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FORD MOTOR COMPANY—WIXOM ASSEMBLY PLANT

HYDROGEOLOGIC INVESTIGATION

By

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FORD MOTOR COMPANY—WIXOM ASSEMBLY PLANT

In June and July of 1987, the Hydrogeologic Section of the Environmental Response Division (ERD), Michigan Department of Natural Resources (MDNR), responded to a request by the Detroit District Environmental Response Division staff to participate in a field investigation at Ford Motor Company's Wixom Assembly Plant. In mid 1986, drums containing hazardous materials were uncovered during construction of an on-site wastewater treatment facility and raised concerns about reports that other hazardous materials were buried within the plant property.

The purpose of the investigation was to confirm the presence of purported buried wastes by (1) identifying their location(s) through the use of geophysical methods and correlation borings, (2) by collecting and analyzing soil samples of questionable materials, and (3) by collecting and analyzing groundwater samples to determine whether hazardous materials were causing groundwater contamination.

A field visit to the plant was made by MDNR personnel in June of 1987 to evaluate site conditions as they related to the goals of the investigation. The area was inspected for locations of overhead and underground utilities, buildings, roads, lagoons, surface topography, etc. The site (Figure 1; 2 sheets) was divided into three separate areas, each having a specific investigative goal.

Site #1 consists of a landfill of approximately 25 acres in size. In this area, the goal was to determine whether local groundwater quality was impacted by the landfill. This was accomplished by installing several monitor wells at specific depths and locations, as necessary, around the perimeter of the landfill. Groundwater was sampled from these wells by District staff and analyzed for selected parameters by the MDNR Environmental Laboratory.

Site #2 consists of a rectangular area approximately 1000 feet x 400 feet. In site #2, an EM survey was conducted throughout the area to define sites of anomalous electrical conductivities. These anomalous areas, contrasting with background conductivities, were further investigated by collecting continuous split spoon core samples from the ground surface to an unaffected depth. Questionable materials collected during the sampling process were analyzed by the MDNR Environmental Laboratory for selected parameters. If a saturated zone was encountered during the sampling, a temporary well would be installed to collect a water sample for analysis by the laboratory.

Site #3 consists of a triangular area approximately 300 feet x 350 feet x 150 feet. During construction of footings for an overhead trestle system, questionable sludge materials were uncovered. An intensive soil boring and split spoon sampling program will be conducted to define the horizontal and vertical extent of the sludges. If a saturated zone was encountered during the sampling, a temporary well would be installed to collect a water sample for analysis.

GEOLOGY

Wixom is situated in a diverse geologic setting. The surface and near surface features are a result of several periods of glaciation, most likely the result of the most recent which ended approximately 10,000 years ago. Many landforms are located in the area, ranging from lakes and swamps to level plains and rolling hills. All types of soils exist, from sands and gravels to clays and mucks. As can be seen by a review of a glacial geologic map of the area (Figure 2), the Wixom area lies in a outwash channel directly west of two parallel morainal ridge formations. These moraines represent the margins of glacial ice and are composed of medium to coarse grained sands, gravels, clays, and loams randomly deposited when glacial ice was at a standstill. Between these ridges and directly adjacent to them are outwash deposits consisting of stratified sands, silts, and gravels. These deposits were created as a result of sedimentation from soil laden glacial melt waters.

--- DENOTES GLACIAL OUTWASH DEPOSITS
(i.e., stratified sands, gravels, etc.)

--- DENOTES GLACIAL MORAINAL DEPOSITS
(i.e., unstratified clays, loams, etc.)

Specifically, the Ford Assembly plant is situated on both outwash and morainal deposits. Near surface soils consist of clays, silts, loams, sands, and gravels, and combinations of some or all of the above. Most of the outwash deposits occur in layers ranging from a few inches to a few feet in thickness. Not all layers are continuous throughout the area and may not even exist in others. The morainal materials are randomly deposited and exhibit no specific vertical or horizontal features. The combination of outwash and morainal deposits in the plant area contribute to complex groundwater flow patterns.

INVESTIGATION--SITE #1

In Site #1, a total of 9 wells were installed (Figure 1). Previous studies conducted within the plant property indicated a north-northwesterly groundwater flow direction. Assuming this information is correct, three to four of the wells can be considered upgradient of the landfill and the remainder as downgradient. All wells were screened in saturated zones as determined by drilling to an approximate depth of 25-30 feet. Three of these upgradient wells are located immediately southeast of the fill, and the fourth well is located west-southwest of the fill. All of these wells were completed with the screen section in the saturated zone nearest the ground surface. None of the wells were developed with the exception of monitor well #1.

All drill cuttings were placed in 55 gallon drums provided by Ford Motor Company pending hazardous waste characterization, with the exception of monitor well #1. This well was completed and developed prior to the request to drum all drill cuttings and fluids. Characterization of materials for the presence of hazardous materials would determine the methods of dealing with borehole materials and future development waters.

A total of five wells were installed at four locations downgradient from the landfill. These wells were located along the north and northwestern sides of the landfill. Each well was completed in the saturated zone nearest the ground surface with the exception of monitor well #4D. This well was screened in a lower zone of saturation to establish a sampling point for monitoring groundwater quality in the lower zone.

Care was taken to prevent any connection between saturated zones in the event that either one or all were contaminated. This was accomplished by grouting the entire length of the borehole except in the immediate vicinity of the screened interval. Grouting consisted of pumping an expansive bentonite slurry down the borehole through the center of the in-hole hollow stem augers. As the level of the grout was elevated to the surface, augers were pulled from the borehole, permitting the bentonite slurry to flow into the borehole from the bottom of the augers. This insured an effective seal between different zones within the borehole. A cemented zone at the top of each borehole provided a seal against any surface induced contaminant from entering the borehole. Each well was equipped with a locking vented cap for security. See Appendix B for individual well logs.

All augering equipment was thoroughly steam cleaned prior to use and after each installation to prevent any contamination or cross contamination from impacting the wells.

All the monitor wells were vertically gamma ray logged. Gamma ray logging is a borehole geophysical technique used in interpreting the vertical lithologic distribution of soils in the immediate vicinity of the borehole. Gamma ray logging measures the total amount of naturally occurring gamma radiation, in counts per second, within soils caused by the presence of uranium, thorium, and potassium. Generally, clay and silt materials, which act as hydrologic barriers, are more radioactive than sands and gravels.

Gamma logging is conducted by lowering and raising a cylindrical gamma radiation measuring probe inside the well. The instrument is calibrated, with respect to the total range of radioactivity present, as it is lowered into the well and a record of the hole collected as the probe is elevated at a specific rate of speed.

INVESTIGATION-SITE #2

In site #2, an electromagnetic (EM) conductivity survey utilizing a Geonics EM-31 instrument was conducted by DNR geologist Kevin Kincare. Sharon A. Mason, Ford Motor Company hydrogeologist, assisted in this survey.

The EM-31 is a geophysical instrument which utilizes two electrical coils to induce and measure an electromagnetic field. A transmitter coil induces an electromagnetic field into the ground and a receiver coil measures the resultant current field which is directly proportional to the ground conductivity. This instrument is useful in delineating areas of buried metallic objects or extraneous fluids having conductivities contrasting with background levels. This instrument has a fixed intercoil spacing of 3.7 meters for an effective depth of exploration of approximately 6 meters.

Ground conductivity is dependant on the ionization characteristics of the soil. It is also dependant on the fluid content and type. For instance, quartz sand has few unsatisfied electrical bonding sites in its chemical structure and, therefore, exhibits low conductivity. Clay minerals have net electrical charges (many bonding sites) and resultant high conductivities. Water with low levels of dissolved solids have few ions in solution, a low ionization potential, and low conductivities. Increasing the amount of dissolved solids, therefore, increases the conductivity. Metals are characterized as having shared electrons that are easily ionized and as such, metals, especially ferrous metals, have very high conductivities.

For this survey, a point at the extreme northern end of the plant property--X-1525, Y-2475--was chosen for calibrating the EM-31. This point and the surrounding area north of the ditch had a relatively uniform conductivity of 13 mmhos/meter.

The total area which could be effectively surveyed within site #2 was somewhat limited by the presence of metallic construction materials (cultural interferences) stored about the site. However, several clear lines were surveyed. Refer to Figure 1 for locations of the EM data points.

Two areas were discovered, one having conductivity values approximately twice as high as background and another having values approximately 10-15 times background. These areas were cored by the split spoon method and samples collected for analysis when questionable materials were encountered. Additional borings were conducted in background areas for the purpose of correlation to the EM survey.

INVESTIGATION-SITE #3

In site #3, a total of 10 borings were conducted (Figure 1). Each boring was conducted by progressively advancing a two foot split spoon sampler ahead of the auger string. Continuous samples were collected at two foot intervals from the surface to an unaffected depth. When questionable materials or saturated zones in the immediate vicinity of the questionable material were encountered, a sample was collected for laboratory analysis. Each boring was either backfilled with a expansive bentonite slurry or with the borehole cuttings depending on the geologic conditions present. See Appendix C for individual boring logs.

INVESTIGATION RESULTS

In site #1, the three upgradient wells depict a multi-layered pattern. This pattern consists of a brown to grey loamy clay layer from the surface to approximately 3 feet below grade. From 3-7 feet, there are sands & loams, from 7-12 feet are clays & loams, from 12-15 feet are sandy zones, from 15-25 feet are loams & clays, and from 25 feet to the

bottom of the borehole are predominantly sands & gravels with substantially less clays than the above layers. The extent, depths, and thicknesses of these layers vary from well to well. The remaining monitor wells downgradient of the landfill also depict a multi-layered pattern. This pattern consists of a fairly thick (3-5 feet) layer of black top soil overlying a 4 feet thick saturated grey silt to sand layer. These layers are above a 10-12 feet thick brown and grey silty clay layer having a minor (1-2 feet) thick silty sand layer within it. This silty sand layer in some instances is saturated. Below this are saturated silty grey sand and gravel layers (20-27 feet below grade) interbedded with thin (less than 1 foot) layers of silty clay.

The silty clay layers from approximately 9-20 feet below grade appear to diminish in thickness and lateral extent to the west. In monitor wells #5 & #7, the layers are less predominant and are replaced by more sand and gravel materials.

Generally, it could be inferred that a similar multi-layered pattern existed in the landfill area. Prior to its existence, the area was likely as follows: from the surface to an approximate depth of 5 feet was top soil, from 5 feet to approximately 10 feet was a sand and gravel layer, from 10 feet to approximately 21 feet was a silty clay layer interbedded with minor sand lenses, from 21 feet to 25 was saturated silty sands and gravels, and from 25 feet-? was silty clays.

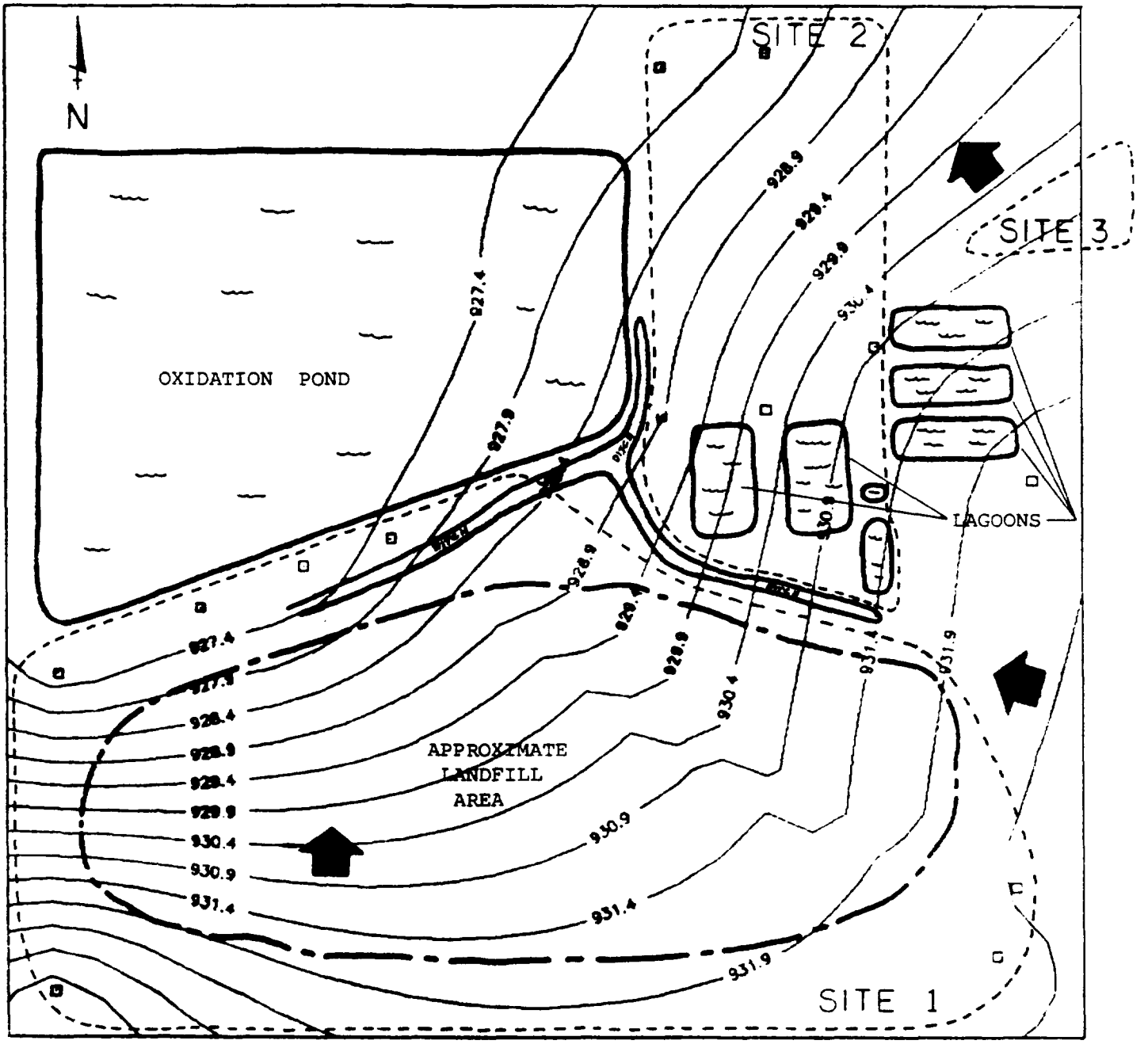
Because of the potential hazards, no drilling was conducted within the landfill. Therefore, no positive connection or correlation of layers was determined. Certainly, the upper 5-10 feet of soil has been disturbed by the landfill operations. The lower sand and gravel layers may be acting as possible conduits to fluid movement, depending on the depth of the landfill cut and the lateral and vertical extent of the clay deposits.

