WATER WELL RECORD

ACT 296 PA 1968

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		
County <u>Ingham</u>	Township Name <u>Dell</u>	Range <u>1</u> N <u>2</u> E <u>2</u> S
Distance And Direction from Road Intersections <u>Michigan State University</u>		
Street address & City of Well Location Locate well on section below		
 D. W. #32		
2 FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Brown Clay	3	3
Brown Sand	22	25
Gray Clay		25
3 CASING Threaded ☒ Welded ☐ Height: Above Below Drum ☐ Surface ☐ ft. <u>4</u> in. to <u>22</u> ft. Depth <u>11</u> lbs./ft. in. to in. Depth Drive Shaft? Yes ☒ No ☐		
4 SCREEN Type <u>Stainless</u> Dia. <u>4"</u> Slot <u>1/8"</u> Length <u>3'</u> Set between <u>22</u> ft. and <u>25</u> ft. Fittings: <u>Standard</u>		
5 STATIC WATER LEVEL <u>No water</u> ft. below land surface		
6 PUMPING LEVEL below land surface ft. after hrs. pumping g.p.m. ft. after hrs. pumping g.p.m.		
7 WATER QUALITY in Parts Per Million: Iron (Fe) Chlorides (Cl) Hardness Other		
8 WELL HEAD COMPLETION ☐ In Approved Pit ☐ Pitless Adapter ☐ 12" Above Grade		
9 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ Depth: From <u>6</u> ft. to <u>21</u> ft.		
10 Nearest Source of possible contamination ft. Direction Type Well disinfected upon completion ☐ Yes ☐ No		
11 PUMP ☒ Not installed Manufacturer's Name Model Number HP Volts Length of Drop Pipe ft. capacity G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating		
12 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. <u>Brown Drilling Co., Inc.</u> 26 REGISTERED BUSINESS NAME REGISTRATION NO. Address <u>7215 W. 1st St.</u> <u>Howell</u> Signed <u>Kurt L. Thompson</u> Date <u>10-16-73</u> AUTHORIZED REPRESENTATIVE		
13 Remarks, elevation, source of data, etc. <u>880.0</u>		

D67d

100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

[illegible]

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		COUNTY		TOWNSHIP		RANGE		SECTION	
Ingham		Delhi							
2 DISTANCE AND DIRECTION FROM ROAD INTERSECTIONS									
Michigan State University									
3 STREET ADDRESS & CITY OF WELL LOCATION									
D. W. 433									
4 WELL DEPTH									
5 CASING									
6 USE									
7 SCREEN									
8 STATIC WATER LEVEL									
9 PUMPING LEVEL									
10 WATER QUALITY									
11 WELL HEAD COMPLETION									
12 NEAREST SOURCE OF POSSIBLE CONTAMINATION									
13 PUMP									
14 REMARKS, ELEVATION, SOURCE OF DATA, ETC.									
15 WATER WELL CONTRACTOR'S CERTIFICATION									

100M (Rev. 12-68)

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE NO.

NOV 07 1973

WATER WELL RECORD
ACT 294 PA 1965MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL County <u>Ingham</u> Township Name <u>Delhi</u> Fraction <u>56 1/4</u> Section Number <u>1</u> Town Number <u>3</u> Range Number <u>2</u> N/W.		3 OWNER OF WELL: <u>Water Quality Management Facility</u> Address _____																															
Distance And Direction from Road Intersections Michigan State University Street address & City of Well Location Locate with "X" in section below X Sketch Map: D. W. #34		4 WELL DEPTH: (completed) <u>49</u> ft. Date of Completion <u>9-11-73</u> 5 ☐ Cable tool ☐ Rotary ☐ Driven ☐ Dip ☐ Hollow rod ☐ Jetted ☐ Bored																															
2 FORMATION <table border="1" style="width: 100%; border-collapse: collapse;"><thead><tr><th>FORMATION</th><th>THICKNESS OF STRATUM</th><th>DEPTH TO BOTTOM OF STRATUM</th></tr></thead><tbody><tr><td>Brown Clay</td><td>8</td><td>8</td></tr><tr><td>Brown Clay</td><td>2</td><td>10</td></tr><tr><td>Brown Clay</td><td>7</td><td>17</td></tr><tr><td>Gray Clay</td><td>3</td><td>20</td></tr><tr><td>Gray Clay</td><td>10</td><td>30</td></tr><tr><td>Gray Clay</td><td>4</td><td>34</td></tr><tr><td>Gravel and Clay</td><td>0</td><td>34</td></tr><tr><td>Sand Stone</td><td>13</td><td>47</td></tr><tr><td>Sand Stone</td><td>2</td><td>49</td></tr></tbody></table>		FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM	Brown Clay	8	8	Brown Clay	2	10	Brown Clay	7	17	Gray Clay	3	20	Gray Clay	10	30	Gray Clay	4	34	Gravel and Clay	0	34	Sand Stone	13	47	Sand Stone	2	49	6 USE: ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ <u>Monitoring</u> 7 CASING: Threaded ☒ Welded ☐ Height: Above/Below Surface _____ ft. Diam. _____ ft. Weight <u>11</u> lbs./ft. Drive Shoe? Yes ☒ No ☐ 8 SCREEN: <u>NO SCREEN -- ROCK WELL</u> Type: _____ Dia.: _____ Slot/Gauze _____ Length _____ Set between _____ ft. and _____ ft. Fittings: _____ 9 STATIC WATER LEVEL _____ ft. below land surface <u>no water</u> 10 PUMPING LEVEL below land surface _____ ft. after _____ hrs. pumping _____ G.P.M. _____ ft. after _____ hrs. pumping _____ G.P.M.	
FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM																															
Brown Clay	8	8																															
Brown Clay	2	10																															
Brown Clay	7	17																															
Gray Clay	3	20																															
Gray Clay	10	30																															
Gray Clay	4	34																															
Gravel and Clay	0	34																															
Sand Stone	13	47																															
Sand Stone	2	49																															
16 Remarks, elevation, source of data, etc. DRILLER, NEW ME BY SIGNATURE		11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____ 12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade 13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ Depth: From <u>0</u> ft. to <u>21</u> ft. 14 Nearest Source of possible contamination _____ feet _____ Direction _____ Type _____ Well disinfected upon completion ☐ Yes ☐ No 15 PUMP: ☒ Not installed Manufacturer's Name _____ Model Number _____ HP _____ Volts _____ Length of Drop Pipe _____ ft. capacity _____ G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating																															
17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co., Inc. <u>26</u> REGISTERED BUSINESS NAME REGISTRATION NO. Address <u>7215 W. 4-59</u> <u>Howell</u> Signed <u>[Signature]</u> Date <u>10-16-73</u> DRILLER REPRESENTATIVE																																	

D974

100M (Rev. 12-64)

GEOLOGICAL SURVEY COPY

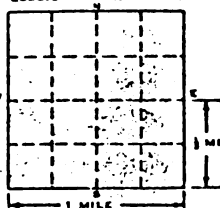
GEOLOGICAL SURVEY SAMPLE NO.

3 NOV 07 1973

WATER WELL RECORD

ACT 294 PA 1965

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		3 OWNER OF WELL:	
County <u>Ingham</u>	Township Name <u>Delhi</u>	Water Quality Management Facility	
Distance And Direction from Road Intersections		Address	
<u>Michigan State University</u>			
Street Address & City of Well Location		4 WELL DEPTH: (completed) Date of Completion	
Locate with "X" in section below		30 ft. 9-11-73	
Sketch Map:		5 ☒ Cable tool ☐ Rotary ☐ Driven ☐ Dug	
		☐ Hollow rod ☐ Jetted ☐ Bored ☐	
2 FORMATION:		6 USE: ☐ Domestic ☐ Public Supply ☐ Industry	
THICKNESS OF STRATUM		☐ Irrigation ☐ Air Conditioning ☐ Commercial	
DEPTH TO BOTTOM OF STRATUM		☐ Test Well ☒ Monitoring	
<u>Hard Brown Gravelly Clay</u> 21 21		7 CASING: Threaded ☒ Welded ☐ Height: Above/Below	
<u>Brown Sand</u> 9 30		Diam. _____ Surface _____ ft.	
<u>Gray Silt</u> 30		4 in. to 27 ft. Depth Weight 11 lbs./ft.	
		in. to _____ ft. Depth Drive Shoe? Yes ☒ No ☐	
		8 SCREEN:	
		Type: <u>Stainless</u> Dia.: <u>4"</u>	
		Slot/Grit <u>10</u> Length <u>3'</u>	
		Set between <u>27</u> ft. and <u>30</u> ft.	
		Fittings: <u>Standard</u>	
		9 STATIC WATER LEVEL	
		_____ ft. below land surface <u>No water</u>	
		10 PUMPING LEVEL below land surface	
		_____ ft. after _____ hrs. pumping _____ g.p.m.	
		_____ ft. after _____ hrs. pumping _____ g.p.m.	
		11 WATER QUALITY in Parts Per Million:	
		Iron (Fe) _____ Chlorides (Cl) _____	
		Hardness _____ Other _____	
		12 WELL HEAD COMPLETION: ☐ In Approved Pit	
		☐ Pitless Adapter ☒ 12" Above Grade	
		13 Well Grouted? ☒ Yes ☐ No	
		☒ Neat Cement ☐ Bentonite ☐	
		Depth: From <u>0</u> ft. to <u>21</u> ft.	
		14 Nearest Source of possible contamination	
		_____ feet _____ Direction _____ Type _____	
		Well disinfected upon completion ☐ Yes ☐ No	
		15 PUMP: ☒ Not installed	
		Manufacturer's Name _____	
		Model Number _____ HP _____ Volts _____	
		Length of Drop Pipe _____ ft. capacity _____ G.P.M.	
		Type: ☐ Submersible ☐ Jet ☐ Reciprocating	
16 Remarks, elevation, source of data, etc.		17 WATER WELL CONTRACTOR'S CERTIFICATION:	
ADDED INFO. BY UNILLEN, HAM 30		This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.	
DESIGNED BY: <u>JH</u>		<u>Brown Drilling Co., Inc.</u> REGISTRATION NO. <u>26</u>	
CONSTRUCTION BY: _____		Address <u>7215 W. W. 59</u> <u>Howell</u>	
SIGNATURE _____		Signed <u>[Signature]</u> Date <u>10-16-73</u>	

D6/3

100M (REV. 12-68)

GEOLOGICAL SURVEY COPY

[illegible]

AC 1294 PA 1965

PUBLIC HEALTH

B47d

100M (Rev. 12-68)

WELL OWNER COPY

[illegible]

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

D67d

100M (Rev. 12-68)

