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# WORK PLAN FOR FIELD INVESTIGATION AND MONITORING WELL INSTALLATION AT THE INDUSTRIAL-TYPE SANITARY LANDFILL ALUMINUM COMPANY OF AMERICA CLEVELAND, OHIO

Submitted to:

Aluminum Company of America
Cleveland, Ohio

September 1988

Submitted by:

GERAGHTY & MILLER, INC.
Ground-Water Consultants

Dublin, Ohio

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## INTRODUCTION

Geraghty & Miller, Inc., (G&M) is pleased to submit this Work Plan for the field investigation and monitoring well installation at the sanitary-type landfill at Alcoa, Cleveland, Ohio. The Work Plan is based on information gathered during the preliminary site assessment segment of the investigation. The purpose of this Work Plan is to summarize the findings of the preliminary site assessment and discuss the approach for the field investigation, including the rationale for well placement. The objective of the field investigation is to assess any potential or existing ground-water problems in the uppermost aquifer and to determine the basic geology and hydrogeologic conditions at the landfill.

## PRELIMINARY SITE ASSESSMENT

The landfill is a private, active landfill located along the southern portion of the Alcoa property adjacent to the Cuyahoga River in Cleveland, Ohio (Figure 1). G&M initiated the preliminary site assessment with a computer literature search of all published sources related to the ground water and geology of Cuyahoga County. This was followed by a visit to the offices of the Ohio Department of Natural Resources (ODNR), Division of Water. Informational sources obtained at the ODNR include; a map of water resources of Cuyahoga County, U.S. Geological Survey topographic quadrangles, a bedrock topographic map, and logs for wells drilled within the Cleveland, south quadrangle. Personnel at the Division of Water were questioned concerning previous or ongoing state

hydrogeologic studies near the Alcoa plant. According to the Division of Water, no recent ground water studies have been conducted by the state within the immediate area of study.

The Ohio Department of Transportation (ODT) and the Cuyahoga County Engineers were contacted to gain information on local borings. Neither of these sources were able to provide useful data or boring information for the area of study. However, information on the Ohio canal in the vicinity of Alcoa was collected through the Ohio Department of Administrative Services and the Ohio Historical Society.

In order to obtain information on potential sources of contamination in the vicinity of the Alcoa plant, G&M contacted local governments. The Newburg City Hall has no easily attainable list of area industries. The Cuyahoga Heights Town Hall is providing G&M with a listing of industries in Cuyahoga Heights. The Cuyahoga Heights local planning committee will provide a list of hazardous substances used in Cuyahoga Heights.

On August 11, 1988, a representative from G&M met with several Alcoa personnel to discuss the history of the plant and the landfill. Detailed information regarding the type of materials that were placed in the landfill and approximate areas where materials were disposed in the landfill was obtained.

G&M's review of well boring logs, maps and geologic reports for the area indicate that the geology in the vicinity of the landfill consists of glacial lake deposits made up of fine sand, silt and clay underlain by bedrock. In

the vicinity of the landfill, bedrock normally occurs approximately 50 feet below ground surface. On the top of the landfill the depth to bedrock may increase approximately 15 to 20 feet; and, therefore, is expected to be encountered at 65 to 70 feet below ground surface.

The glacial lake deposits that fill the buried valley that underlies the Cuyahoga River are predominately non-water-bearing units. Occasionally, a few gravel lenses that are usually thin, narrow and discontinuous are encountered. Some of these gravel lenses have been known to yield up to 175 gallons per minute (gpm). It is not uncommon, however, for wells to penetrate the entire depth of the valley fill without encountering a significant aquifer unit.