After all monitor wells were installed and allowed to equilibrate, a static water elevation was measured in each well. Comparison of the static water elevations to the geologic cross-sections indicate confined aquifer conditions and, therefore, the elevations are indicative of a piezometric surface as compared to a water table surface. This data was used to determine the piezometric surface configuration for the area and a contour map (Figure 3) prepared which graphically shows the surface and the local groundwater flow direction. Analysis of the map indicates that groundwater is flowing in a north to northwest direction depending on location and confirms the flow direction determined from previous studies. There does not appear to be any groundwater mounding in the vicinity of the landfill which could infer its geologic isolation from the surrounding area.

In site #2, the electromagnetic (EM) survey was conducted in all areas where no cultural interferences existed (Figure 1) and a statistical analysis of the data performed. From a total of 821 points, the highest value was 140 mmhos/m and the lowest point was 0.7 mmhos/m. The sample mean was 33 mmhos/m with a mode of 19 mmhos/m which indicates an uneven distribution. Sample skewness of 1.3 indicates a strong imbalance toward lower values. The kurtosis value of 3.8 shows an extreme degree of clustering of data values around the mean. The standard deviation of the sample population is 28. Values above 100 mmhos/m are, therefore, 2.39 standard deviations from the mean. There is a 98% chance that values greater than 100 mmhos/m are anomalous.

The majority of survey lines indicated no electromagnetic anomalies and had values ranging from 10-20 mmhos/meter. Three measurements of sludges generated at the plant were taken in the dewatered half of an oxidation pond on site to determine if they might have any impact on ground conductivities. Two measurements of 11 mmhos/m and one measurement of 12 mmhos/m indicate that the sludges would not cause any electromagnetic anomalies. There is a strong anomaly, however, in the southeastern portion of the site. This anomaly extends radially about 20 feet from the point at X-1735, Y-1555. The highest measurement of conductivity (140 mmhos/m) occurred at X-1735, Y-1535 with 30 adjacent

FIGURE 3



PIEZOMETRIC SURFACE and GROUNDWATER FLOW DIRECTIONS

⊡ - DENOTES MONITOR WELL

-DENOTES GROUNDWATER FLOW DIRECTION

points having values in excess of 100 mmhos/m. Two correlation soil borings (#12 & #13) were conducted in this area to determine the source of the anomaly. From approximately 1-5 feet below grade, a black greasy sand and gravel mixture containing melted metallic materials was found.

This material appears to be some type of foundry sand and is likely the cause of the anomalous EM readings because of its composition and proximity to the surface. Below this layer, clay deposits were found to an approximate depth of 10-11 feet. No borings within this anomalous area were extended below this depth. Soil boring #12 was abandoned by grouting the entire length of the borehole with an expansive bentonite slurry because of the saturated zone at 10-10.5 feet below grade. Soil boring #13 was abandoned by backfilling the hole with compacted borehole materials.

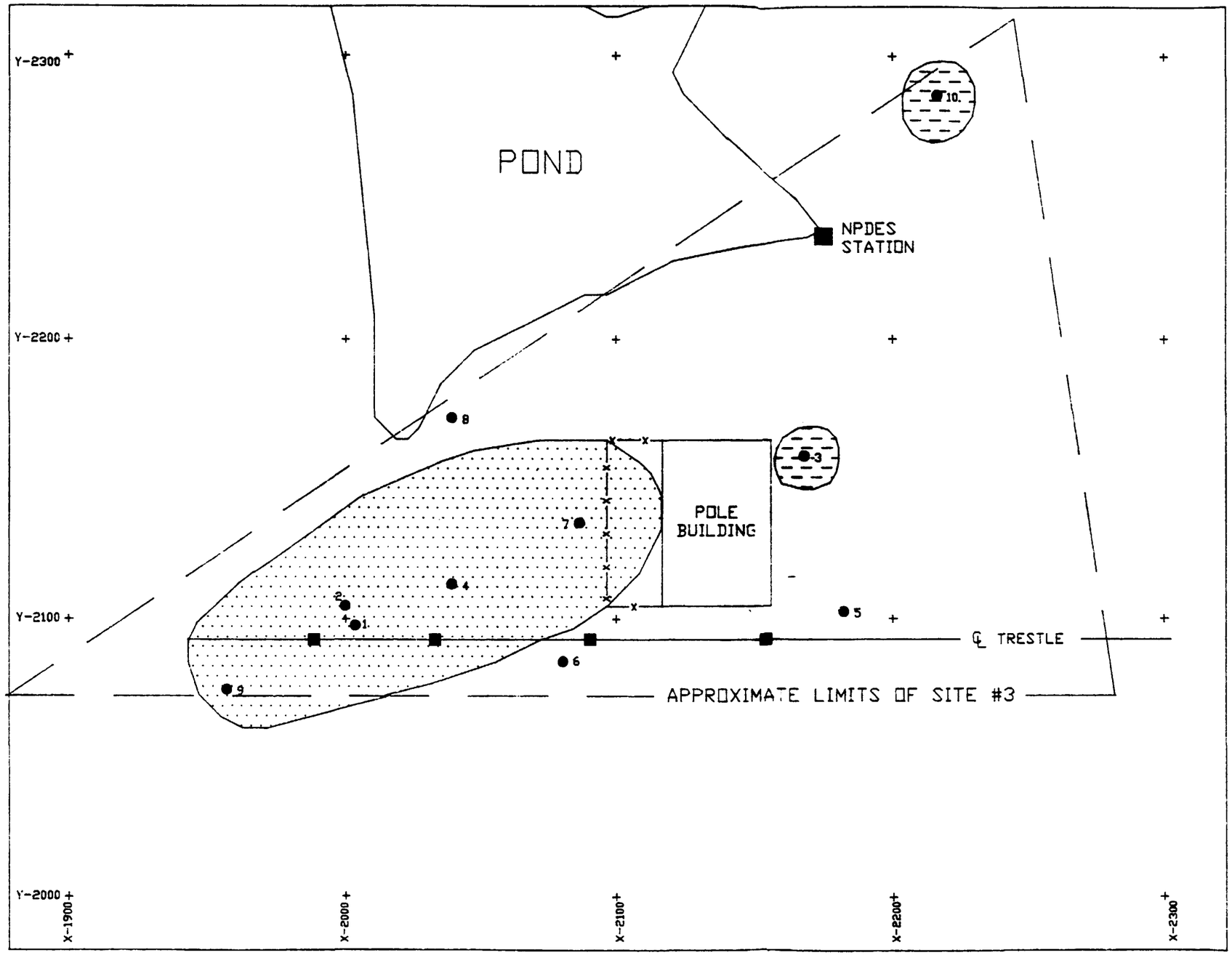
A correlation soil boring (#11) at station X-1745, Y-1940 was conducted in the area having EM values approximately double that of background. Three feet of gravel overlies clay deposits of at least 11 feet in thickness. No questionable materials were found in this boring. The borehole was abandoned by backfilling with compacted borehole materials. The slightly elevated EM values in this area are likely attributable to scattered scrap metal near the surface, the composition of the gravel, or to the amount and extent of clay found in the boring.

A correlation soil boring (#14) was conducted at the extreme northwestern corner of the plant property. In this boring, a soft red cohesive loamy layer was found from approximately 1-2 feet below grade. Below this layer was clay interbedded with thin (less than 1/2 feet thick) sand lenses. A sample of this red loamy material was collected for analysis and the borehole abandoned. A final correlation boring (#15) was conducted at X-1668, Y-2100, a randomly chosen location. This boring consisted of mostly silty clay deposits interbedded with thin lenses of clay loams. No questionable materials were discovered in this boring and the hole was abandoned.

In site #3, five of the ten borings revealed the presence of sludge materials. This sludge was black in color, had a tar-like consistency, and was found in a zone ranging from 4-7 feet in depth. In soil boring #7, the sludge was found from approximately 5-9.5 feet below grade. Several samples of this material were collected for laboratory analysis. In soil boring #2, the sludge had a sandy texture and was saturated. A temporary well was installed and a water sample collected from this boring.

Two of the remaining borings revealed the presence of black foundry-type sand and gravel. Melted metallic materials were present in these soils indicating a non-natural origin. Figure 4 is an enlargement from Figure 1 of the area where these sludges and questionable materials were found and delineates their approximate lateral extent.

In soil borings where the tar like substances were found, all questionable materials were stored in 55 gallons drums. All of the soil borings in site #3 were abandoned in a manner dependent on the geologic conditions present. If any saturated zones were encountered at any depth within the boring, the entire borehole was filled with an expansive bentonite slurry. If no saturated zones were encountered, the borehole was backfilled with compacted borehole materials. Throughout sites #2 & #3, all of the soil borings consisted of interbedded sand and clay deposits. The predominant soil was clay. It appears that these clays were both till and swamp deposits. The till clays were quite silty, dry, and contained a mixture of pebbles of varying sizes. The swamp deposits contained organically decaying roots and twigs and contained shells of simple organisms in a clay matrix.



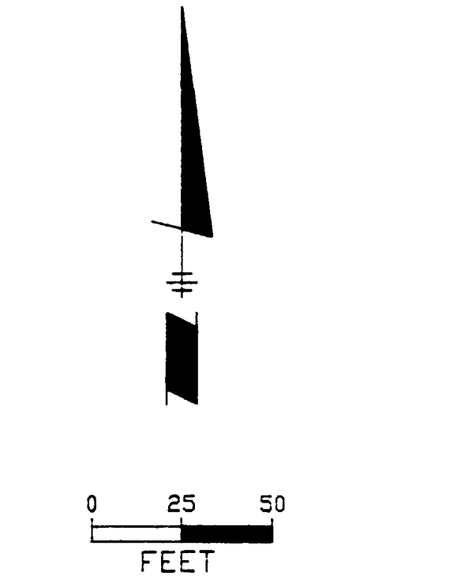


FIGURE 4

APPROXIMATE LIMITS OF SLUDGES & FOUNDRY-TYPE SANDS IN SITE #3

On July 22 and 23, 1987, all of the monitor wells were sampled for analysis by the MDNR Environmental Laboratory and the Ford Motor Company laboratory. Each well was developed by the surge block method for a limited period of time. The amount of time that each well was developed was either (1) until a 55 gallon drum was filled, (2) until development water was clear, (3) or it was believed that the development water was representative of the aquifer zone in which it was screened. The development water from each well was collected into 55 gallon drums provided by Ford Motor Company, pending chemical analysis.

A complete listing of all samples collected and their locations is included in this report (Appendix A). All of the monitor well logs and gamma ray logs (Appendix B) and soil boring data (Appendix C) are included in this report. Actual EM field data is available on request.