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE No. WATER WELL RECORD
ACT 294 PA 1965MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		
County	Township Name	Fraction
Ingham	Alaiedon	
Distance And Direction from Road Intersections		
Michigan State University		
Street address & City of Well Location		
Locate with "X" in section below		
Sketch Map: D. W. #38		
3 OWNER OF WELL		
Water Quality Management Facility		
4 WELL DEPTH: Completion Date of Completion		
42 ft. 9-20-73		
5 ☒ Cable Tool ☐ Rotary ☐ Driven ☐ Dug		
☐ Hollow Rod ☐ Jetting ☐ Bored		
6 USE: ☐ Domestic ☐ Public Supply ☐ Industry		
☐ Irrigation ☐ Air Conditioning ☐ Commercial		
☐ Test Well ☒ Monitoring		
7 CASING: Threaded ☒ Welded ☐ Height: Above/Below		
Diam. _____ Surface _____ ft.		
4 in. to 42 ft. Depth Weight 11 lbs./ft.		
in. to _____ ft. Depth Drive Shoe? Yes ☒ No ☐		
8 SCREEN:		
Type: Stainless Dia.: 4 in.		
Slot: XXX 10 Length: 21		
Set between 39 ft. and 42 ft.		
Fittings: Standard		
9 STATIC WATER LEVEL		
30 ft. below land surface		
10 PUMPING LEVEL below land surface		
_____ ft. after _____ hrs. pumping _____ G.P.M.		
_____ ft. after _____ hrs. pumping _____ G.P.M.		
11 WATER QUALITY in Parts Per Million:		
Iron (Fe) _____ Chlorides (Cl) _____		
Hardness _____ Other _____		
12 WELL HEAD COMPLETION: ☐ In Approved Pit		
☐ Pitless Adapter ☒ 12" Above Grade		
13 Well Grouted? ☒ Yes ☐ No		
☒ Neat Cement ☐ Bentonite ☐ _____		
Depth: From 0 ft. to 21 ft.		
14 Nearest Source of possible contamination		
_____ feet _____ Direction _____ Type _____		
Well disinfected upon completion ☐ Yes ☐ No		
15 PUMP: ☒ Not installed		
Manufacturer's Name _____		
Model Number _____ HP _____ Volts _____		
Length of Drop Pipe _____ ft. capacity _____ G.P.M.		
Type: ☐ Submersible ☐ Jet ☐ Reciprocating		
16 Remarks, elevation, source of data, etc. 869.1		
17 WATER WELL CONTRACTOR'S CERTIFICATION:		
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.		
Brown Drilling Co., Inc. 26		
REGISTERED BUSINESS NAME REGISTRATION NO		
Address 7215 W. M-59 Howell		
Signed <i>Robert L. Thompson</i> Date 10-16-73		
AUTHORIZED REPRESENTATIVE		

D67d

100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE NO. WATER WELL RECORD
ACT 294 PA 1565MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		
County Ingham	Township Name Alelodon	Range 6 N. 5. 7 E.
Distance And Direction from Road Intersection:		
Michigan State University		
Street Address & City of Well Location		
Locate with "X" in section below		
Sketch Map		
D. W. #39		
1 MILE		
2 FORMATION		
Brown Clay	THICKNESS OF STRATUM 10	DEPTH TO BOTTOM OF STRATUM 10
Brown Sand	11	21
3 WATER QUALITY Measurement Facility		
4 Well Depth (feet) 21 Date of Completion 9-14-73		
5 ☐ Cable Tool ☐ Rotary ☐ Driven ☐ Dig		
6 ☐ Jetted ☐ Bored ☐ Other		
7 ☐ Transmission ☐ Public Supply ☐ Industry		
8 ☐ Irrigation ☐ Air Conditioning ☐ Other		
9 ☐ Test Well ☒ Monitoring		
10 ☐ Welded ☐ Flange Above/Below		
11 ☐ Surface ☐ Depth		
12 ☐ Weight ☐ Drive Shoe? Yes ☒ No ☐		
8 SCREEN		
Type: Stainless Dia: 4"		
Slot: 10 Length: 3'		
Set between 18 ft. and 21 ft.		
Fittings: Standard		
9 STATIC WATER LEVEL No water		
ft. below land surface		
10 PUMPING LEVEL below land surface		
ft. after ___ hrs. pumping ___ g.p.m.		
ft. after ___ hrs. pumping ___ g.p.m.		
11 WATER QUALITY in Parts Per Million:		
Iron (Fe) ___ Chlorides (Cl) ___		
Hardness ___ Other ___		
12 WELL HEAD COMPLETION: ☐ In Approved Pit		
☐ Pitless Adapter ☒ 12" Above Grade		
13 Well Grouted? ☒ Yes ☐ No		
☒ Neat Cement ☐ Bentonite ☐ Other		
Depth From 2 ft. to 16 ft.		
14 Nearest Source of possible contamination		
___ feet ___ Direction ___ Type		
Well disinfected upon completion ☐ Yes ☐ No		
15 PUMP: ☒ Not installed		
Manufacturer's Name ___		
Model Number ___ HP ___ Volts ___		
Length of Drop Pipe ___ ft. capacity ___ G.P.M.		
Type: ☐ Submersible ☐ Jet ☐ Reciprocating		
16 Remarks, elevation, source of data, etc. 876.8		
17 WATER WELL CONTRACTOR'S CERTIFICATION.		
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.		
Brown Drilling Co., Inc. 26		
REGISTERED BUSINESS NAME REGISTRATION NO		
Address 7215 W. 50 Howell		
Signed <i>Anthony L. Shypan</i> Date 10-16-73		

D67d

100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE NO.

WATER WELL RECORD
ACT 294 PA 1007MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

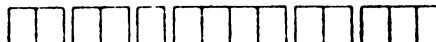
1 LOCATION OF WELL		COUNTY		TOWNSHIP		RANGE		SECTION	
Ingham		Alaio		3		N		1	
Distance And Direction to Road Intersection									
Michigan State University									
Street Address & City of Well Location									
Locate with "X" in Section below									
Sketch Map									
D. W. #40									
2 FORMATION									
Brown Sand & Gravel		20		20					
Gray Gravel some Clay		5		25					
Sand-Gravel trace Clay		5		30					
3 WELL DEPTH									
4 WELL DEPTH									
5 WELL DEPTH									
6 WELL DEPTH									
7 WELL DEPTH									
8 WELL DEPTH									
9 STATIC WATER LEVEL									
10 PUMPING LEVEL									
11 WATER QUALITY									
12 WELL HEAD COMPLETION									
13 WELL GROUTED									
14 NEAREST SOURCE									
15 PUMP									
16 REMARKS									
17 WATER WELL CONTRACTOR'S CERTIFICATION									

D67d

100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE NO. WATER WELL RECORD
ACT 254 PA 1965MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		
County Ingham	Township Name Meridian	Range Number 1 N.W.
Distance And Direction from Road Intersections Michigan State University		
Street address & City of Well Location Locate with "X" in section below Sketch Map: D. W. #41		
3 (OWNER OF WELL) Water Quality Management Facility Address		
4 WELL DEPTH (completed) Date of Completion 58 ft.9-14-73		
5 ☒ Cable tool ☐ Rotary ☐ Driven ☐ Dig ☐ Hollow rod ☐ Jetted ☐ Bored ☐		
6 USE ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring		
7 CASING: Threaded ☒ Welded ☐ Diam. 4 in. to 58 ft. Depth Height: Above/Below Surface 11 ft. Weight 11 lbs./ft. Drive Shoe? Yes ☒ No ☐		
2 FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Brown Clay	10	10
Brown Sand	10	20
Brown Sand Gravel	15	35
Dark Brown Sand	8	43
Gray Clay & Gravel	4	47
Gray Clay & Gravel	11	58
Rock		58
8 SCREEN: NO SCREEN Type: _____ Dia.: _____ Slot/Gauze _____ Length _____ Set between _____ ft. and _____ ft. Fittings: _____		
9 STATIC WATER LEVEL 58' _____ ft. below land surface		
10 PUMPING LEVEL below land surface _____ ft. after _____ hrs. pumping _____ g.p.m. _____ ft. after _____ hrs. pumping _____ g.p.m.		
11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____		
12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pile-on Adapter ☒ 12" Above Grade		
13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ Depth: From 0 ft. to 21 ft.		
14 Nearest Source of possible contamination _____ feet _____ Direction _____ Type _____ Well disinfected upon completion ☐ Yes ☐ No		
15 PUMP: ☒ Not installed Manufacturer's Name _____ Model Number _____ HP _____ Volts _____ Length of Drop Pipe _____ ft. capacity _____ G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating		
16 Remarks, elevation, source of data, etc. 891.7 Depth to bedrock 58' sounding 835.		
17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co., Inc. 26 REGISTERED BUSINESS NAME REGISTRATION NO. Address 7215 W. M-59 Howell Signed <i>Kurt L. Thompson</i> Date 10-16-73 AUTHORIZED REPRESENTATIVE		

Date 100M (Rev. 12-68)

IMPORTANT: File with deed.

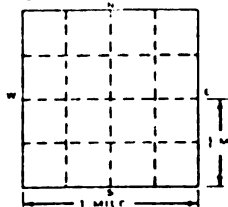
WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE No. 