Figure 2 is a map showing the water resources in the immediate vicinity of the Alcoa facility. Beneath the area of the landfill geologic units are believed to yield less than 2 gpm. Directly northeast of the plant is the ancient Cuyahoga buried river valley that runs slightly northwest to southeast. The boundary of this valley runs directly through the Alcoa property splitting the eastern part of the plant from the western buildings and the landfill. Aquifers located within the ancient buried valley on the eastern part of the plant are expected to yield slightly higher quantities of ground water (3-10 gpm). Isolated areas toward the center of the ancient buried valley, made up of thick sand and gravel deposits, yield significant quantities of ground water.

Monitoring wells located on the eastern side of Alcoa (ES-1 through ES-6) indicate a direction of ground-water flow toward the northwest or parallel to the long axis of the

ancient buried valley. Figure 1 indicates this northwestern direction of ground-water flow on the eastern plant property. Although the current Cuyahoga River valley in the vicinity of the Alcoa plant is slightly southwest of the boundary of the ancient buried Cuyahoga River valley, the two valleys are roughly parallel in orientation. Therefore, the shallow ground-water flow direction on the eastern portion of the Alcoa plant also corresponds with the northwest flow direction of the current Cuyahoga River. G&M believes that the direction of ground-water flow in the shallow aquifer, if present, beneath the landfill will correspond with the general direction of flow of the Cuyahoga River toward the northwest. This belief is supported by the evidence on the eastern plant property showing ground-water flow parallel to the axis of the buried valley; and by numerous investigations of valley fill aquifers in Ohio, where G&M has observed ground-water flow directions parallel to the direction of river flow and/or buried valley orientation. However, the direction of ground-water flow in the vicinity of the landfill may also be locally influenced by the proximity of the river and the configuration of the landfill. These potential influences will be discussed under the field investigation section.

Subsequent to the evaluation of all the information gathered during the preliminary site assessment, G&M selected monitoring well locations believed to most adequately comply with the project specifications and objectives. G&M then flagged all proposed monitoring well locations at the landfill to field check the sites and determine accessability. The following text summarizes G&M's proposed approach for the field investigation.

## FIELD INVESTIGATION/MONITORING WELL INSTALLATION

### Rationale For Monitoring Well Locations

G&M has selected nine proposed monitoring well locations to determine the geology, ground-water flow direction and ground-water quality in the vicinity of the landfill. The locations have been designed to provide investigative coverage of the perimeter of the landfill. In selecting these locations, G&M considered the historical data, field accessibility, and practicality of meeting project specifications and objectives. During this process, G&M identified issues that may affect compliance with the project specifications. The following text lists the project specification that may be affected, and discusses the related influences and G&M's proposed resolution to ensure achievement of the project objectives:

Project Specification - The contractor shall insure proper identification of the uppermost aquifer.

Related Issues - G&M's review of historical data for the area indicates that the presence of an uppermost aquifer (a saturated sand, or sand and gravel unit) may not be encountered beneath the area of the landfill. It is likely, however, that saturated silty clay units are present beneath the landfill. Typically, these units may be screened and monitored, although their permeability is very low. Therefore, recharge to the well may be significantly slow and impede adequate well development or future ground-water sampling.

G&M Resolution - If a typical aquifer unit is not encountered during the drilling, G&M will identify the most permeable unit within the borehole. The saturation and lithology of this material will be evaluated in the field to determine potential for monitoring well installation. If the material is believed to be significantly permeable to yield water, then G&M will install a monitoring well at the location. If monitoring well installation is not recommended, the boring will be abandoned according to specifications under the Scope of Work.

Project Specification - Contractor shall establish ground-water flow direction (hydraulic gradient) and rate in order to ensure proper monitoring well placement.