A P P E N D I X A

SAMPLES COLLECTED FOR LABORATORY ANALYSIS

FORD WIXOM

SITE #3 (Trestle Area)

Test Boring Locations #1 - #10

Sample Collection Locations

SOILS:

TB-1 (6 ft. depth)--Black Sludge Material
07/1/87 12:30

TB-4 (7-1/2 ft. depth)--Black Sludge Material
07/02/87 14.10

TB-4 (11-13 ft. depth)--Clay Beneath Sludge
07/02/87 14:30

TB-5 (4-6 ft. depth)--Gray Silty Clay (greasy)
07/14/87 14:25

TB-6 (4-6 ft. depth)--gray discolored clay
07/14/87 15:15

TB-6 (7 ft. depth)--Reddish Black Sludge
07/14/87 15:40

TB-7 (9-1/2 ft. depth)--Reddish Black Sludge
07/15/87 10:20

TB-10 (2-4 ft. depth)--Black Foundry Type Material
07/16/87 11:15

WATER

TB-2 (6 ft.)--GW from Black Sludge Zone
07/01/87 13:40

TB-9 (10-12 ft.)
07/15/87 15:05

TB-10 (10-12 ft.)
07/16/87 14:30

SITE #2

Sample Locations #11-#14

Samples Collected:

SOILS:

TB-13 (1-2 ft. depth)--Black Foundry Waste
07/22/87 11:00

TB-14 (1-2 ft. depth)--Red Sludge
07/23/87 16:15

A P P E N D I X B

MONITOR WELL & GAMMA RAY LOGS

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT) MONITOR WELL #: 1
GEOLOGIST: D. MONET INSTALLATION DATE: 05/24/87
TOWN: 2 N RANGE: 8 E COUNTY: OAKLAND TOWNSHIP:
SECTION: 7 FRACTION: SW 1/4 NE 1/4

DRILLING DATA

Drilling Method: HOLLOW STEM AUGER	Type of Bit: CARBIDE TEETH
Drilling Fluids;	Casing size;
fluid: from: to:	size: from: to:
fluid: from: to:	size: from: to:

MONITOR WELL DESCRIPTION

Screen Type: STAINLESS STEEL WIRE WOUND	Casing Pipe Material: GALVANIZED STEEL
Diameter of perforated section: 2 INCH	Pipe Diameters; O.D.: I.D.: 2 IN
Perforation Type; slots: X holes: screen:	Pipe Sections; Length: 18 FT Number: 2
Screen point; Perforation size: #7 Length: 2 FT	Length: Number:
Screen sections;	Length: Number:
Perforation size: # 7 Length: Number:	Length: Number:
Perforation size: # 7 Length: Number:	
Total perforated length: 2 FT	Joining Methods: GALVANIZED COUPLINGS

PROTECTION SYSTEM

Casing protective pipe length:	Other protection: LOCKING CAP
Protective pipe O.D.:	

WELL CONSTRUCTION DATA

	DISTANCE ABOVE/BELOW GROUND SURFACE	
Top of Casing Pipe	3 FT +/- ABOVE GRADE	
Top of Protective Pipe		
Perforated Section	33 FT - 37 FT BELOW GRADE	
Screen Tip	37 FT BELOW GRADE	
Bottom of Borehole	38 FT BELOW GRADE	
SWL after installation	14.4 FT BELOW GRADE	

BOREHOLE FILL MATERIALS

	Y/N	FROM - TO	FROM - TO	FROM - TO
Grout/Slurry.	Y	14 FTBG - 2 FTBG		
Bentonite	Y	14 FTBG - 2 FTBG		
Sand	N			
Gravel	N			

TYPE OF GROUT USED: BENTONITE SLURRY WEIGHT BEFORE _____ AFTER _____

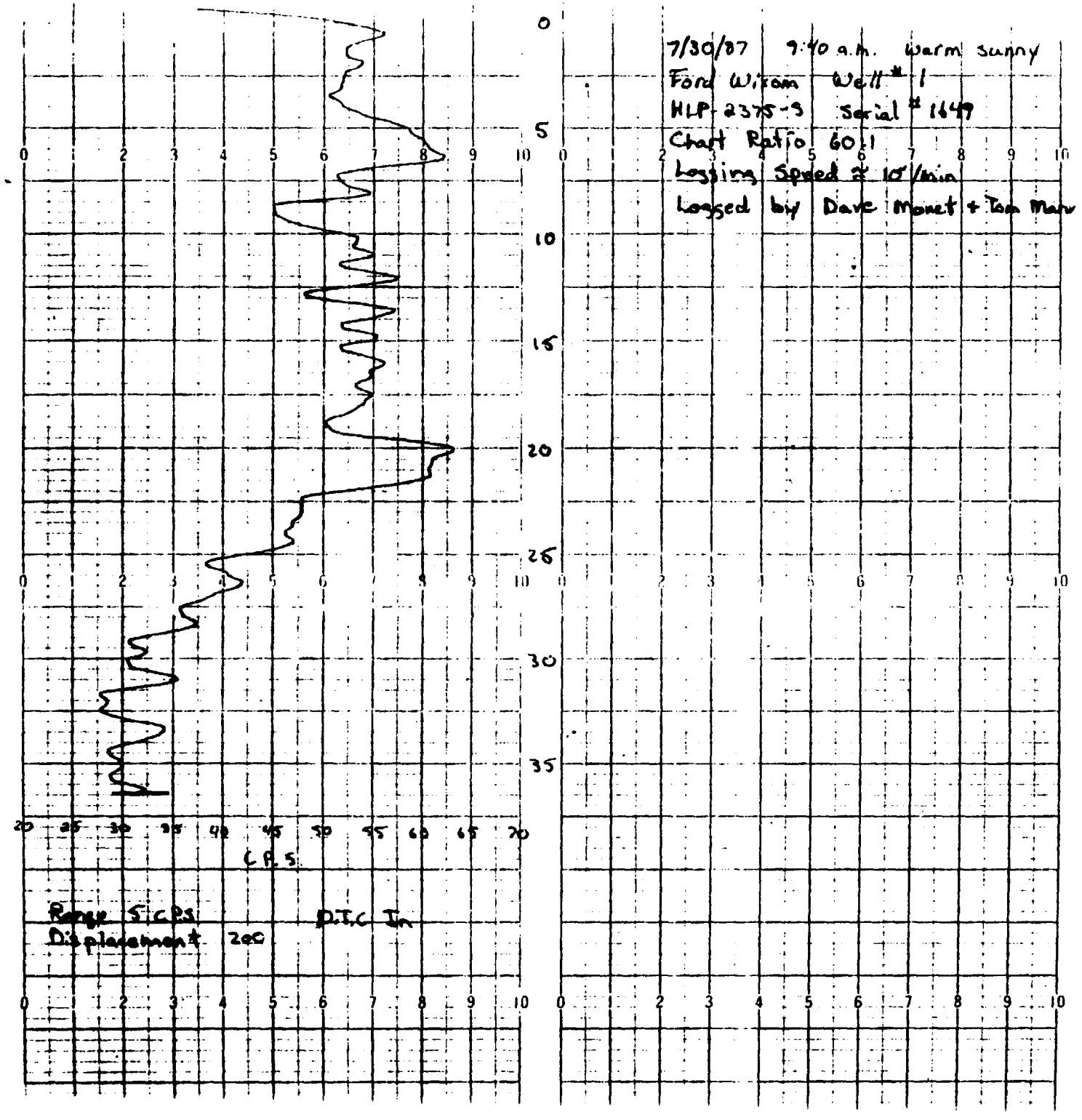
WAS THE MONITOR WELL DEVELOPED AFTER INSTALLATION ? X YES ____ NO
METHOD OF DEVELOPMENT ? SURGE BLOCK

REMARKS FTBG = FEET BELOW GRADE W.T. = WATER TABLE SURFACE
CEMENT EMPLACED AROUND CASING AT GROUND LEVEL

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT)
COUNTY: OAKLAND
TOWN: 2 N RANGE: 8 E
TOWNSHIP:
SECTION: 7 FRACTION: SW 1/4 NE 1/4

MONITOR WELL #: 1
SOIL BORING #:
GEOLOGIST: D. MONET
DRILLER: S. ECKLEY
DRILLING METHOD: HOLLOW STEM AUGER
COMPLETION DATE: 06/24/87

elev feet	samp no.	samp type	samp depth	no. blows	depth feet	profile	description	field test
							Stones (railroad bed fill materials)	
					3.5		Brown loamy and sandy clay (friable)	
					7		Grey clay (sand lens @ 8 - 9 ft)	
					11		grey clay (dry) (increasing sand content w/depth)	
					19		Clay (soft)	
					22		Sandy grey clay	
					30		Grey silty very fine sand (saturated) (some coarse sand grain zones)	
					38	E.O.B.		


7/30/87 9:40 a.m. Warm sunny
Ford Wixom Well # 1
HLP-2375-S Serial # 1649
Chart Ratio 60:1
Logging Speed ≈ 10'/min
Logged by Dave Monet + Tom Marv
C.P.S
Range 5 CPS
Displacement 200
D.T.C In

MONITOR WELL INSTALLATION SHEET

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT)
GEOLOGIST: D. MONET
TOWN: 2 N RANGE: 8 E COUNTY: OAKLAND
SECTION: 7 FRACTION: SW 1/4 NE 1/4

MONITOR WELL #: 2
INSTALLATION DATE: 06/26/87
TOWNSHIP:

DRILLING DATA

Drilling Method: HOLLOW STEM AUGER
Drilling Fluids;
fluid: from: to:
fluid: from: to:

Type of Bit: CARBIDE TEETH
Casing size;
size: from: to:
size: from: to:

MONITOR WELL DESCRIPTION

Screen Type: STAINLESS STEEL WIRE WOUND
Diameter of perforated section: 2 INCH
Perforation Type: slots: X holes: screen:
Screen point; Perforation size: #7 Length: 2 FT
Screen sections;
Perforation size: # 7 Length: 2 FT Number: 2
Perforation size: # 7 Length: Number:
Total perforated length: 6 FT

Casing Pipe Material: GALVANIZED STEEL
Pipe Diameters: O.D.: I.D.: 2 IN
Pipe Sections; Length: 18 FT Number: 1
Length: 9 FT Number: 1
Length: Number:
Length: Number:
Joining Methods: GALVANIZED COUPLINGS

PROTECTION SYSTEM

Casing protective pipe length:
Protective pipe O.D.:
Other protection: LOCKING CAP

WELL CONSTRUCTION DATA

	DISTANCE ABOVE/BELOW GROUND SURFACE	
Top of Casing Pipe	2 FT +/- ABOVE GRADE	
Top of Protective Pipe		
Perforated Section	25 FT - 31 FT BELOW GRADE	
Screen Tip	31 FT BELOW GRADE	
Bottom of Borehole	31 FT BELOW GRADE	
SWL after installation	11.1 FEET BELOW GRADE	

BOREHOLE FILL MATERIALS

	Y/N	FROM - TO	FROM - TO	FROM - TO
Grout/Slurry.	Y	11 FTBG - GROUND		
Bentonite	Y	11 FTBG - GROUND		
Sand	N			
Gravel	N			

TYPE OF GROUT USED: BENTONITE SLURRY WEIGHT BEFORE _____ AFTER _____

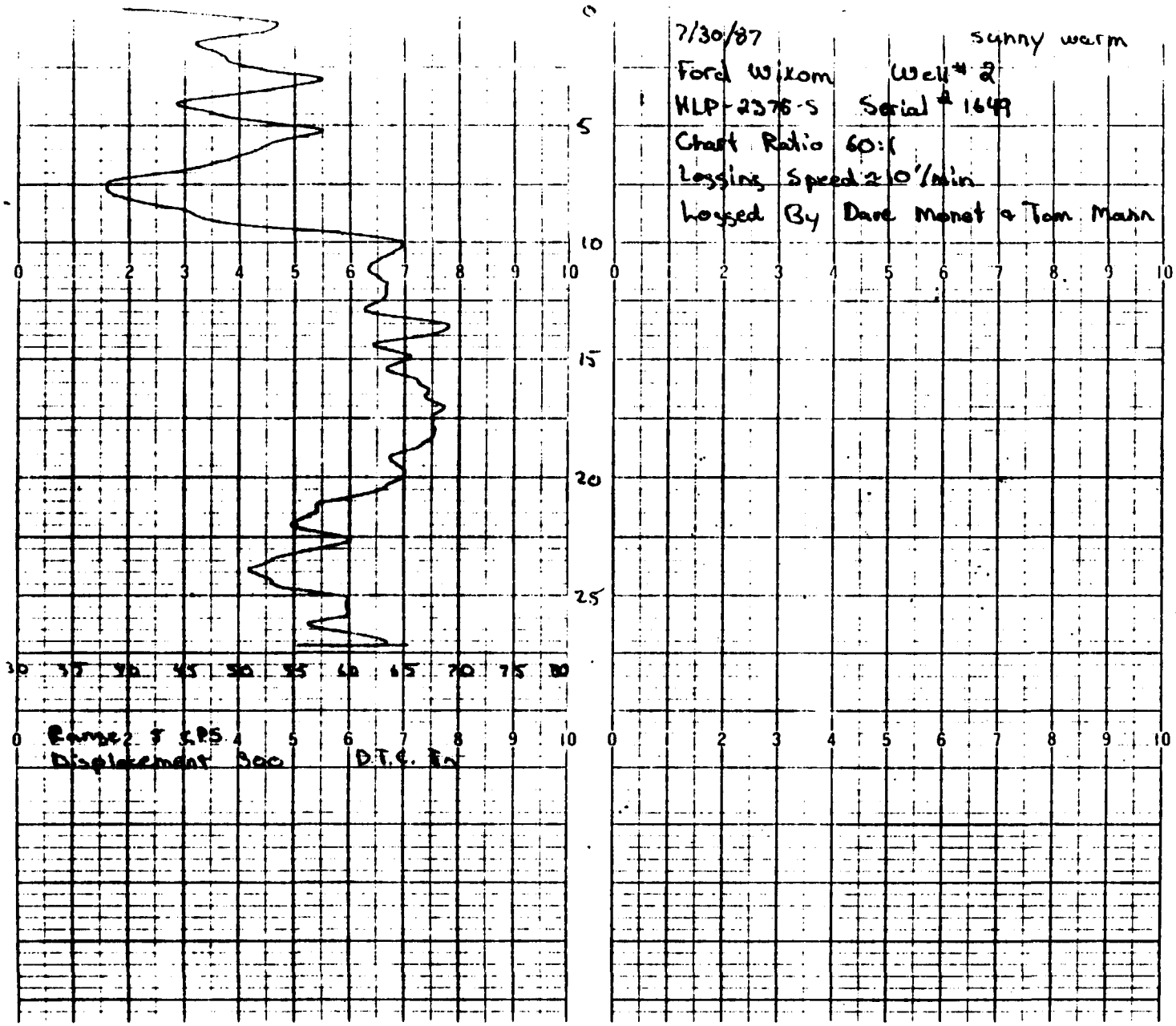
WAS THE MONITOR WELL DEVELOPED AFTER INSTALLATION ? ____ YES X NO
METHOD OF DEVELOPMENT ? _____

REMARKS FTBG = FEET BELOW GRADE W.T. = WATER TABLE SURFACE
PLACED 3 - 4x4 WOOD POSTS AROUND WELL FOR PROTECTION

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT)
COUNTY: OAKLAND
TOWN: 2 N RANGE: 8 E
TOWNSHIP:
SECTION: 7 FRACTION: SW 1/4 NE 1/4

MONITOR WELL #: 2
SOIL BORING #:
GEOLOGIST: D. MONET
DRILLER: S. ECKLEY
DRILLING METHOD: HOLLOW STEM AUGER
COMPLETION DATE: 06/26/87

elev feet	samp no.	samp type	samp depth	no. blows	depth feet	profile	description	field test
							Brown loamy clay sand	
					6.5		sandy zone	
					8		Grey clay (moist) (saturated grey clay sand @ 10 - 10.5 ft)	
					10.5		Grey soft clay (sandy clay zone @ 20.5 - 22 ft)	
					23		Alternating thin lenses of grey clay, sand, and silt	
					31	E.O.B.		