WATER WELL RECORD

ACT 294 PA 1165

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL County <u>Ingham</u> Township <u>Lansing</u> City <u>Lansing</u> Street address & City of Well Location: <u>Michigan State University</u> Sketch Map:  Locate with "X" in section below			3 WATER QUALITY MANAGEMENT FACILITY Address: <u>Water Quality Management Facility</u> 4 WELL DEPTH (measured depth) <u>90</u> ft. (depth to completion) <u>3-1-73</u> 5 ☐ Cable Tool ☒ Rotary ☐ Driven ☐ Other ☐ Hollow Rod ☐ Jetted ☐ Bored 6 USE ☐ Domestic ☐ Public Supply ☐ Industrial ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring 7 CASING Threaded ☒ Welded ☐ Height Above Ground: Surface <u>4</u> ft. to <u>65</u> ft. Depth: <u>4</u> in. to <u>65</u> ft. Depth: <u>4</u> in. to <u>65</u> ft. Depth: <u>4</u> in. to <u>65</u> ft. Drive Shoe? Yes ☒ No ☐																																												
2 FORMATION <table border="1" style="width: 100%; border-collapse: collapse;"><thead><tr><th>FORMATION</th><th>THICKNESS OF STRATUM</th><th>DEPTH TO BOTTOM OF STRATUM</th></tr></thead><tbody><tr><td>Brown Clay</td><td>14</td><td>14</td></tr><tr><td>Gray Clay</td><td>2</td><td>16</td></tr><tr><td>Brown Clay</td><td>6</td><td>22</td></tr><tr><td>Gray Clay</td><td>4</td><td>26</td></tr><tr><td>Brown Clay & Gravel</td><td>1</td><td>27</td></tr><tr><td>Gray Clay</td><td>13</td><td>40</td></tr><tr><td>Gravel Streaks & Clay</td><td>5</td><td>45</td></tr><tr><td>Sand & Gravel</td><td>10</td><td>55</td></tr><tr><td>Gray Sandy Clay</td><td>3</td><td>58</td></tr><tr><td>Gray Shale</td><td>4</td><td>62</td></tr><tr><td>Gray Shale & Sand Rock</td><td>3</td><td>65</td></tr><tr><td>White Sand Rock</td><td>25</td><td>90</td></tr><tr><td>Some very thin shale streaks</td><td></td><td></td></tr></tbody></table>			FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM	Brown Clay	14	14	Gray Clay	2	16	Brown Clay	6	22	Gray Clay	4	26	Brown Clay & Gravel	1	27	Gray Clay	13	40	Gravel Streaks & Clay	5	45	Sand & Gravel	10	55	Gray Sandy Clay	3	58	Gray Shale	4	62	Gray Shale & Sand Rock	3	65	White Sand Rock	25	90	Some very thin shale streaks			8 SCREEN Type: _____ Dia.: _____ Slot Gauge: _____ Length: _____ Set between _____ ft. and _____ ft. Fittings: _____ 9 STATIC WATER LEVEL <u>62</u> ft. below land surface 10 PUMPING LEVEL below land surface _____ ft. after _____ hrs. pumping _____ g.p.m. _____ ft. after _____ hrs. pumping _____ g.p.m. 11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____ 12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade 13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ _____ Depth: From <u>0</u> ft. to <u>65</u> ft. 14 Nearest Source of possible contamination _____ feet _____ Direction _____ Type _____ Well disinfected upon completion ☒ Yes ☐ No 15 PUMP: ☐ Not installed Manufacturer's Name <u>Red Jacket</u> Model Number <u>5000</u> H.P. <u>1/2</u> Volts <u>115</u> Length of Drop Pipe <u>65</u> ft. capacity _____ G.P.M. Type: ☒ Submersible ☐ Jet ☐ Reciprocating <u>KH2-2059</u>		
FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM																																													
Brown Clay	14	14																																													
Gray Clay	2	16																																													
Brown Clay	6	22																																													
Gray Clay	4	26																																													
Brown Clay & Gravel	1	27																																													
Gray Clay	13	40																																													
Gravel Streaks & Clay	5	45																																													
Sand & Gravel	10	55																																													
Gray Sandy Clay	3	58																																													
Gray Shale	4	62																																													
Gray Shale & Sand Rock	3	65																																													
White Sand Rock	25	90																																													
Some very thin shale streaks																																															
16 Remarks, elevation, source of data, etc. <u>803</u>			17 WATER WELL CONTRACTOR'S CERTIFICATION. This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. <u>Brown Drilling Co., Inc.</u> <u>26</u> REGISTERED BUSINESS NAME REGISTERATION NO. Address <u>7215 W. M-59</u> <u>Howell</u> Signed <u>[Signature]</u> Date <u>11-7-73</u> AUTHORIZED REPRESENTATIVE																																												

D67d

100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

□

[illegible]

AC 1.294 PA 126

PUBLIC HEALTH

Q474

100M (Rev. 12-68)

WELL OWNER COPY

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

047d 100M (Rev. 12-68)

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE NO.

--	--	--	--	--	--	--	--	--	--	--	--

WATER WELL RECORD
ACT 294 PA 1904MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1. LOCATION OF WELL Ingham		Township Name Meridian	Fraction 31	Range 4	Section 1	Elev. 200
Distance and Direction from Road Intersections Michigan State University						
Street address & City of Well Location Locate with "X" in section below X Sketch Map S. R. #4						
2 FORMATION		THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM	3. WATER QUALITY MANAGEMENT FACILITY Address		
Brown Clay		20	20	4 WELL DEPTH 118 ft. 10-12-73		
Brown Sand		10	30	5 ☐ Cable tool ☒ Rotary ☐ Driven ☐ Dredge ☐ Mudflow rod ☐ Jetted ☐ Bored		
Coal & Sand		5	35	6 USE: ☐ Domestic ☐ Public Supply ☐ Industrial ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring		
Brown Sand		6	41	7 CASING: Thickness ☒ Welded ☐ Height: Above: Below: 4 in. to 94 ft. Depth Surface _____ ft. _____ in. to _____ ft. Depth Weight _____ lbs. ft. Drive Shoe? Yes ☒ No ☐		
Gray Clay & Gravel		38	79	8 SCREEN: Type: _____ Dia: _____ Slot Gauge _____ Length _____ Set between _____ ft. and _____ ft. Fittings: _____		
Gray Shale		1	80	9 STATIC WATER LEVEL _____ ft. below land surface		
White Sandrock & Gray Shale		11	91	10 PUMPING LEVEL below land surface _____ ft. after _____ hrs. pumping _____ g.p.m. _____ ft. after _____ hrs. pumping _____ g.p.m.		
White Sand Rock		2	93	11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____		
Gray White Sand Rock		25	118	12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade		
little water				13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ Depth: From 0 ft. to 94 ft.		
				14 Nearest Source of possible contamination _____ feet _____ Direction _____ Type _____ Well disinfected upon completion ☒ Yes ☐ No		
				15 PUMP: ☐ Not installed Manufacturer's Name <i>Reddyco</i> Model Number <i>68L</i> HP <i>1/2</i> Volts <i>115</i> Length of Drive Pipe <i>107</i> ft. capacity <i>5</i> G.P.M. Type: ☒ Submersible <i>KNE</i> <i>ONE</i> ☐ Jet ☐ Reciprocating		
16 Remarks, elevation, source of data, etc. <i>8-11-73</i>		17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co. Inc. 26 REGISTERED BUSINESS NAME REGISTRATION NO. Address <i>7215 W. M-59</i> Howell Signed <i>[Signature]</i> Date <i>11-7-73</i> AUTHORIZED REPRESENTATIVE				

D47d

100M (Rev. 12-68)

OWNER COPY

11/11/2019

[illegible]

AL 1294 PA 1965

PUBLIC HEALTH

D&D

100M (Rev. 12-68)

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE No

WATER WELL RECORD

ACT 274 PA 1301

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		
County	Township Name	
Ingham	Alaledon	
Distance And Direction from Road Intersection		
Michigan State University		
Street address & City of Well Location		
Locate well with 1/4" in section below		
Section Map		
S. R. #6		
1 MILE		
2 FORMATION		
THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM	
Sandy Brown Clay	10	10
Sand & Gravel	22	32
Gray Clay	23	55
Hard Sandy Gray Clay	10	65
Chipped Rocks & Sand Rock	6	71
Soft Gray Shale	4	75
Large Gravel, Sandstone chips	2	77
Blue Shale & Sand Rock	5	82
Gray Sand Rock	6	88
Shale & Sand Rock	5	93
Shale & Sandstone	10	103
Sandstone & Shale Streaks	5	108
SandStone	5	113
USE A 2ND SHEET IF NEEDED		
16 Remarks, elevation, source of data, etc. 886.14		
17 WATER WELL CONTRACTOR'S CERTIFICATION:		
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.		
Brown Drilling Co., Inc. 26		
REGISTERED BUSINESS NAME REGISTRATION NO		
Address 7215 W. M-59 Howell		
Signed K. H. L. for Date 11-7-73		
AUTHORIZED REPRESENTATIVE		

D67d

100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE No. WATER WELL RECORD
ACT 254 PA 1165MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		
County Ingham	Township Name Alaiedon	Range 6 Section 3 NW 1
Distance And Direction from Road Intersections Michigan State University		
Street address & City of Well Location Locate with "X" in section below Sketch Map: S. R. #7		
3 QUALITY OF WATER Water Quality Management Facility		
4 WELL DEPTH 95 ft. 3-1-73		
5 ☐ Cable Tool ☒ Rotary ☐ Driven ☐ Dig ☐ Hollow Rod ☐ Jetted ☐ Bored		
6 USE: ☐ Domestic ☐ Public Supply ☐ Industrial ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring		
7 CASING: Threaded ☐ Welded ☒ Height Above/Below Diaphragm _____ ft. Surface _____ ft. _____ in. to _____ ft. Depth Weight _____ lbs. ft. _____ in. to _____ ft. Depth Drive Shaft? Yes ☐ No ☒		
8 SCREEN: Type: _____ Dia.: _____ Slot Gauge _____ Length _____ Set between _____ ft. and _____ ft. Fittings: _____		
9 STATIC WATER LEVEL _____ ft. below land surface		
10 PUMPING LEVEL below land surface _____ ft. after _____ hrs. pumping _____ g.p.m. _____ ft. after _____ hrs. pumping _____ g.p.m.		
11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____		
12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade		
13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ Depth: From 0 ft. to 68 ft.		
14 Nearest Source of possible contamination _____ feet _____ Direction _____ Type _____ Well disinfected upon completion ☒ Yes ☐ No		
15 PUMP: ☐ Not installed Manufacturer's Name K&B Model Number 3C-1NC HP 1/3 Volts 115 Length of Drop Pipe 65 ft. capacity 5 G.P.M. Type: ☒ Submersible ☐ Jet ☐ Reciprocating CHZ 7475		
16 Remarks, elevation, source of data, etc. 880.34		
17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co., Inc. 26 REGISTERED BUSINESS NAME REGISTRATION NO. Address 7215 W. M-59 Howell Signed [Signature] Date 11-7-73 AUTHORIZED REPRESENTATIVE		

D67d

100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE NO.

--	--	--	--	--	--	--	--	--	--

WATER WELL RECORD
ACT 294 PA 1965MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		
County Ingham	Township Name Alaiedon	Range Township Section 6 3 N X 1 E W.
Distance And Direction from Road Intersections: Michigan State University		
Street address & City of Well Location Locate with "X" in section below Sketch Map: S. R. #8 1 MI. 1 MI.		
2 FORMATION		
Hard Brown Clay	7	7
Soft Brown Clay Sand	20	27
Brown Gravel	11	38
Gray Clay	16	54
Chipped Rock & Gravel	1	55
Gray Sand Rock	9.5	64.5
White Sand Rock	15.5	80
Brown Sand Rock	2	82
White Sand Rock	7	89
USE A 2ND SHEET IF NEEDED		
16 Remarks, elevation, source of data, etc. 882.70		
3 WATER QUALITY MANAGEMENT FACILITY		
4 Well Depth 89 ft. Date of Completion 9-12-73		
5 ☐ Hand Drilled ☒ Rotary ☐ Driven ☐ Cased		
6 ☐ Public Supply ☐ Irrigation ☐ Industrial ☐ Other		
7 CASING: ☒ Welded ☐ Height Above Surface 65 ft.		
8 SCREEN: Type 4 in. to 65 ft. Depth 65 ft. Depth 65 ft. Drive Show? yes ☒ No ☐		
9 STATIC WATER LEVEL 65 ft. below land surface		
10 PUMPING LEVEL below land surface 65 ft. after 0 hrs. pumping 65 g.p.m.		
11 WATER QUALITY in Parts Per Million: Iron (Fe) 0 Chlorides (Cl) 0		
12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade		
13 Well Grouted? ☒ Yes ☐ No ☒ Next Cement ☐ Bentonite 0 ft. to 65 ft.		
14 Nearest Source of possible contamination 0 feet Direction 0 Type 0		
15 PUMP: ☐ Not installed ☒ Manufacturer's Name K&E Model Number HP 13 Volts 115 Length of Drop Pipe 65 ft. capacity 5 G.P.M. Type: ☒ Submersible ☐ Jet ☐ Reciprocating K&E F100		
17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co., Inc. 26 REGISTERED BUSINESS NAME 2215 W. M-59 REGISTRATION NO Howell Address 2215 W. M-59 Date 11-7-73 Signed [Signature] AUTHORIZED REPRESENTATIVE		

D67d 100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

[illegible]

ACT 294 PA 1965

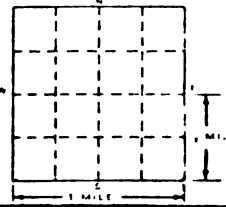
OF
PUBLIC HEALTH

D474

100M (Rev. 12-68)

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE No. WATER WELL RECORD
ACT 294 PA 1965MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		
County Ingham	Township Name Alaiedon	Section 6 3 1
Distance And Direction from Road Intersections		
Michigan State University		
Street address & City of Well Location		
Locate with "X" in section below		
Sketch Map S. R. #10		
		
2 FORMATION		
THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM	
Brown Sandy Clay	5	5
Brown Sand & Clay some Gravel	5	10
Gray Clay & Gravel	20	30
Gravel & Clay Balls	5	35
Gray Clay & Gravel	10	45
Gravel & Gray Clay Sandstone with traces	2	47
Chipped Rocks	8	55
Sand Rock	7	62
Black Shale	3	65
White Sand Rock	10	75
Gray Shale	12	87
3 WELL DEPTH		
Date of Completion 10-12-73		
Type of Well: ☒ Rotary ☐ Driven ☐ Dig		
Use: ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☒ Test Well ☒ Monitoring		
7 CASING		
Type: ☒ Threaded ☐ Welded		
Height Above Surface: _____ ft.		
Weight: _____ lbs./ft.		
Drive Shoe? ☒ Yes ☐ No		
8 SCREEN		
Type: _____		
Slot/Gauze: _____		
Set between _____ ft. and _____ ft.		
Fittings: _____		
9 STATIC WATER LEVEL		
_____ ft. below land surface		
10 PUMPING LEVEL below land surface		
_____ ft. after _____ hrs. pumping _____ g.p.m.		
_____ ft. after _____ hrs. pumping _____ g.p.m.		
11 WATER QUALITY in Parts Per Million:		
Iron (Fe) _____ Chlorides (Cl) _____		
Hardness _____ Other _____		
12 WELL HEAD COMPLETION: ☐ In Approved Pit ☒ Pitless Adapter ☒ 12" Above Grade		
13 Well Grouted? ☒ Yes ☐ No		
Neat Cement ☐ Bentonite ☐ _____		
Depth: From 0 ft. to 63 ft.		
14 Nearest Source of possible contamination		
_____ feet _____ Direction _____ Type _____		
Well disinfected upon completion ☒ Yes ☐ No		
15 PUMP: ☐ Not installed		
Manufacturer's Name Red Jacket		
Model Number 6RC-400 HP 1/2 Volts 115		
Length of Drop Pipe 44 ft. capacity 5 G.P.M.		
Type: ☒ Submersible ☐ Jet ☐ Reciprocating KH2 P088		
16 Remarks, elevation, source of data, etc. S 3.6		
17 WATER WELL CONTRACTOR'S CERTIFICATION:		
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.		
Brown Drilling Co., Inc. 26		
REGISTERED BUSINESS NAME		
REGISTRATION NO.		
Address 7215 W. M-59 Howell		
Signed [Signature] Date 11-7-73		
AUTHORIZED REPRESENTATIVE		

D67d

100M (Rev. 12-69)

IMPORTANT: File with deed.

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE NO.

WATER WELL RECORD
ACT 294 PA 1105MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL			2 FORMATION		THICKNESS OF STRATUM		DEPTH TO BOTTOM OF STRATUM	
County	Ingham	Township Name	Alaledon					
Distance And Direction from Recent Intersections			Michigan State University					
Street address & City of Well Location			S. R. #11B					
Locate with 1/4" in section below			Sketch Map					
4 WELL DEPTH: Completed to 10 ft. 86 ft. 10-12-73 5 ☐ Cable tool ☒ Rotary ☐ Driven ☐ Dig ☐ Hollow rod ☐ Jetted ☐ Bored ☐ _____ 6 USE ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring 7 CASING: Threaded ☒ Welded ☐ Height Above Surface _____ ft. _____ in. to _____ ft. Depth Weight _____ lbs. ft. _____ in. to _____ ft. Depth Drive Sheet Yes ☒ No ☐			8 SCREEN: Type: _____ Dia.: _____ Slot/Gauze _____ Length _____ Set between _____ ft. and _____ ft. Fittings: _____ 9 STATIC WATER LEVEL _____ ft. below land surface 10 PUMPING LEVEL below land surface _____ ft. after _____ hrs. pumping _____ g.p.m. _____ ft. after _____ hrs. pumping _____ g.p.m. 11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____ 12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade 13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ _____ Depth: From _____ ft. to _____ ft. 14 Nearest Source of possible contamination _____ feet Direction _____ Type _____ Well disinfected upon completion ☒ Yes ☐ No 15 PUMP: ☐ Not installed Manufacturer's Name <u>22411-50</u> Model Number <u>22411-50</u> HP <u>1/2</u> Volts <u>115</u> Length of Drop Pipe <u>65</u> ft. capacity <u>5</u> G.P.M. Type: ☒ Submersible ☐ Jet ☐ Reciprocating _____					
16 Remarks, elevation, source of data, etc.			17 WATER WELL CONTRACTOR'S CERTIFICATION:					
883.5			This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. <u>Brown Drilling Co., Inc.</u> 26 REGISTERED BUSINESS NAME REGISTRATION NO Address <u>7215 W. M-59</u> <u>Howell</u> Signed <u>[Signature]</u> Date <u>11-7-73</u> AUTHORIZED REPRESENTATIVE					

D67d

100M (Rev. 12-68)

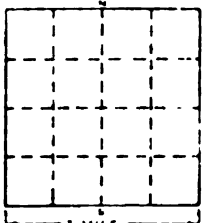
IMPORTANT: File with deed.

WELL OWNER COPY

WATER WELL RECORD

ACT 294 PA 190

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL			Water Quality Management Facility	
County Ingham	Township Name Alaledon	Range 6	Section 3	Quarter 1
Distance And Direction from Road Intersection:				
Michigan State University				
Street address & City of Well Location				
Locate with "X" in section below		Sketch Map		
		S. R. #12		
2 FORMATION				
	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM		
Top Soil	2	2		
Brown Sand	8	10		
Gray Clay	10	20		
Brown Clay	4	24		
Gray Clay	26	50		
Gray Clay, Sand Rock chips	5	55		
White Sandrock & Gray Shale shelves	5	60		
White Sand Rock	2	62		
Blue Shale	3	65		
White Sandrock some Shale	10	75		
Gray Sandrock	12	87		
USE A 2ND SHEET IF NEEDED				
16 Remarks, elevation, source of data, etc. 855.0			17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co., Inc. 26 REGISTERED BUSINESS NAME REGISTRATION NO. Address 7215 W. M-59 Howell Signed <i>[Signature]</i> Date 11-7-73 AUTHORIZED REPRESENTATIVE	

IMPORTANT: File with deed.

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE No. WATER WELL RECORD
ACT 294 PA 1967MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		
County Ingham	Township Name Alaiedon	Range Section Township 6 3 N.E. 1 E.A.
Distance And Direction from Road Intersections Michigan State University		
Street address & City of Well Location Locate well, 1/4" in section below Sketch Map S.R. #13		
2 FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Brown Clay-Sandy	29	29
Sand & Gravel	15	44
Gray Clay & Gravel, Sandrock W/traces	6	50
White Sand Rock	12	62
White Sandrock With Gray Shale	13	75
White Sandrock	12	87
USE A 2ND SHEET IF NEEDED		
16 Remarks, elevation, source of data, etc. 874.50		
17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co., Inc. 26 REGISTERED BUSINESS NAME REGISTRATION NO. Address 7215 W. M-59 Howell Signed <i>[Signature]</i> Date 11-7-73 AUTHORIZED REPRESENTATIVE		

Water Quality Management Facility

4 WELL DEPTH 87 10-15-73	
5 ☐ Latent ☒ Return ☐ Driven ☐ D.C. ☐ Recharge ☐ Jetted ☐ Bored ☐	6 USE: ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring
7 CASING: ☒ Threaded ☐ Welded ☐ Height: Above/Below Surface _____ ft. 4 in. to 63 ft. Depth 63 ft. Depth Weight _____ lbs./ft. Drive Shoe? Yes ☒ No ☐	

8 SCREEN:	
Type: _____ Dia: _____	Slot Gauge _____ Length _____
Set between _____ ft. and _____ ft.	
Fittings: _____	

9 STATIC WATER LEVEL _____ ft. below land surface

10 PUMPING LEVEL below land surface _____ ft. after _____ hrs. pumping _____ g.p.m. _____ ft. after _____ hrs. pumping _____ g.p.m.
--

11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____

12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade
--

13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ _____ Depth From 0 ft. to 63 ft.
--

14 Nearest Source of possible contamination _____ feet _____ Direction _____ Type _____ Well disinfected upon completion ☒ Yes ☐ No

15 PUMP: ☐ Not installed Manufacturer's Name Red Jacket Model Number 65C-175 HP 1/2 Volts 115 Length of Drop Pipe 60 ft. capacity 5 G.P.M. Type: ☒ Submersible ☐ Jut ☐ Reciprocating KNE FCH

IMPORTANT: File with deed.