7/30/87
sunny warm
Ford Wixom
Well # 2
HLP-2376-S
Serial # 1649
Chart Ratio 60:1
Logging Speed 210'/min
Logged By Dave Monat & Tom Mann
Range 2 & 5PS
Displacement 300
D.T.C. In

MONITOR WELL INSTALLATION SHEET

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT) MONITOR WELL #: 3
GEOLOGIST: D. MONET INSTALLATION DATE: 06/30/87
TOWN: 2 N RANGE: 8 E COUNTY: OAKLAND TOWNSHIP:
SECTION: 7 FRACTION: SW 1/4 NE 1/4

DRILLING DATA

Drilling Method: HOLLOW STEM AUGER
Drilling Fluids;
fluid: from: to:
fluid: from: to:

Type of Bit: CARBIDE TEETH
Casing size;
size: from: to:
size: from: to:

MONITOR WELL DESCRIPTION

Screen Type: STAINLESS STEEL WIRE WOUND
Diameter of perforated section: 2 INCH
Perforation Type; slots: X holes: screen:
Screen point; Perforation size: #7 Length: 2 FT
Screen sections;
Perforation size: # 7 Length: 2 FT Number: 2
Perforation size: # 7 Length: Number:
Total perforated length: 6 FT

Casing Pipe Material: GALVANIZED STEEL
Pipe Diameters; O.D.: I.D.: 2 IN
Pipe Sections; Length: 9 FT Number: 1
Length: 4.5 FT Number: 1
Length: 3 FT Number: 1
Length: Number:
Joining Methods: GALVANIZED COUPLINGS

PROTECTION SYSTEM

Casing protective pipe length:
Protective pipe O.D.:
Other protection: LOCKING CAP

WELL CONSTRUCTION DATA

	DISTANCE ABOVE/BELOW GROUND SURFACE	
Top of Casing Pipe	3 FT +/- ABOVE GRADE	
Top of Protective Pipe		
Perforated Section	13.5 FT 19.5 FT BELOW GRADE	
Screen Tip	19.5 FT BELOW GRADE	
Bottom of Borehole	20 FT BELOW GRADE	
SWL after installation	9.3 FT BELOW GRADE	

BOREHOLE FILL MATERIALS

	Y/N	FROM - TO	FROM - TO	FROM - TO
Grout/Slurry.	Y	9 FTBG - 2 FTBG		
Bentonite	Y	9 FTBG - 2 FTBG		
Sand	N			
Gravel	N			

TYPE OF GROUT USED: BENTONITE SLURRY WEIGHT BEFORE _____ AFTER _____

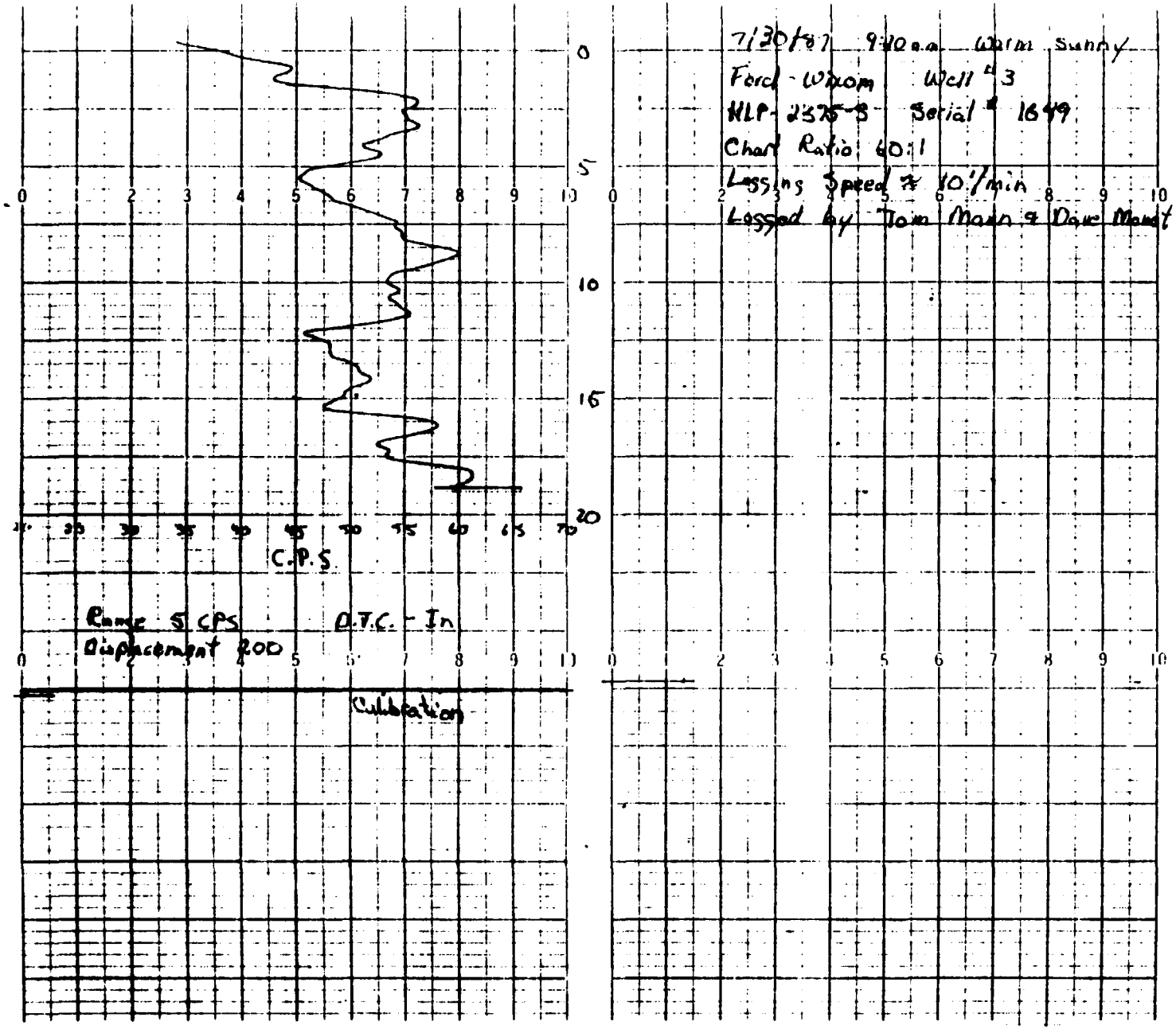
WAS THE MONITOR WELL DEVELOPED AFTER INSTALLATION ? ____ YES __X__ NO
METHOD OF DEVELOPMENT ? _____

REMARKS FTBG = FEET BELOW GRADE W.T. = WATER TABLE SURFACE
CEMENT PACKED AROUND CASING FROM 2 FTBG - GRADE.

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT)
COUNTY: OAKLAND
TOWN: 2 N RANGE: 8 E
TOWNSHIP:
SECTION: 7 FRACTION: SW 1/4 NE 1/4

MONITOR WELL #: 3
SOIL BORING #:
GEOLOGIST: D. MONET
DRILLER: S. ECKLEY
DRILLING METHOD: HOLLOW STEM AUGER
COMPLETION DATE: 06/30/87

elev feet	samp no.	samp type	samp depth	no. blows	depth feet	profile	description	field test
					1		Loamy top soil	
							Brown medium loamy sand	
					2		Brown clay loam (moist)	
					5		Brown sandy loam (moist)	
					7		Grey clay (stiff & dry)	
					12		Grey gravelly sand (saturated)	
					15.5		clay lens	
					16.5		grey sand (saturated)	
					17.5		clay lens	
					19	E.O.B.		


7/30/87 9:40 a.m. Warm Sunny
Ford - Wixom Well # 3
HLP-2375-3 Serial # 1649
Chart Ratio 60:1
Logging Speed ≈ 10'/min
Logged by Tom Mann & Dave Mandt
C.P.S.
Range 5 CPS D.T.C. - In
Displacement 200
Calibration

MONITOR WELL INSTALLATION SHEET

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT) MONITOR WELL #: 4S
GEOLOGIST: D. MONET INSTALLATION DATE: 07/01/87
TOWN: 2 N RANGE: 8 E COUNTY: OAKLAND TOWNSHIP:
SECTION: 7 FRACTION: SW 1/4 NE 1/4

DRILLING DATA

Drilling Method: HOLLOW STEM AUGER
Drilling Fluids;
fluid: from: to:
fluid: from: to:

Type of Bit: CARBIDE TEETH
Casing size;
size: from: to:
size: from: to:

MONITOR WELL DESCRIPTION

Screen Type: STAINLESS STEEL WIRE WOUND
Diameter of perforated section: 2 INCH
Perforation Type; slots: X holes: screen:
Screen point; Perforation size: #7 Length: 2 FT
Screen sections;
Perforation size: # 7 Length: Number:
Perforation size: # 7 Length: Number:
Total perforated length: 2 FT

Casing Pipe Material: GALVANIZED STEEL
Pipe Diameters; O.D.: I.D.: 2 IN
Pipe Sections; Length: 9 FT Number: 1
Length: 3 FT Number: 1
Length: Number:
Length: Number:
Joining Methods: GALVANIZED COUPLINGS

PROTECTION SYSTEM

Casing protective pipe length:
Protective pipe O.D.:
Other protection: LOCKING CAP

WELL CONSTRUCTION DATA

	DISTANCE ABOVE/BELOW GROUND SURFACE	
Top of Casing Pipe	3 FT +/- ABOVE GRADE	
Top of Protective Pipe		
Perforated Section	9 FT - 11 FT BELOW GRADE	
Screen Tip	11 FT BELOW GRADE	
Bottom of Borehole	12 FT BELOW GRADE	
GWL after installation	6.4 FEET BELOW GRADE	

BOREHOLE FILL MATERIALS

	Y/N	FROM - TO	FROM - TO	FROM - TO
Grout/Slurry.	Y	8 FTBG - 2 FTBG		
Bentonite	Y	8 FTBG - 2 FTBG		
Sand	Y	12 FTBG - 8 FTBG		
Gravel	N			

TYPE OF GROUT USED: BENTONITE SLURRY WEIGHT BEFORE _____ AFTER _____

WAS THE MONITOR WELL DEVELOPED AFTER INSTALLATION ? ____ YES X NO
METHOD OF DEVELOPMENT ? _____

REMARKS FTBG = FEET BELOW GRADE W.T. = WATER TABLE SURFACE
CEMENT PLACED AROUND CASING FROM 2 FTBG - GRADE

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT)
COUNTY: OAKLAND
TOWN: 2 N RANGE: 8 E
TOWNSHIP:
SECTION: 7 FRACTION: SW 1/4 NE 1/4

MONITOR WELL #: 4S
SOIL BORING #:
GEOLOGIST: D. MONET
DRILLER: S. ECKLEY
DRILLING METHOD: HOLLOW STEM AUGER
COMPLETION DATE: 07/01/87

elev feet	samp no.	samp type	samp depth	pen. blows	depth feet	profile	description	field test
							Black top soil (clayey)	
					5.5			
					6		Grey clay	
							Brown silty clay (soft & moist)	
					10		Brown silty sand (saturated)	
					12	E.O.B.		