WELL OWNER COPY

WATER WELL RECORD

ACT 234 P.S.T. 1961

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL

County

Ingham

Township

Alaiedon

Distance and Direction from Nearest Town

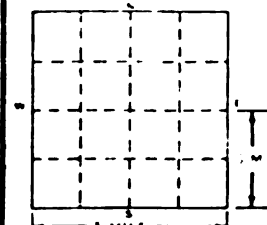
Michigan State University

Street address & City of Well Location

Locate with "X" in sketch below

Sketch Map

S. R. #14



2 FORMATION

THICKNESS
OF
STRATUMDEPTH TO
BOTTOM OF
STRATUM

Brown Sandy Clay	5	5
Brown Sand	10	15
Brown Sand, Clay, Coal	13	28
Gray Clay & Gravel	31	(59)
Gray Shale & pink Sandrock	1	60
Gray Soft Shale	15	75
Gray Sandy Shale	5	80
Gray-Black Shale	20	100
Sandy Light Gray Shale	5	105

USE A 2ND SHEET IF NEEDED

16 Remarks, elevation, source of data, etc. 889.46

Water Quality Management Facility

Address

105 10-15-73

☒ Domestic ☐ Industrial ☐ Other
☐ Irrigation ☐ Other ☐ Other
☒ Monitoring

☒ Welded ☐ Cast Iron ☐ Other
 Depth: 81 ft. Depth: 81 ft.

4 ft. Depth: 81 ft. Depth: 81 ft.
 Weight: 100 lbs. ft.

9 STATIC WATER LEVEL
 ft. below land surface
 10 PUMPING LEVEL below land surface
 ft. after hrs. pumping g.p.m.
 ft. after hrs. pumping g.p.m.

11 WATER QUALITY in Parts Per Million:
 Iron (Fe) Chlorides (Cl)
 Hardness Other

12 WELL HEAD COMPLETION: ☐ In Approved Pit
☐ Pitless Adapter ☒ 12" Above Grade
 13 Well Grouted? ☒ Yes ☐ No
☒ Best Cement ☐ Bentonite ☐ Other
 Depth From 0 ft. to 81 ft.

14 Nearest Source of possible contamination
 feet Direction Type
 Well disinfected upon completion ☒ Yes ☐ No

15 PUMP: ☐ Not installed
 Manufacturer's Name: EBC
 Model Number: EBC-100 HP 1/2 Volts 115
 Length of Draw Pipe: 65 ft. Capacity: 5 G.P.M.
 Type: ☒ Submersible ☐ JET ☐ Reciprocating
 K.H. 2094

17 WATER WELL CONTRACTOR'S CERTIFICATION

This well was drilled under my supervision and this report is true
 to the best of my knowledge and belief.

Brown Drilling Co. Inc. 26
 REGISTRATION NO.

Address: 7215 W. M-59 Howell

Date: 11-7-73

IMPORTANT: File with deed.

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE NO.

WATER WELL RECORD
ACT 294 PA 1965MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL			2. WATER QUALITY MANAGEMENT FACILITY		
County Ingham	Township Name Alaledon	Section Number 6	Range Number 3 N X	Elevation Number 1 g.w.	
Distance And Direction from Road Intersections			Address		
Michigan State University			Water Quality Management Facility		
Street address & City of Well Location			Date of Completion		
Locate with "X" in section below			4 WELL DEPTH		
Sketch Map: S. R. #15			87 ft. 10-8-73		
2 FORMATION			5 ☐ Cased hole ☒ Rotary ☐ Driven ☐ Dig		
			☐ Mottled red ☐ Jetted ☐ Bored ☐		
			6 USE ☐ Domestic ☐ Public Supply ☐ Industry		
			☐ Irrigation ☐ Air Conditioning ☐ Commercial		
			7 CASING ☒ Threaded ☐ Welded ☐ Height Above/Below Surface ☐ ft.		
			4 in. to 62 ft. Depth ☐ in. to ft. Depth Drive Shown? ☒ Yes ☐ No		
Sand, Gravel, Coal			8 SCREEN:		
Gray Clay			Type _____ Dia. _____		
Pink Clay			Slot/Gauge _____ Length _____		
Rock Shelf			Set between _____ ft. and _____ ft.		
Gray Clay			Fittings: _____		
Sand Rock			9 STATIC WATER LEVEL		
White Sand Rock			_____ ft. below land surface		
			10 PUMPING LEVEL below land surface		
			_____ ft. after _____ hrs. pumping _____ g.p.m.		
			_____ ft. after _____ hrs. pumping _____ g.p.m.		
			11 WATER QUALITY in Parts Per Million:		
			Iron (Fe) _____ Chlorides (Cl) _____		
			Hardness _____ Other _____		
			12 WELL HEAD COMPLETION: ☐ In Approved Pit		
			☐ Pitless Adapter ☒ 12" Above Grade		
			13 Well Grouted? ☒ Yes ☐ No		
			☒ Neat Cement ☐ Bentonite		
			Depth: From 0 ft. to 62 ft.		
			14 Nearest Source of possible contamination		
			_____ feet _____ Direction _____ Type _____		
			Well disinfected upon completion ☒ Yes ☐ No		
			15 PUMP:		
			☐ Not installed		
			Manufacturer's Name Red Jacket		
			Model Number 68C W3 HP 1/2 Volts 115		
			Length of Drop Pipe 65 ft. capacity 5 G.P.M.		
			Type: ☒ Submersible HHZ P 072		
			☐ Jet ☐ Reciprocating		
16 Remarks, elevation, source of data, etc.			17 WATER WELL CONTRACTOR'S CERTIFICATION		
			This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.		
			Brown Drilling Co., Inc. 26		
			REGISTERED BUSINESS NAME REGISTRATION NO.		
			Address 7215 W. M-59 Howell		
			Signed Robert J. Brown Date 11-7-73		
			AUTHORISED REPRESENTATIVE		

D67d

100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE No. WATER WELL RECORD
ACT 294 PA 1965MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		
County Ingham	Township & Range Meridian	Section 21
Distance And Direction from Road Intersections Michigan State University		
Street address & City of Well Location Locate with "X" in section below		
X D. R. #1		
2 FORMATION		
Sandy Clay	THICKNESS OF STRATUM 10	DEPTH TO BOTTOM OF STRATUM 10
Brown Sand	5	15
Fine Sand	5	20
Gravel & Coal	5	25
Sand	5	30
Course Gravel	5	35
Gravel	5	40
Grey Clay & Gravel	5	45
Grey Clay & Gravel	15	60
Grey Sandstone & Gravel	18	70
Grey Sandstone	8	86
White Sand Rock	9	95
Black Shale	10	105
White Sand Rock	100	214
USE A 2ND SHEET IF NEEDED		
3 QUALITY MANAGEMENT FACILITY Address		
4 WELL DEPTH Completed Date of Completion 21 ft. 9-21-73		
5 ☐ Cable Tool ☒ Rotary ☐ Driven ☐ Dip ☐ Jetted ☐ Bored ☐		
6 USE ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring		
7 CASING ☒ Welded ☐ Height: Above/Below Drum: 56 ft. Depth: 56 ft. Weight: lbs./ft. ☒ No Drive Shoe? Yes ☒ No ☐		
8 SCREEN Type: _____ Dia: _____ Slot/Gauze _____ Length _____ Set between _____ ft. and _____ ft. Fittings: _____		
9 STATIC WATER LEVEL 62 ft. below land surface		
10 PUMPING LEVEL below land surface _____ ft. after _____ hrs. pumping _____ g.p.m. _____ ft. after _____ hrs. pumping _____ g.p.m.		
11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chloride (Cl) _____ Hardness _____ Other _____		
12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade		
13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ Depth: From _____ ft. to _____ ft.		
14 Nearest Source of possible contamination _____ feet _____ Direction _____ Type _____ Well disinfected upon completion ☒ Yes ☐ No		
15 PUMP: ☒ Not installed REDUCED Manufacturer's Name REDUCED Model Number 600-115 HP 1/2 Volts 115 Length of Drop Pipe 56 ft. capacity 5 G.P.M. Type: ☒ Submersible KH2 P095 ☐ Jet ☐ Reciprocating		
16 Remarks, elevation, source of data, etc. NO. 2, 1, 3		
17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co., Inc. 26 REGISTERED BUSINESS NAME _____ REGISTRATION NO. _____ Address 2215 W. W-59 Powell Signed <i>[Signature]</i> Date 10-23-73 AUTHORIZED REPRESENTATIVE		

D67d

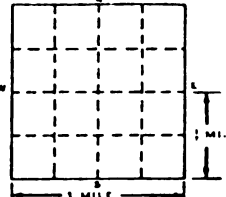
100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE NO.

WATER WELL RECORD
ACT 294 PA 1965MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

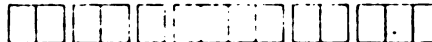
1 LOCATION OF WELL			2 FORMATION		THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM	3 OWNER OF WELL
County Ingham	Township Name Alaledon	Range 2 N 1					Address Water Quality Management Facility
Distance and Direction from Road Intersections Michigan State University							4 WELL DEPTH (Completed Date of Completion) 202 9-19-73
Street address & City of Well Location Locate with "X" in section below 			Sketch Map: D. H. #2				5 ☐ Cable tool ☒ Rotary ☐ Driven ☐ Jetted ☐ Bored
							6 USE: ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☒ Test Well ☒ Monitoring
							7 CASING: Threaded ☒ Welded ☐ Height: Above Below Surface ☐ ft. Weight ☐ lbs./ft. Drive Shoe? Yes ☒ No ☐
							8 SCREEN: Type: ☐ Dia: ☐ Slot/Gauze ☐ Length ☐ Set between ☐ ft. and ☐ ft. Fittings: ☐
							9 STATIC WATER LEVEL 25 ft. below land surface
							10 PUMPING LEVEL below land surface ft. after ☐ hrs. pumping ☐ g.p.m. ft. after ☐ hrs. pumping ☐ g.p.m.
							11 WATER QUALITY in Parts Per Million: Iron (Fe) ☐ Chlorides (Cl) ☐ Hardness ☐ Other ☐
							12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade
							13 Well Grouted? ☒ Yes ☐ No ☒ Neat Cement ☐ Bentonite ☐ Depth: From 0 ft. to 71 ft.
							14 Nearest Source of possible contamination ft. Direction ☐ Type ☐ Well disinfected upon completion ☒ Yes ☐ No
							15 PUMP: ☒ Not installed ☐ Jet ☐ Reciprocating Manufacturer's Name Red Jacket Model Number 66CWS HP 1/2 Volts 115 Length of Drop Pipe 65 ft. capacity 2 G.P.M. Type: ☒ Submersible ☐ Jet ☐ Reciprocating KH2P 090
16 Remarks, elevation, source of data, etc. 876.70			17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Brown Drilling Co., Inc. 26 REGISTERED BUSINESS NAME REGISTRATION NO. Address 7215 W. M-59 Howell Signed Kimberly L. Brown Date 10-23-73 AUTHORIZED REPRESENTATIVE				