MONITOR WELL INSTALLATION SHEET

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT) MONITOR WELL #: 40 '
GEOLOGIST: D. MONET INSTALLATION DATE: 06/30/87
TOWN: 2 N RANGE: 8 E COUNTY: OAKLAND TOWNSHIP:
SECTION: 7 FRACTION: SW 1/4 NE 1/4

DRILLING DATA

Drilling Method: HOLLOW STEM AUGER
Drilling Fluids;
fluid: from: to:
fluid: from: to:

Type of Bit: CARBIDE TEETH
Casing size;
size: from: to:
size: from: to:

MONITOR WELL DESCRIPTION

Screen Type: STAINLESS STEEL WIRE WOUND
Diameter of perforated section: 2 INCH
Perforation Type; slots: X holes: screen:
Screen point; Perforation size: #7 Length: 2 FT
Screen sections;
Perforation size: # 7 Length: 2 FT Number: 2
Perforation size: # 7 Length: Number:
Total perforated length: 6 FT

Casing Pipe Material: GALVANIZED STEEL
Pipe Diameters; O.D.: I.D.: 2 IN
Pipe Sections; Length: 18 FT Number: 1
Length: 4.5 FT Number: 1
Length: 3 FT Number: 1
Length: Number:
Joining Methods: GALVANIZED COUPLINGS

PROTECTION SYSTEM

Casing protective pipe length:
Protective pipe O.D.: . .
Other protection: LOCKING CAP

WELL CONSTRUCTION DATA

	DISTANCE ABOVE/BELOW GROUND SURFACE	
Top of Casing Pipe	3 FT +/- ABOVE GRADE	
Top of Protective Pipe		
Perforated Section	22 FT - 28 FT BELOW GRADE	
Screen Tip	28 FT BELOW GRADE	
Bottom of Borehole	29 FT BELOW GRADE	
SWL after installation	5.7 FEET BELOW GRADE	

BOREHOLE FILL MATERIALS

	Y/N	FROM - TO	FROM - TO	FROM - TO
Grout/Slurry.	Y	21 FTBG - 2 FTBG		
Bentonite	Y	21 FTBG - 2 FTBG		
Sand	N			
Gravel	N			

TYPE OF GROUT USED: BENTONITE SLURRY WEIGHT BEFORE _____ AFTER _____

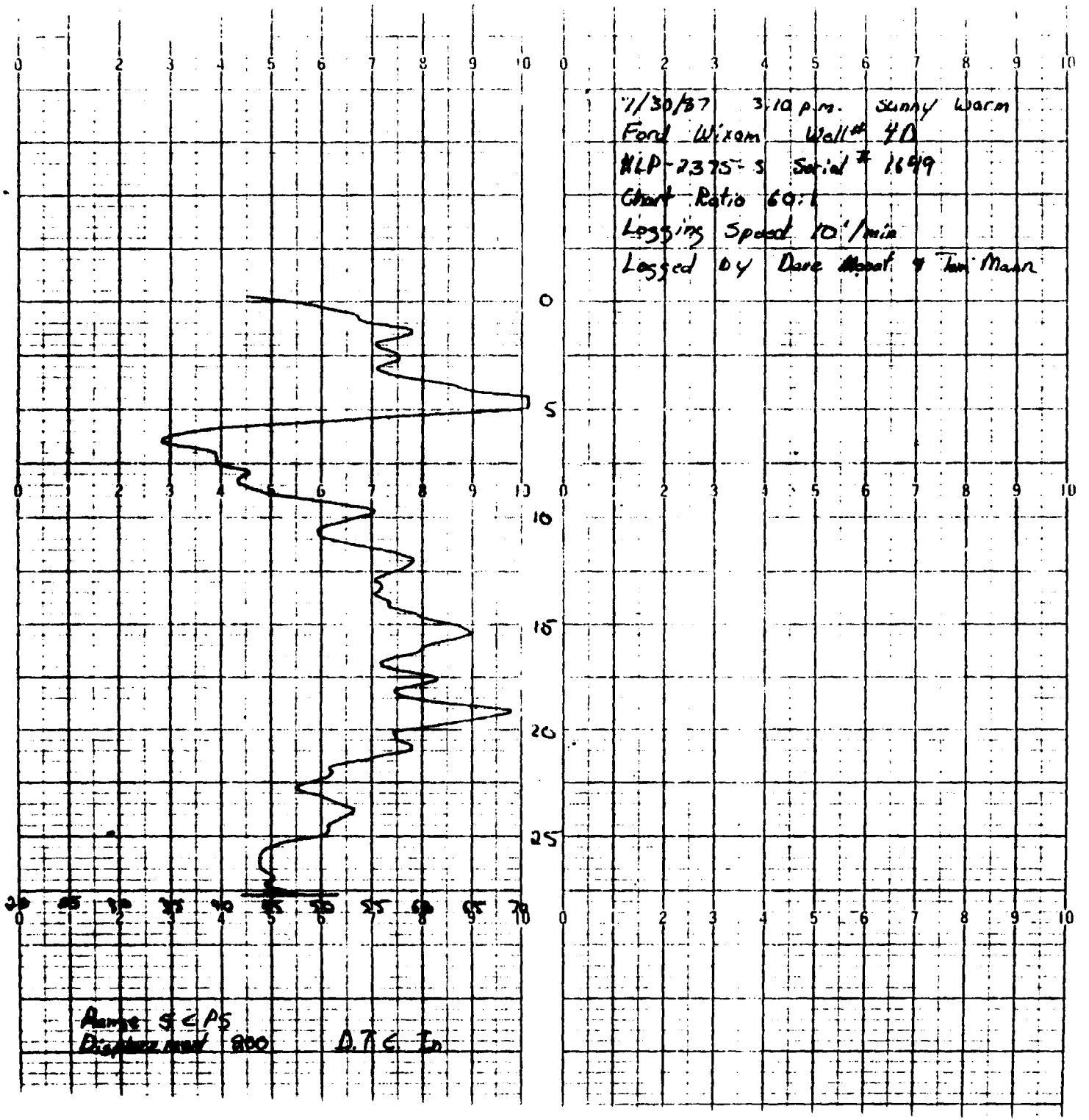
WAS THE MONITOR WELL DEVELOPED AFTER INSTALLATION ? ____ YES __X__ NO
METHOD OF DEVELOPMENT ? _____

REMARKS FTBG = FEET BELOW GRADE W.T. = WATER TABLE SURFACE
CEMENT PLACED AROUND CASING FROM 2 FTBG - GRADE

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT)
COUNTY: OAKLAND
TOWN: 2 N RANGE: 8 E
TOWNSHIP:
SECTION: 7 FRACTION: SW 1/4 NE 1/4

MONITOR WELL #: 4D
SOIL BORING #:
GEOLOGIST: D. MONET
DRILLER: S. ECKLEY
DRILLING METHOD: HOLLOW STEM AUGER
COMPLETION DATE: 06/30/87

elev feet	samp no.	samp type	samp depth	no. blows	depth feet	profile	description	field test
							Black top soil (clayey)	
					5.5		Grey clay	
					6		Brown silty clay (soft & moist)	
					10		Brown silty sand (saturated)	
					11.5		Brown silty clay	
					12.5		Grey silty clay (firm) (drier w/depth)	
					21		Grey sandy gravel	
					23		Grey sandy clay (wet)	
					25		Grey sandy gravel and clay lenses (saturated)	
					29	E.O.B.		


7/30/87 3:10 p.m. Sunny Warm
Ford Wixom Well# 4D
HLP-2375-S Serial # 1649
Chart Ratio 60:1
Logging Speed 10'/min
Logged by Dave Moore & Tom Mann
Range 5 CPS
Displacement 800 D.T.C. In

MONITOR WELL INSTALLATION SHEET

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT) MONITOR WELL #: 5
GEOLOGIST: D. MONET INSTALLATION DATE: 07/17/87
TOWN: 2 N RANGE: 8 E COUNTY: OAKLAND TOWNSHIP:
SECTION: 7 FRACTION: SW 1/4 NE 1/4

DRILLING DATA

Drilling Method: HOLLOW STEM AUGER
Drilling Fluids;
fluid: from: to:
fluid: from: to:

Type of Bit: CARBIDE TEETH
Casing size;
size: from: to:
size: from: to:

MONITOR WELL DESCRIPTION

Screen Type: STAINLESS STEEL WIRE WOUND
Diameter of perforated section: 2 INCH
Perforation Type; slots: X holes: screen:
Screen point; Perforation size: #7 Length: 2 FT
Screen sections;
Perforation size: # 7 Length: 2 FT Number: 2
Perforation size: # 7 Length: Number:
Total perforated length: 6 FT

Casing Pipe Material: GALVANIZED STEEL
Pipe Diameters; O.D.: I.D.: 2 IN
Pipe Sections; Length: 9 FT Number: 1
Length: 4.5 FT Number: 1
Length: Number:
Length: Number:
Joining Methods: GALVANIZED COUPLINGS

PROTECTION SYSTEM

Casing protective pipe length:
Protective pipe O.D.:
Other protection: LOCKING CAP

WELL CONSTRUCTION DATA

	DISTANCE ABOVE/BELOW GROUND SURFACE	
Top of Casing Pipe	2 FT +/- ABOVE GRADE	
Top of Protective Pipe		
Perforated Section	11.5 FT - 17.5 FT BELOW GRADE	
Screen Tip	17.5 FT BELOW GRADE	
Bottom of Borehole	24 FT BELOW GRADE	
GWL after installation	8.6 FEET BELOW GRADE	

BOREHOLE FILL MATERIALS

	Y/N	FROM - TO	FROM - TO	FROM - TO
Grout/Slurry.	Y	9.5 FTBG - 2 FTBG		
Bentonite	Y	9.5 FTBG - 2 FTBG		
Sand	N			
Gravel	N			

TYPE OF GROUT USED: BENTONITE SLURRY WEIGHT BEFORE _____ AFTER _____

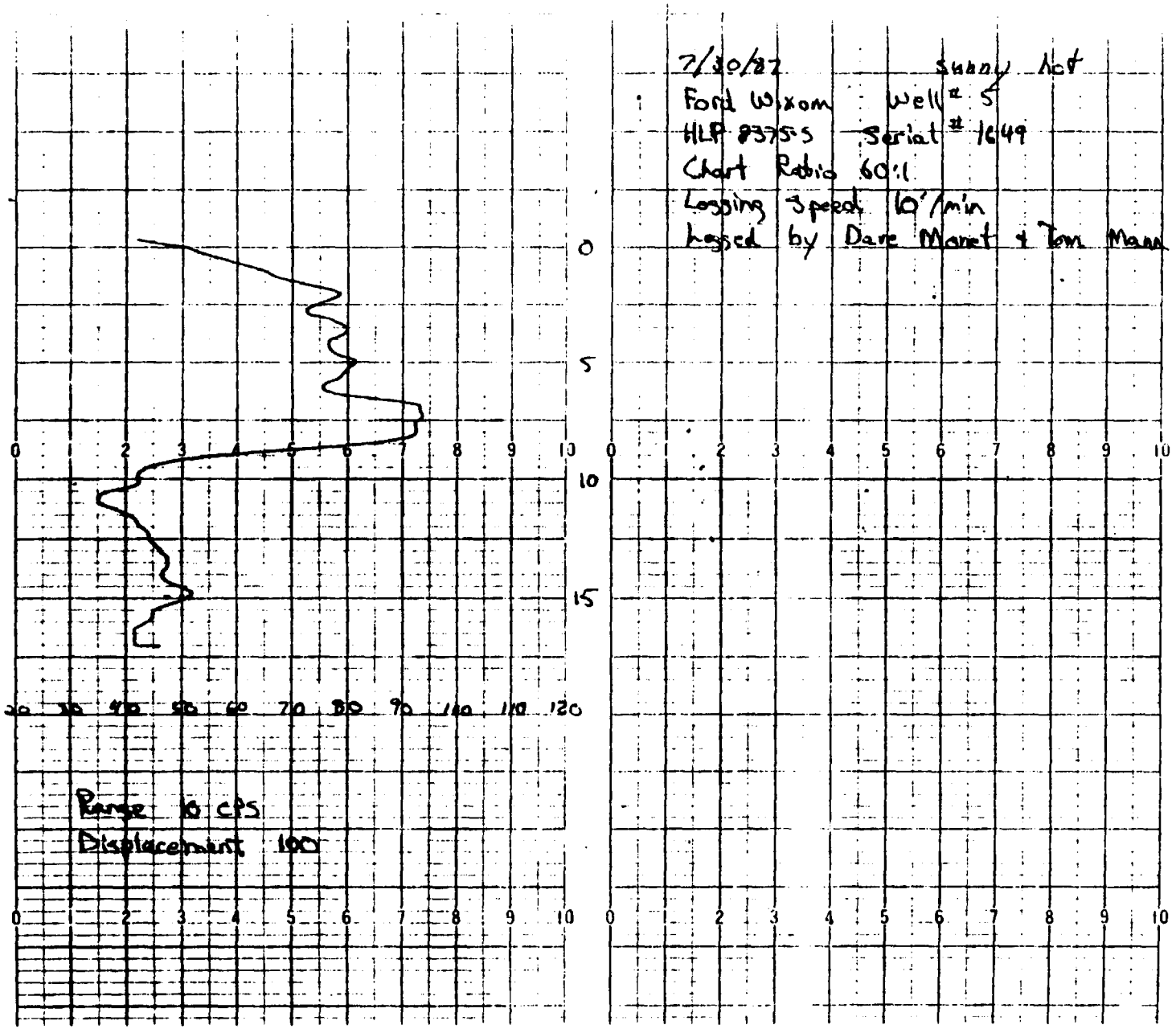
WAS THE MONITOR WELL DEVELOPED AFTER INSTALLATION ? ____ YES __X__ NO
METHOD OF DEVELOPMENT ? _____

REMARKS FTBG = FEET BELOW GRADE W.T. = WATER TABLE SURFACE
CEMENT PLACED AROUND CASING FROM 2 FTBG - GRADE.