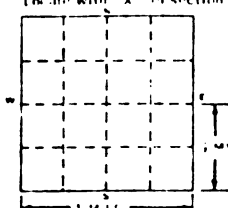
D67d

100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

GEOLOGICAL SURVEY SAMPLE NO. WATER WELL RECORD
ACT 244 PA 1100MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		
County: <u>Ingham</u> Township: <u>Alabaster</u> Range: <u>1</u> Section: <u>1</u> Well: <u>1</u>		
Distance And Direction from Road Intersect: <u>Michigan State University</u>		
Street Address & City of Well Location: Locality with T.M. or Section below: <u>D. R. 13</u>		
		
2 FORMATION		
Sand	THICKNESS OF STRATUM <u>11</u>	DEPTH TO BOTTOM OF STRATUM <u>11</u>
Gray Clay & Gravel	<u>21</u>	<u>32</u>
Small amount of White Sand	<u>15</u>	<u>47</u>
Fine Silty Sand Rock:	<u>7 (52)</u>	<u>54</u>
White Sand Stone w/Gray Clay	<u>3</u>	<u>57</u>
White - Brown Sand Rock	<u>6</u>	<u>63</u>
White Sand Rock	<u>120</u>	<u>183</u>
3 WELL DEPTH		
4 CASING		
5 SCREEN		
6 STATIC WATER LEVEL		
7 PUMPING LEVEL		
8 WATER QUALITY		
9 WELL HEAD COMPLETION		
10 NEAREST SOURCE OF POSSIBLE CONTAMINATION		
11 PUMP		
12 WATER WELL CONTRACTOR'S CERTIFICATION		
13 REMARKS, ELEVATION, SOURCE OF DATA, ETC.		

067d

100M (Rev. 12-68)

IMPORTANT: File with deed.

WELL OWNER COPY

[illegible]

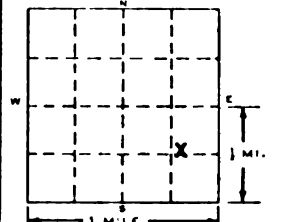
MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

DAJd 100M (Rev. 12-68)

WELL OWNER COPY

--	--	--	--	--	--	--	--	--	--	--	--	--

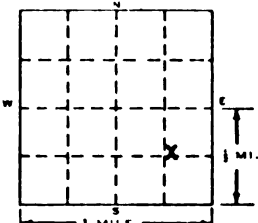
MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		ACT 294 PA 1965		PUBLIC HEALTH		
County Ingham	Township Name Aleidon	Fraction SW $\frac{1}{4}$ NE $\frac{1}{4}$ SW $\frac{1}{4}$	Section Number 6	Town Number 3	Range Number 1	E/W.
Distance And Direction from Road Intersections			3 OWNER OF WELL: Michigan State University Address W.Q.M.P.			
Well # A-			4 WELL DEPTH: (completed) Date of Completion 62 feet Oct. 25, 1977			
Street address & City of Well Location Locate with "X" in section below Sketch Map:			5 ☐ Cable tool ☒ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☐ Bored ☐			
 1 MI. 1 MILE			6 USE: ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☒ Test Well ☐			
			7 CASING: Threaded ☐ We ded ☐ Height: Above/Below Surface 12' ft. Diam. _____ 4 in. to 25 ft. Depth Weight ____ lbs./ft. in. to ____ ft. Depth Drive Shoe? Yes ☐ No ☐			
2 FORMATION			8 SCREEN:			
Brown Sandy Clay	THICKNESS OF STRATUM 20	DEPTH TO BOTTOM OF STRATUM 20	Type: _____ Dia.: _____ Slot/Gauze _____ Length _____ Set between 25 ft. and 62 ft. Fittings: _____			
Gray Clay	10	30				
Gray Clay/coarses sand & Fine Gravel	32	62	9 STATIC WATER LEVEL 12 ft. below land surface			
Black Shale	0.5	62.5	10 PUMPING LEVEL below land surface 25 ft. after 12 hrs. pumping 12 g.p.m. _____ ft. after _____ hrs. pumping _____ g.p.m.			
Sandstone	1.5	64	11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____			
			12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☒ 12" Above Grade			
			13 Well Grouted? ☒ Yes ☐ No ☐ Neat Cement ☒ Bentonite ☐ _____ Depth: From _____ ft. to _____ ft.			
			14 Nearest Source of possible contamination _____ feet _____ Direction _____ Type _____ Well disinfected upon completion ☐ Yes ☐ No			
			15 PUMP: ☒ Not installed Manufacturer's Name _____ Model Number _____ HP _____ Volts _____ Length of Drop Pipe _____ ft. capacity _____ G.P.M. Type: ☐ Submersible ☐ Reciprocating ☐ Jet			
USE A 2ND SHEET IF NEEDED			17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. REGISTERED BUSINESS NAME _____ REGISTRATION NO. _____ Address _____ Signed _____ Date _____			
16 Remarks, elevation, source of data, etc.						

GEOLOGICAL SURVEY SAMPLE NO.

--	--	--	--	--	--	--	--	--	--

WATER WELL RECORD
ACT 294 PA 1965MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		
County Ingham	Township Name Alledon	Fraction SW 1/4 ne 1/4 SW 1/4
	Section Number 6	Town Number 3
	Range Number 7	E. W. W.
Distance And Direction from Road Intersections Well B		
Street address & City of Well Location Locate with "X" in section below		
Sketch Map: 		
3 OWNER OF WELL: Michigan State University Address W.Q.H.P.		
4 WELL DEPTH: (completed) 60 ft. Date of Completion Oct. 25, 1977		
5 ☐ Cable tool ☒ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☐ Bored ☐		
6 USE: ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☒ Test Well ☐		
7 CASING: Threaded ☐ Welded ☐ Height: Above/Below Diam. _____ Surface _____ ft. _____ in. to _____ ft. Depth Weight _____ lbs./ft. _____ in. to _____ ft. Depth Drive Shoe? Yes ☐ No ☐		
8 SCREEN: Type: _____ Dia.: _____ Slot/Gauze _____ Length _____ Set between _____ ft. and _____ ft. Fittings: _____		
9 STATIC WATER LEVEL _____ ft. below land surface		
10 PUMPING LEVEL below land surface _____ ft. after _____ hrs. pumping _____ g.p.m. _____ ft. after _____ hrs. pumping _____ g.p.m.		
11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____		
12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☐ 12" Above Grade		
13 Well Grouted? ☐ Yes ☐ No ☐ Neat Cement ☐ Bentonite ☐ _____ Depth: From _____ ft. to _____ ft.		
14 Nearest Source of possible contamination _____ feet _____ Direction _____ Type _____ Well disinfected upon completion ☐ Yes ☐ No		
15 PUMP: ☐ Not installed Manufacturer's Name _____ Model Number _____ HP _____ Volts _____ Length of Drop Pipe _____ ft. capacity _____ G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating		
16 Remarks, elevation, source of data, etc.		
17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. _____ REGISTERED BUSINESS NAME REGISTRATION NO. _____ Address _____ Signed _____ Date _____ AUTHORIZED REPRESENTATIVE		

D67d

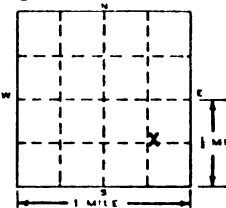
100M (Rev. 12-68)

GEOLOGICAL SURVEY COPY

GEOLOGICAL SURVEY SAMPLE No.

--	--	--	--	--	--	--	--	--	--

WATER WELL RECORD
ACT 294 PA 1965MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL		
County Ingham	Township Name Alfredon	Fraction SW 1/4 ne 1/4 SW 1/4
Section Number 6		
Town Number 3		
Range Number 1		
Distance And Direction from Road Intersections Well B		
Street address & City of Well Location Locate with "X" in section below		
 Sketch Map:		
2 FORMATION		
Brown sandy clay	15	15
Gray clay	18	38
Gray clay/ sand & gravel	12	50
Gray Clay/ sand & gravel	6	56
Gravel & clay/ coarse sand	4	60
Black shale	2	62
3 OWNER OF WELL: Michigan State University		
Address W.Q.M.P.		
4 WELL DEPTH: (completed) 60 ft. Date of Completion Oct. 25, 1977		
5 ☐ Cable tool ☒ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☐ Bored ☐		
6 USE: ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☒ Test Well ☐		
7 CASING: Threaded ☐ Welded ☐ Height: Above/Below Surface _____ ft. _____ in. to _____ ft. Depth Weight _____ lbs./ft. _____ in. to _____ ft. Depth Drive Shoe? Yes ☐ No ☐		
8 SCREEN: Type: _____ Dia.: _____ Slot/Gauze _____ Length _____ Set between _____ ft. and _____ ft. Fittings: _____		
9 STATIC WATER LEVEL _____ ft. below land surface		
10 PUMPING LEVEL below land surface _____ ft. after _____ hrs. pumping _____ g.p.m. _____ ft. after _____ hrs. pumping _____ g.p.m.		
11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____		
12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☐ 12" Above Grade		
13 Well Grouted? ☐ Yes ☐ No ☐ Neat Cement ☐ Bentonite ☐ Depth: From _____ ft. to _____ ft.		
14 Nearest Source of possible contamination _____ feet _____ Direction _____ Type _____ Well disinfected upon completion ☐ Yes ☐ No		
15 PUMP: ☐ Not installed Manufacturer's Name _____ Model Number _____ HP _____ Volts _____ Length of Drop Pipe _____ ft. capacity _____ G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating		
16 Remarks, elevation, source of data, etc.		
17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. REGISTERED BUSINESS NAME _____ REGISTRATION NO. _____ Address _____ Signed _____ AUTHORIZED REPRESENTATIVE _____ Date _____		

D67d

100M (Rev. 12-68)

GEOLOGICAL SURVEY COPY

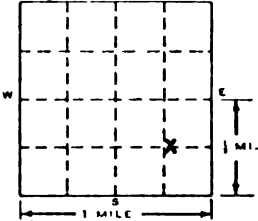
GEOLOGICAL SURVEY SAMPLE No.

--	--	--	--	--	--	--	--	--	--

WATER WELL RECORD

ACT 294 PA 1965

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL					
County Ingham	Township Name Alliedon	Fraction SW 1/4 ne 1/4 SW 1/4	Section Number 6	Town Number 3 N/2	Range Number 1 W.
Distance And Direction from Road Intersections Well c					
Street address & City of Well Location Locate with "X" in Section Below  Sketch Map:					
3 OWNER OF WELL: Michigan State University Address W.Q.M.P.					
4 WELL DEPTH: (completed) 60 ft. Date of Completion Oct. 25, 1977					
5 ☐ Cable tool ☒ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☐ Bored ☐					
6 USE: ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☒ Test Well ☐					
7 CASING: Threaded ☐ Welded ☐ Height: Above/Below Diam. _____ Surface _____ ft. _____ in. to _____ ft. Depth Weight _____ lbs./ft. _____ in. to _____ ft. Depth Drive Shoe? Yes ☐ No ☐					
8 SCREEN: Type: _____ Dia.: _____ Slot/Gauze _____ Length _____ Set between _____ ft. and _____ ft. Fittings: _____					
9 STATIC WATER LEVEL _____ ft. below land surface					
10 PUMPING LEVEL below land surface _____ ft. after _____ hrs. pumping _____ g.p.m. _____ ft. after _____ hrs. pumping _____ g.p.m.					
11 WATER QUALITY in Parts Per Million: Iron (Fe) _____ Chlorides (Cl) _____ Hardness _____ Other _____					
12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☐ 12" Above Grade					
13 Well Grouted? ☐ Yes ☐ No ☐ Neat Cement ☐ Bentonite ☐ Depth: From _____ ft. to _____ ft.					
14 Nearest Source of possible contamination _____ feet _____ Direction _____ Type _____ Well disinfected upon completion ☐ Yes ☐ No					
15 PUMP: ☐ Not installed Manufacturer's Name _____ Model Number _____ HP _____ Volts _____ Length of Drop Pipe _____ ft. capacity _____ G.P.M. Type: ☐ Submersible ☐ Jet ☐ Reciprocating					
16 Remarks, elevation, source of data, etc.				17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. REGISTERED BUSINESS NAME _____ REGISTRATION NO. _____ Address _____ Signed _____ Date _____ AUTHORIZED REPRESENTATIVE	

D67d

100M (Rev. 12-68)

GEOLOGICAL SURVEY COPY

MICHIGAN DEPARTMENT OF CONSERVATION
GEOLOGICAL SURVEY DIVISION

Permit No.

Owner No.

WATER WELL RECORD

County

Ingham

Twp.

Delhi

NE & NE & SE & Sec. 1

Town

3 NPL

Range

2 W. 2 W.

Distance from Roads, Section Lines, etc.

Horticulture site

.25 mi N of Sq. dual to mid W of College

376' W. of C/L of College Rd and 1200' S. of I-96 freeway

FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM	Owner:
Top soil	13	13	Mich. State Univ.
Clay + stones	10	23	Address:
Clay + rock	10	33	Driller and Address:
Clay	10	43	Well Depth: 373 ft. Date of Completion 9-16-65
Clay + rock	7	50	Use: ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Dewatering ☐ Test Well ☐
Gravel, fine sand	3	53	Casing: Diam. 16 in. to 65 ft. Depth
Gravel, coarse + fine S.	2	55	Height: Above/Below surface ft. Type-Weight
Sandstone Hard	17	72	Screen: Type: Dia: Slot/Gauze Length Set between ft. and ft. Accessories:
Sandstone	50	132	Water level: 40? ft. above/below
" coarse	10	142	ft. above/below
"	10	142	Meas. by Date
" shaley	10	152	Drawdown: 57? ft. after 12 hrs. pumping 503 p.m.
" fine	20	172	ft. after hrs. pumping g.p.m. Meas. by Date
"	15	187	Flow: g.p.m./g.p.h. Temp: °F
Shale	5	192	Water Quality in Parts Per million: Iron (Fe) Chlorides (Cl)
Sandstone H ₂ O 40' static	70	262	Hardness
Shale	4	266	Elevation: ft. above
Sandstone	6	272	Source of data:
Shale + Sandstone	10	282	Record by: Date:
Shale	5	287	
Sandstone	11	298	
Shale	4	302	
Sandstone 40' static	10	312	

Remarks:

MICHIGAN DEPARTMENT OF CONSERVATION
GEOLOGICAL SURVEY DIVISION

Permit No.

Page

/ of /

Sample No.
W 2203

WATER WELL RECORD

Owner No.

County

Ingham

Twp.

Dchli

NE & NE & NE

Sec. 1

Town

3N

Range

2W

E/W.

Distance from Roads, Section Lines, etc.

About 2 blocks south of Cavanaugh Road (Jolly Road) and west of College Road,
southwest of I-96 overpass at College Road.

FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM	Owner:
No record	70	70	Michigan State University
Sandstone, fine-med., white	20	90	Address: <i>Hort</i>
Shale, light gray	10	100	Driller and Address: Maurer & Parks Well Drlg.
Sandstone, fine-med., white, some			Well Depth: 300 ft. Date of Completion: Dec., 1965
shale, light gray, pyrite	10	110	☐ Cable tool ☒ Rotary ☐ Dug ☐ R.C.
Sandstone, fine-coarse, some shale	20	130	☐ Driven ☐ Jetted ☐ Bored
Shale, light gray	10	140	Use: ☐ Domestic ☐ Public Supply ☐ Industry
Sandstone, fine-med., white, pyrite,			☐ Irrigation ☐ Air Conditioning ☐ Dewatering
some shale (cavings)	10	150	☐ Test Well ☐
Sandstone, fine-med., white	30	180	Casing: Diam. 4 in. to 77 ft. Depth
Sandstone, fine-coarse, pyrite, some			Height: Above/Below surface _____ ft.
shale, black	20	200	Type-Weight _____
Sandstone, fine, white, some coal,			Screen: Type: none Dia: _____
soft	20	220	Slot/Gauze _____ Length _____
Sandstone, fine-coarse, white, some dark			Set between _____ ft. and _____ ft.
shale, pyrite	10	230	Accessories: _____
Sandstone, fine-med., white	70	300	Water level: _____ ft. above/below _____
			_____ ft. above/below _____
			Meas. by _____ Date _____
			Drawdown: _____ ft. after _____ hrs. pumping 60 g.p.m.
			_____ ft. after _____ hrs. pumping _____ g.p.m.
			Meas. by _____ Date _____
			Flow: _____ g.p.m./g.p.h. Temp: _____ °F
			Water Quality in Parts Per Million:
			Iron (Fe) _____ Chlorides (Cl) _____
			Hardness _____
			Elevation: _____ ft. above _____
			Source of data: Drlg., and samples
			Record by: RPB Date: 1/71/66
Remarks: 200' pump setting			

--	--	--	--	--	--	--	--	--

5.22

D67D 100M 6-66

GEOLOGICAL SURVEY COPY

[illegible]

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

D67d 100M (Rev. 12-63)

GEOLOGICAL SURVEY COPY

GEOLOGICAL SURVEY SAMPLE No.

833

WATER WELL RECORD

ACT 294 PA 1965

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

1 LOCATION OF WELL			3 OWNER OF WELL:	
County	Twp.	Fraction	Section No.	Town
Ingham	Albion	S 1/4 S 1/4 E 1/4	5	N/S. R/E/W.
Distance And Direction from Road Intersections			Address	
300' W of intersection of Sandhill & Hagadorn Rds. Street address & City of Well Location on E side of Hagadorn Rd.			Fred Algate 3110 Hagadorn Rd. Rt 4 Mason, Michigan	
2 FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM	4 WELL DEPTH: (completed) Date of Completion	
clay & gravel	25	25	200 ft. 12/16/57	
watersand	10	35	5 ☐ Cable tool ☒ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☐ Bored ☐	
clay & gravel	15	50	6 USE: ☒ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☐	
sandrock	10	60	7 CASING: Threaded ☒ Welded ☐ Height: Above: <u>1</u> ft. Diam. <u>1</u> in. to <u>75</u> ft. Depth Weight <u> </u> lbs./ft. <u> </u> in. to <u> </u> ft. Depth Drive Shoe? Yes ☐ No ☒	
shale	75	135	8 SCREEN: None Type: <u> </u> Dia.: <u> </u> Slot/Gauze: <u> </u> Length: <u> </u> Set between <u> </u> ft. and <u> </u> ft. Fittings: <u> </u>	
rock	65	200	9 STATIC WATER LEVEL <u>1.0</u> ft. below land surface	
			10 PUMPING LEVEL below land surface <u> </u> ft. after <u> </u> hrs. pumping <u>1.0</u> g.p.m. <u> </u> ft. after <u> </u> hrs. pumping <u> </u> g.p.m.	
			11 WATER QUALITY in Parts Per Million: <u>unknown</u> Iron (Fe) <u> </u> Chlorides (Cl) <u> </u> Hardness <u> </u>	
			12 WELL HEAD COMPLETION: ☐ In Approved Pit ☒ Pitless Adapter ☐ 12" Above Grade	
			13 GROUTING: Well Grouted? ☒ Yes ☐ No Material: ☐ Neat Cement ☐ <u> </u> Depth: From <u> </u> ft. to <u> </u> ft.	
			14 SANITARY: Nearest Source of possible contamination <u>65</u> feet <u>E</u> Direction <u>surface</u> Type Well disinfected upon completion ☒ Yes ☐ No	
			15 PUMP: Manufacturer's Name <u>Acme</u> Model Number <u>S1001</u> HP <u>1</u> Length of Drop Pipe <u>63</u> ft. capacity <u>1.5</u> G.P.M. Type: ☒ Submersible ☐ <u> </u> ☐ Jet ☐ Reciprocating	
16 Remarks, elevation, source of data, etc. WELLER: <u>Wm N. 890</u> APPROVED BY: <u> </u> REVISION BY: <u> </u> SEP 1 1968			17 WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. DAVE J. JACKSON WELL DRILLING, INC. 0320 REGISTERED BUSINESS NAME REGISTRATION NO. Address: <u>6524 Annapolis Rd., Lansing, Michigan</u> Signed: <u>Dave Jackson</u> Date: <u>11/30/68</u> AUTHORIZED REPRESENTATIVE	

D67D 100M 6-66

GEOLOGICAL SURVEY COPY

WATER WELL RECORD

227 734 25 1935

MICHIGAN DEPARTMENT
OF
PUBLIC HEALTH

FEDERAL BUREAU OF INVESTIGATION
 WASHINGTON, D. C. 20535
 Date: 11/14/77
 File No.: 100-443891
 Subject: AL NERDRUM
 610 W. OTTAWA ST.
 S.W.