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT)
COUNTY: OAKLAND
TOWN: 2 N RANGE: 8 E
TOWNSHIP:
SECTION: 7 FRACTION: SW 1/4 NE 1/4

MONITOR WELL #: 5
SOIL BORING #:
GEOLOGIST: D. MONET
DRILLER: S. ECKLEY
DRILLING METHOD: HOLLOW STEM AUGER
COMPLETION DATE: 07/17/87

elev feet	samp no.	samp type	samp depth	no. blows	depth feet	profile	description	field test
							Brown sand	
					2.5		Brown silty clay loam (very compact & hard drilling)	
					6.5		Grey silty loam	
					8.5		Grey sandy, silty loam (moist & easy drilling)	
					9.5		Grey silty gravel (saturated) (very fluid)	
					17		Grey silty clay	
					24	E.O.B.		


7/30/87 Sunny hot
Ford Wixom well # 5
HLP 8375-5 Serial # 1649
Chart Ratio 60:1
Logging Speed 10'/min
Logged by Dave Moret & Tom Mann
Range 10 CPS
Displacement 100
0
5
10
15
0 2 3 4 5 6 7 8 9 10
20 30 40 50 60 70 80 90 100 110 120

MONITOR WELL INSTALLATION SHEET

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT) MONITOR WELL #: 6S '
GEOLOGIST: D. MONET INSTALLATION DATE: 07/17/87
TOWN: 2 N RANGE: 9 E COUNTY: OAKLAND TOWNSHIP:
SECTION: 7 FRACTION: SW 1/4 NE 1/4

DRILLING DATA

Drilling Method: HOLLOW STEM AUGER
Drilling Fluids;
fluid: from: to:
fluid: from: to:

Type of Bit: CARBIDE TEETH
Casing size;
size: from: to:
size: from: to:

MONITOR WELL DESCRIPTION

Screen Type: STAINLESS STEEL WIRE WOUND
Diameter of perforated section: 2 INCH
Perforation Type; slots: X holes: screen:
Screen point; Perforation size: #7 Length: 2 FT
Screen sections;
Perforation size: # 7 Length: Number:
Perforation size: # 7 Length: Number:
Total perforated length: 2 FT

Casing Pipe Material: GALVANIZED STEEL
Pipe Diameters; O.D.: I.D.: 2 IN
Pipe Sections; Length: 9 FT Number: 1
Length: 3 FT Number: 1
Length: Number:
Length: Number:
Joining Methods: GALVANIZED COUPLINGS

PROTECTION SYSTEM

Casing protective pipe length:
Protective pipe O.D.:
Other protection: LOCKING CAP

WELL CONSTRUCTION DATA

	DISTANCE ABOVE/BELOW GROUND SURFACE	
Top of Casing Pipe	3 FT +/- ABOVE GRADE	
Top of Protective Pipe		
Perforated Section	8.5 FT - 10.5 FEET BELOW GRADE	
Screen Tip	10.5 FEET BELOW GRADE	
Bottom of Borehole	14 FT BELOW GRADE	
SWL after installation	7.2 FEET BELOW GRADE	

BOREHOLE FILL MATERIALS

	Y/N	FROM - TO	FROM - TO	FROM - TO
Grout/Slurry.	Y	7 FTBG - 2 FTBG		
Bentonite	Y	7 FTBG - 2 FTBG		
Sand	N			
Gravel	N			

TYPE OF GROUT USED: BENTONITE SLURRY WEIGHT BEFORE _____ AFTER _____

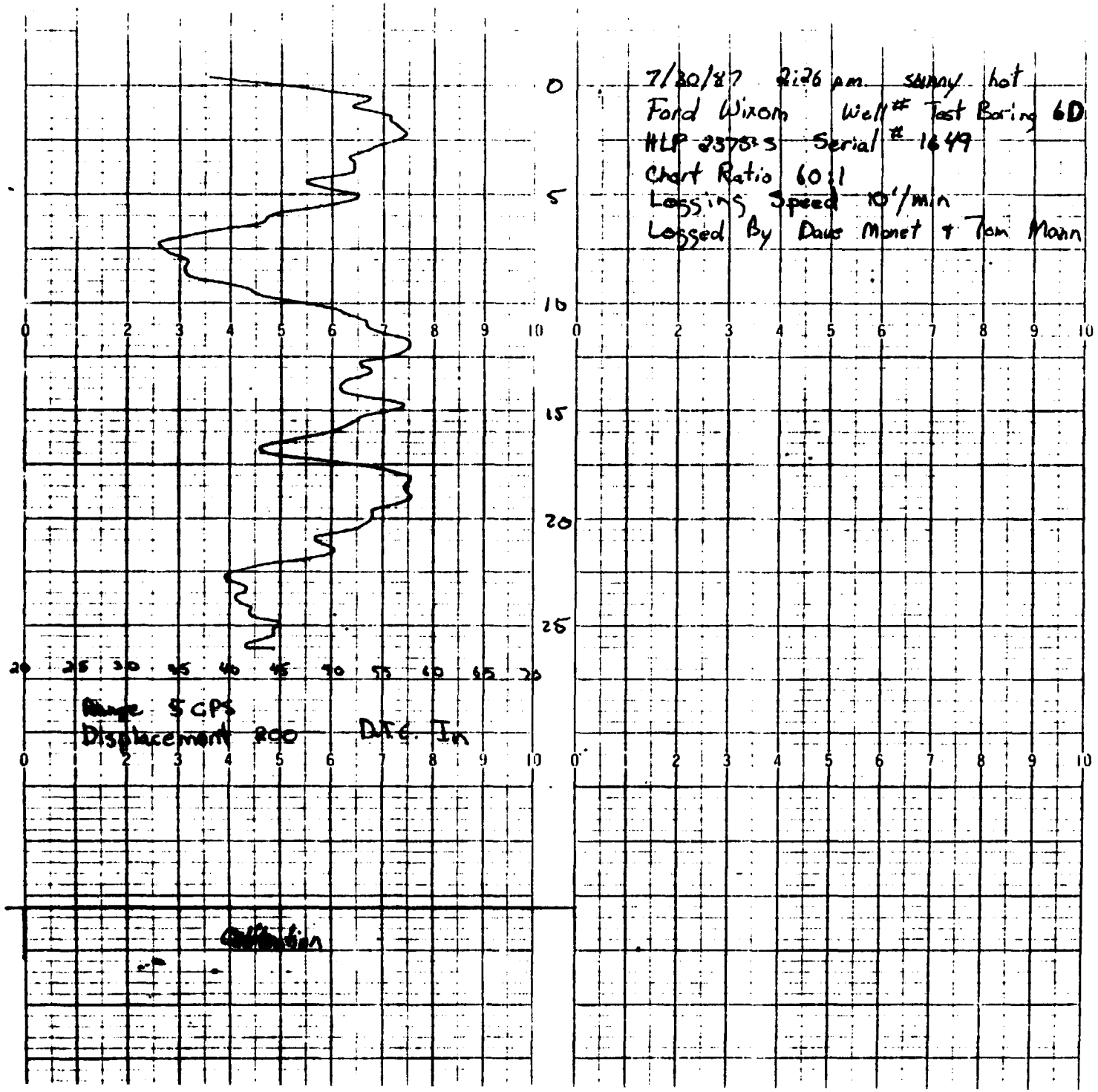
WAS THE MONITOR WELL DEVELOPED AFTER INSTALLATION ? ____ YES __X__ NO
METHOD OF DEVELOPMENT ? _____

REMARKS FTBG = FEET BELOW GRADE W.T. = WATER TABLE SURFACE
CEMENT PLACED AROUND CASING FROM 2 FTBG - GRADE

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT)
COUNTY: OAKLAND
TOWN: 2 N RANGE: 8 E
TOWNSHIP:
SECTION: 7 FRACTION: SW 1/4 NE 1/4

MONITOR WELL #: 6S
SOIL BORING #:
GEOLOGIST: D. MONET
DRILLER: S. ECKLEY
DRILLING METHOD: HOLLOW STEM AUGER
COMPLETION DATE: 07/17/87

elev feet	samp no.	samp type	samp depth	no. blows	depth feet	profile	description	field test
							Black top soil (clayey)	
					4.5		Grey silty clay	
					6.5		Grey silty gravel (saturated)	
					10		Brown & grey silty clay	
					21.5		Grey silty loam	
					27	E.O.B.		


7/30/87 2:26 pm sunny hot
Ford Wixom Well # Test Boring 6D
HLP 2375-S Serial # 1649
Chart Ratio 60:1
Logging Speed 10'/min
Logged By Dave Monet + Tom Mann
Range 5 CPS
Displacement 200 D.I.C. In
Calibration

MONITOR WELL INSTALLATION SHEET

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT) MONITOR WELL #: 7
GEOLOGIST: D. MONET INSTALLATION DATE: 07/21/87
TOWN: 2 N RANGE: 8 E COUNTY: OAKLAND TOWNSHIP:
SECTION: 7 FRACTION: SW 1/4 NE 1/4

DRILLING DATA

Drilling Method: HOLLOW STEM AUGER
Drilling Fluids;
fluid: from: to:
fluid: from: to:

Type of Bit: CARBIDE TEETH
Casing size;
size: from: to:
size: from: to:

MONITOR WELL DESCRIPTION

Screen Type: STAINLESS STEEL WIRE WOUND
Diameter of perforated section: 2 INCH
Perforation Type; slots: X holes: screen:
Screen point; Perforation size: #7 Length: 2 FT
Screen sections;
Perforation size: # 7 Length: 2 FT Number: 1
Perforation size: # 7 Length: Number:
Total perforated length: 4 FT

Casing Pipe Material: GALVANIZED STEEL
Pipe Diameters; O.D.: I.D.: 2 IN
Pipe Sections; Length: 18 FT Number: 1
Length: Number:
Length: Number:
Length: Number:
Joining Methods: GALVANIZED COUPLINGS

PROTECTION SYSTEM

Casing protective pipe length:
Protective pipe O.D.:
Other protection: LOCKING CAP

WELL CONSTRUCTION DATA

	DISTANCE ABOVE/BELOW GROUND SURFACE	
Top of Casing Pipe	3 FT +/- ABOVE GRADE	
Top of Protective Pipe		
Perforated Section	15 FT - 19 FT BELOW GRADE	
Screen Tip	19 FT BELOW GRADE	
Bottom of Borehole	25 FT BELOW GRADE	
SWL after installation	11.6 FEET BELOW GRADE	

BOREHOLE FILL MATERIALS

	Y/N	FROM - TO	FROM - TO	FROM - TO
Grout/Slurry.	Y	11 FTBG - GROUND		
Bentonite	Y	11 FTBG - GROUND		
Sand	Y	19 FTBG - 14 FTBG		
Gravel	N			