1. NAME OF WELL: AL NERDRUM
 2. ADDRESS: 610 W. OTTAWA ST., S.W.
 3. CITY: ALBUQUERQUE, N.M.
 4. STATE: N.M.
 5. ZIP: 87101

6. DATE OF INSTALLATION: 11/14/77
 7. WELL DEPTH (feet): 130
 8. WELL TYPE: ☒ Casing ☐ Driven ☐ Jet
☐ Rotary ☐ Air Lift ☐ Other

9. WELL PURPOSE: ☒ Domestic ☐ Public Supply ☐ Industry
☐ Irrigation ☐ Air Conditioning ☐ Commercial
☐ Test Well ☐ Other

10. CASING: Thread: ☒ Welded ☐ Weight: Above/Below
 Diameter: 4 in. to 63 in. Depth: 11 lbs./ft.
 Drive S. or N. of: ☐ No

11. SCREEN: Type: ☐ Slot ☐ Wire Cloth
 Slot: ☐ Size: ☐ Length: ☐
 Set between: ☐ ft. and ☐ ft.
 Fittings: ☐

12. STATIC WATER LEVEL: 21 ft. below land surface
 13. PUMPING LEVEL below land surface:
 _____ ft. after _____ hrs. pumping _____ g.p.m.
 _____ ft. after _____ hrs. pumping _____ g.p.m.

14. WATER QUALITY in Parts Per Million:
 Iron (Fe): _____ Chloride (Cl): _____
 Hardness: _____ Other: _____

15. WELL HEAD COMPLETION: ☐ In Approved P.C.
☒ Plug Adapter ☒ 12" Above Grade
☐ Well Capped ☐ Yes ☐ No
☐ Not Cement ☐ Bentonite ☐ _____

16. SOURCE OF POSSIBLE CONTAMINATION:
 1/5 ft. North Direction SEPTIC Type _____
 Well is surfaced upon completion ☒ Yes ☐ No

17. PUMP: ☐ Not installed
 Manufacturer's Name MYERS
 Model Number 524-220 No. 220
 Length of Drop Pipe 43 ft. capacity 10 G.P.M.
 Type ☒ Submersible ☐ Jet ☐ Electric

18. WATER WELL CONTRACTOR'S CERTIFICATION:
 This well was drilled under my supervision and this report is true
 to the best of my knowledge and belief.
 Signature: [Signature] Date: 11/30/77
 Address: 641 W. 11th Road, Detroit, MI 48206

19. FORMATION:
 Clay 15 15
 Grey Clay 17 32
 Tuff 2 2
 Grey Clay w/ gravel stones 25 60
 Sandstone, white 16 75
 Limestone, brown, very hard 8 84
 Sandstone 7 93
 Shale sandstone 37 130
 Shale 130

20. OTHER NOTES:
 8895 ELt

GEOLOGICAL SURVEY COPY

APPENDIX B

Depth to Water Table
(feet)

Drift Well #	Sept. 1st	Oct. 1st	Nov. 1st	Dec. 1st	Jan. 4th-5th	Feb. 15th	March 5th	April 3rd	May 2nd	June 3rd	July 1st	Aug. 3rd	Sept. 1st
20	26.25	26.5	26.9	27.5	27.73	28.19	27.9	28.0	27.5	28.0	28.2	28.2	28.38
21	5.2	5.15	5.15	5.2	5.07	5.48	4.87	4.07	3.9	5.8	5.3	5.8	6.0
22	7.0	8.3	7.5	8.5	7.5	7.5	7.08	7.4	6.1	6.25	6.7	7.5	7.7
23	11.0	11.0	10.75	10.9	10.73	11.23	10.87	9.61	9.4	11.0	11.0	11.8	12.0
24	*	9.4	8.9	8.9	8.73	9.07	7.4	5.94	6.65	8.65	9.1	9.8	10.1
25	24.0	24.0	24.0	24.4	24.17	24.29	24.58	23.58	22.92	23.8	24.2	24.8	25.2
26	23.5	23.9	24.1	24.9	24.65	24.82	24.87	24.58	23.98	24.65	25.1	25.3	25.4
27	12.0	12.9	13.0	13.3	13.42	13.79	13.58	13.17	13.00	13.6	13.9	14.6	14.9
36	21.0	21.1	21.3	21.4	21.43	21.85	21.77	21.1	20.56	21.4	21.8	22.1	22.6
37	13.0	12.9	13.2	14.1	14.48	14.98	14.07	13.7	13.2	13.7	13.8	14.2	14.41
38	21.6	21.55	21.70	22.3	22.09	22.47	22.38	21.55	20.8	21.9	21.9	22.7	23.0
39	D	D	19.35	19.7	20.10	20.96	20.52	20.81	20.96	21.4	21.3	D	21.7
6b	*	*	D	D	D	D	*	D	*	*	D	*	*
7	*	D	*	*	D	*	*	D	*	*	D	*	*
8	*	34.1	*	*	35.0	*	*	35.75	*	*	D	*	*
9	*	36.9	*	*	D	*	*	D	*	*	D	*	*
10	*	32.8	*	*	33.04	*	*	33.67	*	*	33.75	*	*
11	*	29.2	*	*	30.89	*	*	30.43	*	*	30.81	*	*
12	*	26.6	*	*	27.57	*	*	27.82	*	*	27.82	*	*
14	*	26.0	*	*	24.96	*	*	26.9	*	*	26.52	*	*
15	*	12.0	*	*	14.15	*	*	10.9	*	*	13.69	*	*
19	*	16.25	*	*	18.33	*	*	16.58	*	*	16.5	*	*
31	*	19.0	*	*	20.45	*	*	*	*	*	21.99	*	*
34	*	37.9	*	*	37.18	*	*	*	*	*	39.43	*	*
35	*	11.55	*	*	13.92	*	*	*	*	*	14.58	*	*
40	*	D	*	*	D	*	*	D	*	*	D	*	*
41	*	*	*	*	*	*	*	*	*	*	*	*	*
16	*	D	*	*	*	*	*	*	*	*	*	*	*
17	*	D	*	*	*	*	*	*	*	*	*	*	*
29A	*	D	*	*	*	*	*	*	*	*	*	*	*
30A	*	D	*	*	*	*	*	*	*	*	*	*	*
3	*	D	*	*	*	*	*	*	*	*	*	*	*
4	*	D	*	*	*	*	*	*	*	*	*	*	*

D = measured dry

* = not measured

Water Table Elevations (feet amsl)

Drift Well #	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.
8	*	853.4	*	*	852.5	*	*	851.8	*	*	D	*	*
9	*	853.6	*	*	D	*	*	D	*	*	D	*	*
10	*	846.7	*	*	846.5	*	*	845.8	*	*	845.8	*	*
11	*	852.3	*	*	850.6	*	*	851.1	*	*	850.7	*	*
12	*	856.5	*	*	855.5	*	*	855.3	*	*	855.3	*	*
14	*	834.9	*	*	836.0	*	*	834.0	*	*	834.4	*	*
15	*	849.3	*	*	847.2	*	*	850.4	*	*	847.6	*	*
19	*	846.8	*	*	844.7	*	*	846.4	*	*	846.5	*	*
20	861.8	861.5	861.1	860.5	860.3	859.8	860.1	860.0	860.5	860.0	859.8	859.8	859.6
21	847.4	847.5	847.5	847.4	847.5	847.1	847.7	848.5	848.7	846.8	847.3	846.8	846.6
22	848.0	846.7	847.5	846.5	847.5	847.5	848.0	847.6	848.9	848.8	848.3	847.5	847.3
23	844.5	844.5	844.8	844.6	844.8	844.3	844.6	845.9	846.1	844.5	844.5	843.7	843.5
24	*	845.6	846.1	846.1	846.3	845.9	847.6	849.1	848.4	846.4	845.9	845.2	844.9
25	850.7	850.7	850.7	850.3	850.5	850.4	850.1	851.1	851.8	850.9	850.5	849.9	849.5
26	858.3	857.9	857.7	856.9	857.2	857.0	856.9	857.2	857.8	857.2	856.7	856.5	856.4
27	881.6	880.7	880.6	880.3	880.2	879.8	880.0	880.4	880.6	880.0	879.7	879.0	878.7
31	*	863.8	*	*	862.4	*	*	*	*	*	860.8	*	*
34	*	831.7	*	*	832.4	*	*	*	*	*	830.2	*	*
35	*	872.4	*	*	870.0	*	*	*	*	*	869.3	*	*
36	848.0	847.9	847.7	847.6	847.6	847.2	847.2	847.9	848.4	847.6	847.2	846.9	846.4
37	857.2	857.3	857.0	856.1	855.7	855.2	856.1	856.5	857.0	856.5	856.4	856.0	855.8
38	847.5	847.6	847.4	846.8	847.0	846.3	846.7	847.6	848.3	847.2	847.2	846.4	846.1
39	D	D	857.4	857.1	856.7	855.8	856.3	856.0	855.8	855.4	855.5	D	855.1
EX. A													

D = measured dry

* = well not measured

APPENDIX C

APPENDIX C

The rise of the water table in response to a vertically downward uniform rate of recharge (Hantush, 1967).

$$h_m^2 - h_i^2 = \frac{W_m \bar{M} t}{15 S_y} \left\{ W^* \left[1.37 (b_m + x) \sqrt{\frac{S_y}{T t}}, 1.37 (a_m + y) \sqrt{\frac{S_y}{T t}} \right] \right. \\ + W^* \left[1.37 (b_m + x) \sqrt{\frac{S_y}{T t}}, 1.37 (a_m - y) \sqrt{\frac{S_y}{T t}} \right] \\ + W^* \left[1.37 (b_m - x) \sqrt{\frac{S_y}{T t}}, 1.37 (a_m + y) \sqrt{\frac{S_y}{T t}} \right] \\ \left. + W^* \left[1.37 (b_m - x) \sqrt{\frac{S_y}{T t}}, 1.37 (a_m - y) \sqrt{\frac{S_y}{T t}} \right] \right\}$$

Where

h_i = initial height of water table above aquiclude, in feet

h_m = height of water table above aquiclude with recharge, in feet

W_m = recharge rate, in gpd per unit area

$\bar{M}$ = $0.5 (h_i + h_m)$, in feet

t = time after recharge starts, in days

S_y = specific yield of aquifer, fraction

b_m = one-half width of recharge area, in feet

x, y = coordinates of observation point in relation to center of recharge area, in feet

T = coefficient of transmissibility, in gpd/ft

a_m = one-half length of recharge area, in feet

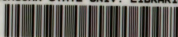
$W^* (a_m, b_m)$ from tables (Hantush, 1967)

The decay of the water table (Hantush, 1967).

$$h_m^2 - h_i^2 = Z(x,y,t) - Z(x,y,t-t_0)$$

Where $Z(x,y,t)$, $Z(x,y,t-t_0)$ is the right hand member of the above equation and t_0 is the time after recharge ceases, in days.

MICHIGAN STATE UNIV. LIBRARIES



31293100643299