TYPE OF GROUT USED: BENTONITE SLURRY WEIGHT BEFORE _____ AFTER _____

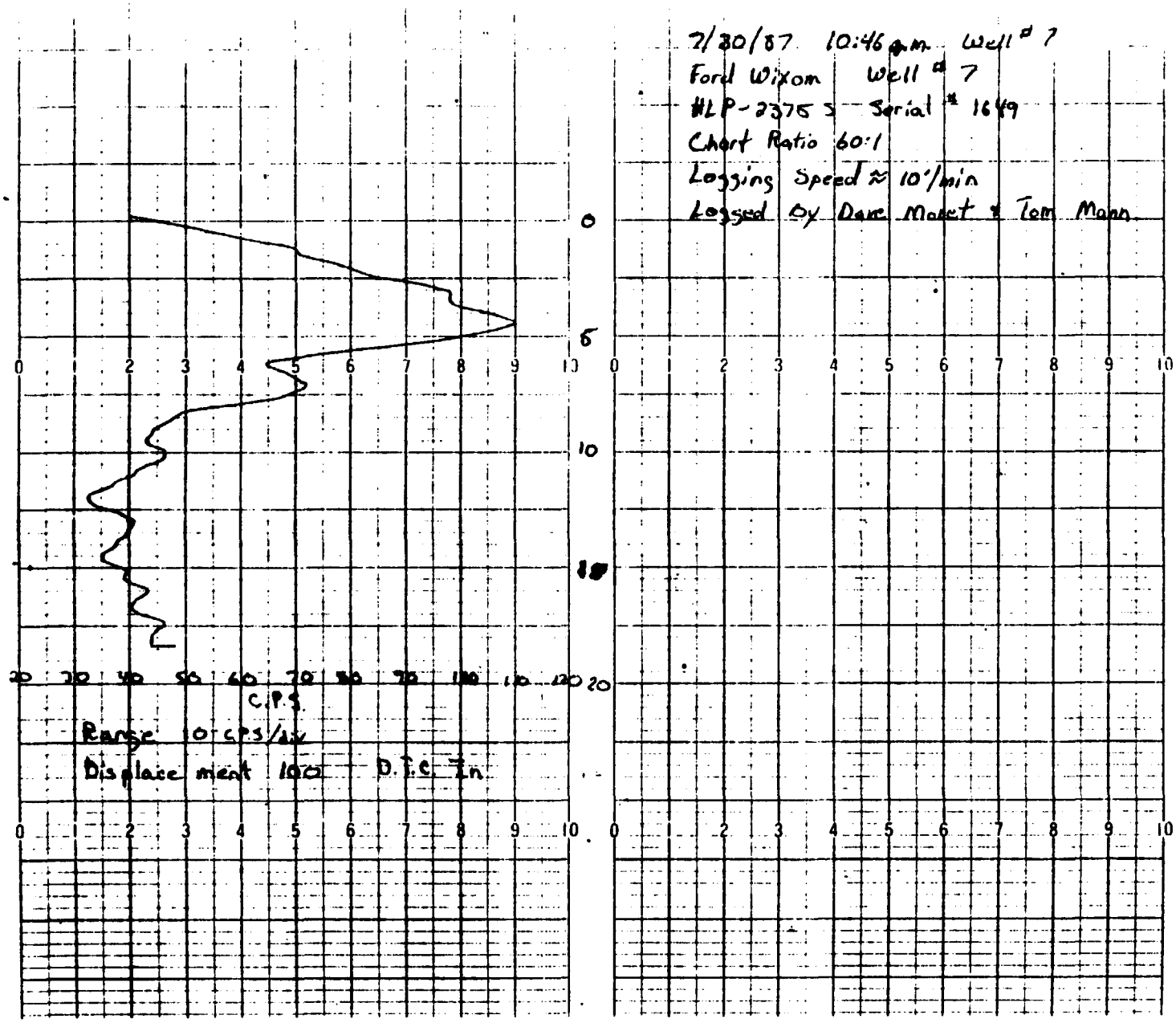
WAS THE MONITOR WELL DEVELOPED AFTER INSTALLATION ? ____ YES __X__ NO
METHOD OF DEVELOPMENT ? _____

REMARKS FTBG = FEET BELOW GRADE W.T. = WATER TABLE SURFACE

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT)
COUNTY: OAKLAND
TOWN: 2 N RANGE: 8 E
TOWNSHIP:
SECTION: 7 FRACTION: SW 1/4 NE 1/4

MONITOR WELL #: 7
SOIL BORING #:
GEOLOGIST: D. MONET
DRILLER: S. ECKLEY
DRILLING METHOD: HOLLOW STEM AUGER
COMPLETION DATE: 07/21/87

elev feet	samp no.	samp type	samp depth	no. blows	depth feet	profile	description	field test
							Brown silt loam	
					2.5		Dark brown silt loam	
					5.5		Stones	
					6.5		Brown clay (moist & friable)	
					9		Brown fine sand (moist)	
					12.5		Grey pebbly medium sand (moist)	
					15.5		Brown very coarse gravelly sand (saturated)	
					17		clay lens	
					18		Grey coarse sand (saturated)	
					19		Grey silty sand (saturated)	
					25			
					26	E.O.B.	Grey silty, loamy clay	


7/30/87 10:46 a.m. Well # 7
Ford Wixom Well # 7
#LP-2375 S Serial # 1649
Chart Ratio 60:1
Logging Speed ≈ 10'/min
Logged by Dave Moret & Tom Mann
C.P.S.
Range 10 cps/div
Displacement 100 D.I.C. In

MONITOR WELL INSTALLATION SHEET

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT)
GEOLOGIST: D. MONET
TOWN: 2 N RANGE: 8 E COUNTY: OAKLAND
SECTION: 7 FRACTION: SW 1/4 NE 1/4

MONITOR WELL #: 8
INSTALLATION DATE: 07/21/87
TOWNSHIP:

DRILLING DATA

Drilling Method: HOLLOW STEM AUGER
Drilling Fluids;
fluid: from: to:
fluid: from: to:

Type of Bit: CARBIDE TEETH
Casing size;
size: from: to:
size: from: to:

MONITOR WELL DESCRIPTION

Screen Type: STAINLESS STEEL WIRE WOUND
Diameter of perforated section: 2 INCH
Perforation Type; slots: X holes: screen:
Screen point; Perforation size: #7 Length: 2 FT
Screen sections;
Perforation size: # 7 Length: 2 FT Number: 1
Perforation size: # 7 Length: Number:
Total perforated length: 4 FT

Casing Pipe Material: GALVANIZED STEEL
Pipe Diameters; O.D.: I.D.: 2 IN
Pipe Sections; Length: 9 FT Number: 1
Length: 3 FT Number: 2
Length: Number:
Length: Number:
Joining Methods: GALVANIZED COUPLINGS

PROTECTION SYSTEM

Casing protective pipe length:
Protective pipe O.D.:
Other protection: LOCKING CAP

WELL CONSTRUCTION DATA

	DISTANCE ABOVE/BELOW GROUND SURFACE	
Top of Casing Pipe	3.5 FT +/- ABOVE GRADE	
Top of Protective Pipe		
Perforated Section	11.5 FT - 15.5 FEET BELOW GRADE	
Screen Tip	15.5 FT BELOW GRADE	
Bottom of Borehole	16 FT BELOW GRADE	
SWL after installation	3.8 FEET BELOW GRADE	

BOREHOLE FILL MATERIALS

	Y/N	FROM - TO	FROM - TO	FROM - TO
Grout/Slurry.	Y	11 FTBG - GROUND		
Bentonite	Y	11 FTBG - GROUND		
Sand	N			
Gravel	N			

TYPE OF GROUT USED: BENTONITE SLURRY WEIGHT BEFORE _____ AFTER _____

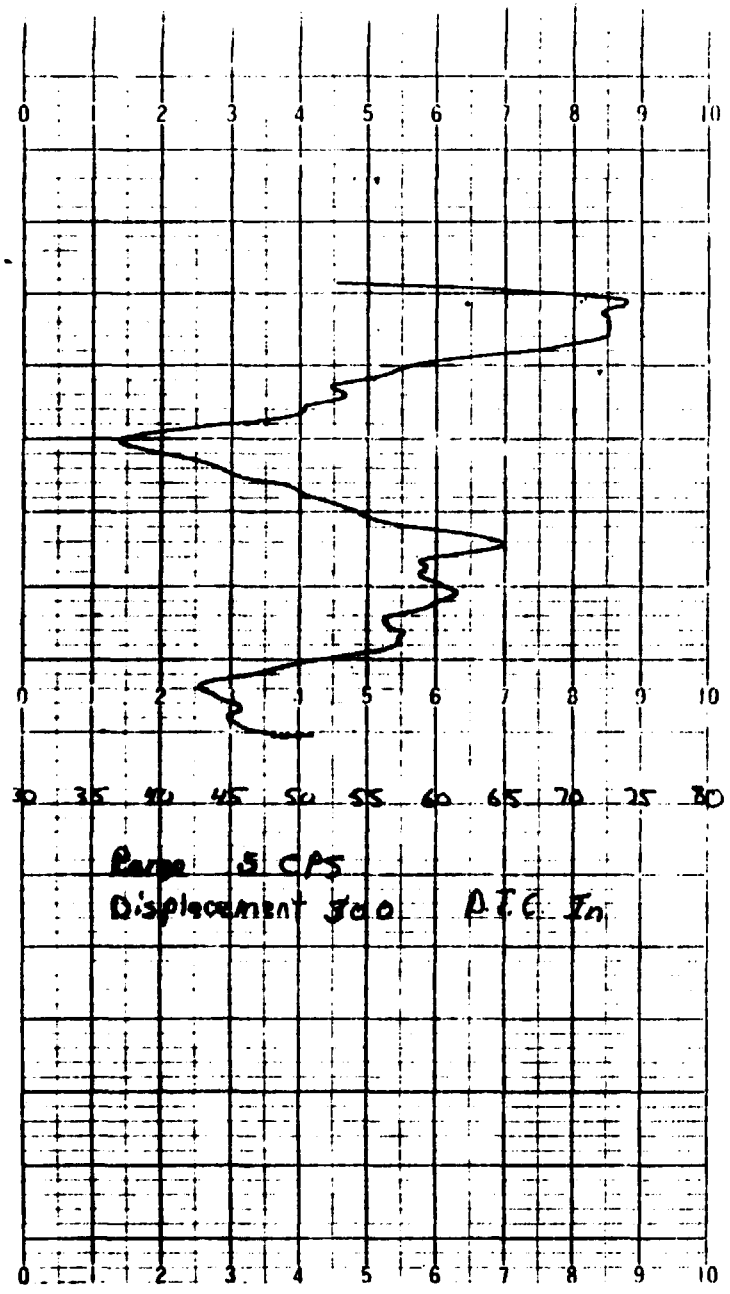
WAS THE MONITOR WELL DEVELOPED AFTER INSTALLATION ? ____ YES __X__ NO
METHOD OF DEVELOPMENT ? _____

REMARKS FTBG = FEET BELOW GRADE W.T. = WATER TABLE SURFACE

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT)
COUNTY: OAKLAND
TOWN: 2 N RANGE: 8 E
TOWNSHIP:
SECTION: 7 FRACTION: SW 1/4 NE 1/4

MONITOR WELL #: 8
SOIL BORING #:
GEOLOGIST: D. MONET
DRILLER: S. ECKLEY
DRILLING METHOD: HOLLOW STEM AUGER
COMPLETION DATE: 07/21/87

elev feet	samp no.	samp type	samp depth	no. blows	depth feet	profile	description	field test
							Black top soil	
					3		Grey sandy loam (moist)	
					6		Brown silty & clayey sand (saturated)	
					7		Brown silty clay (slightly sandy)	
					9		Brown sandy loam (moist & silty)	
					12.5		Grey silty sand (saturated)	
					16		Grey silty & sandy clay	
					17	E.O.B.		



7/30/80 2:55 p.m. sunny hot
Ford Wixom Well # 8
HLP-2375-S Serial # 1649
Chart Ratio 60:1
Logging Speed 10'/min
Logged By Dave Moret + Tim Mann

A P P E N D I X C

SOIL BORING DATA

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT)
STATION: (X-2005,Y-2098)
COUNTY: OAKLAND
TOWN: 2 N RANGE: 8 E
SECTION: 7 FRACTION: SW 1/4 NE 1/4

SOIL BORING #: 1
GEOLOGIST: D. MONET
DRILLER: W. ROGERS
DRILLING METHOD: HOLLOW STEM AUGER
COMPLETION DATE: 07/01/87

sample no.	sample type	HNU reading	depth	profile	description
		0			Brown coarse sand
		0	4		
			5		Black coarse sand (saturated)
		3 - 4	6		
			6.5		Black sandy sludge (saturated)
1	soil			E.O.B.	
			10		
			15		
			20		

COMPLETION DATA	GROUT (Y/N)	GROUT TYPE	FROM - TO (FEET)	BOREHOLE CUTTINGS (Y/N)	FROM - TO (FEET)
	N			Y	0 - 6.5

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT)
STATION: (X-2002,Y-2102)
COUNTY: OAKLAND
TOWN: 2 N RANGE: 8 E
SECTION: 7 FRACTION: SW 1/4 NE 1/4

SOIL BORING #: 2
GEOLOGIST: D. MONET
DRILLER: W. ROGERS
DRILLING METHOD: HOLLOW STEM AUGER
COMPLETION DATE: 07/01/87

sample no.	sample type	HNU reading	depth	profile	description
		0			Brown coarse sand
			3		
					Brown clay
			5	5	
1	soil	3 - 4	5.5		Black sludge
			7	E.O.B.	
			10		
			15		
			20		

COMPLETION DATA	GROUT (Y/N)	GROUT TYPE	FROM - TO (FEET)	BOREHOLE CUTTINGS (Y/N)	FROM - TO (FEET)
	Y	bentonite powder	7 - 1	Y	1 - 0

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT)
STATION: (X-2168,Y-2158)
COUNTY: OAKLAND
TOWN: 2 N RANGE: 8 E
SECTION: 7 FRACTION: SW 1/4 NE 1/4

SOIL BORING #: 3
GEOLOGIST: D. MONET
DRILLER: W. ROGERS
DRILLING METHOD: HOLLOW STEM AUGER
COMPLETION DATE: 07/01/87

sample no.	sample type	HNU reading	depth	profile	description
					Rocky fill (stones)
			1		
		0			Black gravel (greasy texture)
			4		
			5		Brown clay loam
			8		
					Light brown clay loam
			10		(2 inch saturated brown silt lens @ approx. 11 ft)
1	soil				
			12	E.O.B.	
			15		
			20		

COMPLETION DATA	GROUT (Y/N)	GROUT TYPE	FROM - TO (FEET)	BOREHOLE CUTTINGS (Y/N)	FROM - TO (FEET)
	N			Y	12 - 0

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT)
STATION: (X-2038,Y-2112)
COUNTY: OAKLAND
TOWN: 2 N RANGE: 8 E
SECTION: 7 FRACTION: SW 1/4 NE 1/4

SOIL BORING #: 4
GEOLOGIST: D. MONET
DRILLER: W. ROGERS
DRILLING METHOD: HOLLOW STEM AUGER
COMPLETION DATE: 07/02/97

sample no.	sample type	HNU reading	depth	profile	description
		0	2.5		Brown clay loam
			3		Gravel
			4		Grey clay loam
		25	5		Black sludge
			6		Brown sandy clay loam
			9		
1	soil	0	10		Brown & grey mottled clay
			11		
2	soil	0	13.5		Grey & brown mottled clay
3	soil	0	15		Grey pebbly clay
4	soil	0	18.5		
				E.O.B.	
			20		

COMPLETION DATA	GROUT (Y/N)	GROUT TYPE	FROM - TO (FEET)	BOREHOLE CUTTINGS (Y/N)	FROM - TO (FEET)	COMMENTS
	N			Y	18.5 - 0	Backfilled hole w/cuttings except for sludges.

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT)
STATION: (X-2183,Y-2102)
COUNTY: OAKLAND
TOWN: 2 N RANGE: 8 E
SECTION: 7 FRACTION: SW 1/4 NE 1/4

SOIL BORING #: 5
GEOLOGIST: D. MONET
DRILLER: S. ECKLEY
DRILLING METHOD: HOLLOW STEM AUGER
COMPLETION DATE: 07/14/87

sample no.	sample type	HNU reading	depth	profile	description
			0.5		Brown sandy loam
					Brown clay loam
1	soil		3		
			3.5		Brown sand
					Brown sandy clay
4	soil	5	5		
		1 - 2			Blue-grey sandy clay (oily)
			6		
			6.5		Blue-grey clay
			7		Brown medium sand (metal fragments in soil sample)
			8		Grey to white chalky clay (slightly fibrous)
				E.O.B.	
		10			
		15			
		20			

COMPLETION DATA	GROUT (Y/N)	GROUT TYPE	FROM - TO (FEET)	BOREHOLE CUTTINGS (Y/N)	FROM - TO (FEET)
	N			Y	8 - 0

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT)
STATION: (X-2079,Y-2085)
COUNTY: OAKLAND
TOWN: 2 N RANGE: 8 E
SECTION: 7 FRACTION: SW 1/4 NE 1/4

SOIL BORING #: 6
GEOLOGIST: D. MONET
DRILLER: S. ECKLEY
DRILLING METHOD: HOLLOW STEM AUGER
COMPLETION DATE: 07/14/87

sample no.	sample type	HNU reading	depth	profile	description
			0.5		Brown sandy loam
					Brown sand & gravel
			2		
			2.5		Grey sandy clay loam
1	soil	0	3		Grey sandy loam
			3.5		Brown sand
			4		Brown sandy clay
		2.5	4.5		Dark grey clay
2	soil	5			Brown pebbly clay
		0	5.5		
3	soil	0			Brown clay
			8		
			8.5		Brown sandy clay
4	soil	0			Grey clay
			9.5		
		10	10		Reddish brown sandy clay (oily)
5	soil	0	11		Grey clay (oily)
					Grey clay (soft)
			12.5		
6	soil	0	13		Grey sand (saturated)
			14		Peat w/shells & twigs in matrix
				E.O.B.	
		15			
		20			

COMPLETION DATA	GROUT (Y/N)	GROUT TYPE	FROM - TO (FEET)	BOREHOLE CUTTINGS (Y/N)	FROM - TO (FEET)
	Y	bentonite slurry	14 - 9.5	Y	9.5 - 0

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT)
STATION: (X-2086,Y-2131)
COUNTY: OAKLAND
TOWN: 2 N RANGE: 8 E
SECTION: 7 FRACTION: SW 1/4 NE 1/4

SOIL BORING #: 7
GEOLOGIST: D. MONET
DRILLER: S. ECKLEY
DRILLING METHOD: HOLLOW STEM AUGER
COMPLETION DATE: 07/15/87

sample no.	sample type	HNU reading	depth	profile	description
					Brown loam
			2		
		0			Brown clay loam (increasing clay content w/depth)
			5	5	
		4			Black sandy sludge (reddish tint @ 5 - 5.5 ft)
			9.5		
1	soil	1	10		Blue-grey chalky clay (pebbly)
			10.5		
		0	11		
2	soil				
		0			Grey & brown pebbly clay
3	soil		15		
			16		
				E.O.B.	
			20		

COMPLETION DATA	GROUT (Y/N)	GROUT TYPE	FROM - TO (FEET)	BOREHOLE CUTTINGS (Y/N)	FROM - TO (FEET)
	Y	bentonite powder & sand	10 - 0	Y	16 - 10

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT)
STATION: (X-2038,Y-2174)
COUNTY: OAKLAND
TOWN: 2 N RANGE: 8 E
SECTION: 7 FRACTION: SW 1/4 NE 1/4

SOIL BORING #: 8
GEOLOGIST: D. MONET
DRILLER: S. ECKLEY
DRILLING METHOD: HOLLOW STEM AUGER
COMPLETION DATE: 07/15/87

sample no.	sample type	HNU reading	depth	profile	description
					Brown loam
			1		
					Brown sandy clay loam
			5	5	
					Brown medium clay sand
			8		
					Brown sandy clay
			9		
1	soil	10			Brown pebbly clay
			11		
				E.O.B.	
		15			
		20			

COMPLETION DATA	GROUT (Y/N)	GROUT TYPE	FROM - TO (FEET)	BOREHOLE CUTTINGS (Y/N)	FROM - TO (FEET)
	Y	bentonite powder	11 - 0		

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT)
STATION: (X-1959,Y-2077)
COUNTY: OAKLAND
TOWN: 2 N RANGE: 8 E
SECTION: 7 FRACTION: SW 1/4 NE 1/4

SOIL BORING #: 9
GEOLOGIST: D. MONET
DRILLER: S. ECKLEY
DRILLING METHOD: HOLLOW STEM AUGER
COMPLETION DATE: 07/15/87

sample no.	sample type	HNU reading	depth	profile	description
					Dark brown loamy gravel
			2		Brown clay loam
			3		
			3.5		Black sludge
1	soil				Brown silty clay (saturated)
		5	5		Brown silty clay
			6		
2	soil				
					Brown & grey clay (stiff)
3	soil	0			
		10	10		
4	water				Brown & grey medium sand (saturated)
			12	E.O.B.	
		15			
		20			

COMPLETION DATA	GROUT (Y/N)	GROUT TYPE	FROM - TO (FEET)	BOREHOLE CUTTINGS (Y/N)	FROM - TO (FEET)
	Y	bentonite slurry	12 - 0		

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT)
STATION: (X-2216,Y-2278)
COUNTY: OAKLAND
TOWN: 2 N RANGE: 8 E
SECTION: 7 FRACTION: SW 1/4 NE 1/4

SOIL BORING #: 10
GEOLOGIST: D. MONET
DRILLER: S. ECKLEY
DRILLING METHOD: HOLLOW STEM AUGER
COMPLETION DATE: 07/16/87

sample no.	sample type	HNU reading	depth	profile	description
					Stones
			1		
1	soil				Black top soil and gravel
			5		
			6		
2	soil		7		Brown silty clay
3	soil	0	9		Grey & brown mottled silty clay (1 inch +/- grey medium sand lens @ 8.75 ft)
		10			Dark brown clay loam
			11		
4	soil & water		12		Grey sandy clay
			12.5		Grey medium sand (saturated)
5	soil				
		15			Brown clay (slightly silty)
6	soil				
			17		
				E.O.B.	
		20			

COMPLETION DATA	GROUT (Y/N)	GROUT TYPE	FROM - TO (FEET)	BOREHOLE CUTTINGS (Y/N)	FROM - TO (FEET)
	Y	bentonite slurry	17 - 0		

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT)
STATION: (X-1745,Y-1940)
COUNTY: OAKLAND
TOWN: 2 N RANGE: 8 E
SECTION: 7 FRACTION: SW 1/4 NE 1/4

SOIL BORING #: 11
GEOLOGIST: D. MONET
DRILLER: S. ECKLEY
DRILLING METHOD: HOLLOW STEM AUGER
COMPLETION DATE: 07/16/87

sample no.	sample type	HNU reading	depth	profile	description
		0	1		Brown gravel
		0	2		Dark brown gravel
		0	3		Brown clay loam
		0	5		Grey clay (silty)
		0	8		Light grey clay
		0	9		Brown clay (soft)
			10		
			14	E.O.B.	
			15		
			20		

COMPLETION DATA	GROUT (Y/N)	GROUT TYPE	FROM - TO (FEET)	BOREHOLE CUTTINGS (Y/N)	FROM - TO (FEET)
				Y	14 - 0

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT)
STATION: (X-1735,Y-1535)
COUNTY: OAKLAND
TOWN: 2 N RANGE: 8 E
SECTION: 7 FRACTION: SW 1/4 NE 1/4

SOIL BORING #: 12
GEOLOGIST: D. MONET
DRILLER: S. ECKLEY
DRILLING METHOD: HOLLOW STEM AUGER
COMPLETION DATE: 07/22/87

sample no.	sample type	HNU reading	depth	profile	description
					Black top soil
			1		
		0			
1	soil				Black sandy gravel
2	soil	0			
3	soil	5	5		
		0			Brown clay
					(brown & grey mottled clay @ 5 ft)
4		0			
			7.5		
			8		Brown & grey mottled clay
5		0			Brown clay
		10	10		
			10.5		Brown medium sand (saturated)
			11		Brown clay
				E.O.B.	
		15			
			20		

COMPLETION DATA	GROUT (Y/N)	GROUT TYPE	FROM - TO (FEET)	BOREHOLE CUTTINGS (Y/N)	FROM - TO (FEET)
	Y	bentonite slurry	11 - 0	N	

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT)
STATION: (X-1735,Y-1550)
COUNTY: OAKLAND
TOWN: 2 N RANGE: 9 E
SECTION: 7 FRACTION: SW 1/4 NE 1/4

SOIL BORING #: 13
GEOLOGIST: D. MONET
DRILLER: S. ECKLEY
DRILLING METHOD: HOLLOW STEM AUGER
COMPLETION DATE: 07/22/87

sample no.	sample type	HNU reading	depth	profile	description
					Brown top soil
			1		
1	soil				Black loam & sand (greasy) (molten pebbles mixed into soil)
			4		
2	soil	5			Brown clay (decayed & rotted wood particles in matrix)
			6.5		
3	soil				Brown & grey mottled clay
4	soil				(1 inch saturated sand lens @ 8 ft)
		10	10		
				E.O.B.	
		15			
		20			

COMPLETION DATA	GROUT (Y/N)	GROUT TYPE	FROM - TO (FEET)	BOREHOLE CUTTINGS (Y/N)	FROM - TO (FEET)
	N			Y	10 - 0

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT)
STATION: (X-1508,Y-2350)
COUNTY: OAKLAND
TOWN: 2 N RANGE: 8 E
SECTION: 7 FRACTION: SW 1/4 NE 1/4

SOIL BORING #: 14
GEOLOGIST: D. MONET
DRILLER: S. ECKLEY
DRILLING METHOD: HOLLOW STEM AUGER
COMPLETION DATE: 07/23/87

sample no.	sample type	HNU reading	depth	profile	description
					Brown top soil
			1.5		
			2		Red silty loam (cohesive)
			2.5		Brown sandy clay
1	soil		3		Brown & grey mottled clay
2	soil	5			Grey silty clay (stoney)
3	soil		8		
					Black peat (roots, etc.)
4	soil	10	10		
					Grey fine clay sand (saturated)
			11.5		
5	soil		12		Grey coarse sand (saturated)
			12.5		Grey clay
			13		Grey & brown medium saturated sand @ 12.5 - 12.75 ft
				E.O.B.	Brown clay (dry) @ 12.75 - E.O.B.
		15			
		20			

COMPLETION DATA	GROUT (Y/N)	GROUT TYPE	FROM - TO (FEET)	BOREHOLE CUTTINGS (Y/N)	FROM - TO (FEET)
	Y	bentonite slurry	13 - 0	N	

PROJECT NAME: WIXOM (FORD ASSEMBLY PLANT)
STATION: (X1668,Y-2100)
COUNTY: OAKLAND
TOWN: 2 N RANGE: 8 E
SECTION: 7 FRACTION: SW 1/4 NE 1/4

SOIL BORING #: 15
GEOLOGIST: D. MONET
DRILLER: S. ECKLEY
DRILLING METHOD: HOLLOW STEM AUGER
COMPLETION DATE: 07/24/87

sample no.	sample type	HNU reading	depth	profile	description
					Brown medium sand
			1		
					Brown loam
			2		
1	soil				Brown & dark brown clay (decayed roots & wood in matrix)
			3.5		
			4		Brown fine sand & silt mix
					Dark brown clay
2	soil	5	5		
			5.5		Brown sandy loam (dry)
			6		Brown & grey mottled clay
			6.5		Dark brown clay loam
3	soil				
					Brown & grey mottled clay and silt
		10	10		
				E.O.B.	
		15			
		20			

COMPLETION DATA	GROUT (Y/N)	GROUT TYPE	FROM - TO (FEET)	BOREHOLE CUTTINGS (Y/N)	FROM - TO (FEET)
	N			Y	10 - 0