Related Issues - Typically monitoring wells or piezometers are utilized to establish ground-water flow direction, hydraulic gradient, and ground-water flow rate. Therefore, for this investigation, G&M proposed to review historical data to initially determine ground-water flow direction and then base well placement on this information. From the data obtained during the preliminary site assessment, G&M believes that the direction of ground-water flow beneath the landfill will be parallel to the flow of the river or towards the northwest across the site. However, localized ground-water flow in the landfill may be affected by the presence of the river to the south as a local discharge point. Some ground water may flow directly towards the river since it is the nearest discharge point; whereas regional ground-water flow may correspond with direction of flow of the river to the northwest. If the ground-water gradient across the site is

relatively flat, then slight fluctuations of water levels in certain areas could change the ground-water flow pattern across the site. G&M has observed this situation at other facilities located immediately adjacent to a river. The river characteristics, and water level must be further evaluated in association with the ground-water levels and associated fluctuations in the vicinity of the landfill to determine the nature of the hydraulic gradient between the two areas and, in turn, to confirm whether ground-water flow directions may fluctuate seasonally or in response to certain recharge events.

In addition landfills and waste piles frequently create what is referred to as a mounding effect. This is where ground water flows radially away from the center of the waste unit because of the influence of added fill. The hydraulic head in the landfill is most likely increased due to the additional recharge, infiltration and storage of ground water in the fill material. This creates a higher hydraulic head in the mounded area and subsequent ground-water flow toward areas of lower hydraulic head in a radial pattern.

G&M Resolution - G&M's proposed monitoring well locations are designed to optimize the ability to determine ground-water flow direction in the vicinity of the landfill. Final determination of the ground-water flow direction may not be possible until water levels are monitored through time to establish possible seasonal fluctuations and response to recharge events. G&M's nearly radial coverage of the landfill allows for determination of ground-water flow in any direction across the landfill.

Project Specification - A minimum of (6) monitoring wells shall be located downgradient of the landfill (based on ground-water flow direction) close to the perimeter of the landfill or property boundary to detect any leachate entering the ground water or aquifer. A minimum of three (3) monitoring wells shall be located upgradient to determine background water quality.

Related Issues - As stated previously, G&M believes that ground-water flow across the site will be towards the northwest. However, local influences to the ground-water flow direction due to mounding and the presence of the river adjacent to the site must be evaluated over time. It is possible that the gradient fluctuates in response to seasonal and/or recharge events. Presuming that the ground-water flow direction is to the northwest, then monitoring wells AL-6 through AL-8 should act as upgradient wells for ground-water quality. Ideally, G&M would locate an upgradient well southeast of monitoring well AL-5 to be utilized as an upgradient well for ground water quality. However, evidence of waste disposal on off-site property potentially upgradient of the landfill along the southeast boundary renders this area inadequate as an upgradient quality data location.

G&M Resolution - G&M's proposed monitoring locations provide radial coverage of the landfill so that ground water quality may be determined along all the landfill boundaries. This pattern will be especially useful in determining quality of ground water leaving any part of the site if ground-water flow directions are determined to fluctuate seasonally or to be radial in orientation. If the ground water flow direction

is determined to be towards the northwest, as preliminary data indicate, then monitoring wells AL-6 through AL-8 should provide adequate upgradient coverage.

## Field Investigation Methodology

### Drilling and Well Installation

Subsequent to approval of this Work Plan, G&M will implement the drilling program to install the nine proposed monitoring wells. All borings will be drilled using 4 1/2-inch diameter, hollow-stem, continuous-flight augers. All drilling will be directly supervised by a G&M representative. Soil samples will be collected at 5-foot intervals by driving a split-spoon sampler ahead of the lead auger into the undisturbed stratum. Soil samples will be described and logged in the field by the G&M representative.

Where saturated upper aquifer zone or significant water bearing unit is present, borings will be converted to monitoring wells constructed of 2-inch diameter, flush joint, schedule 40, PVC casing and a 10-foot screen section of .010-inch slot screen with a sump or sediment trap installed at the bottom. Final vertical well depths and screen lengths will be determined based on potential pathways and migration of possible contaminants.

Each monitoring well will be installed through the inside of the augers. The annular space around the screen will be filter packed with clean silica sand to 2 feet above the top of the screen. A minimum of two feet of certified sodium bentonite pellets will be installed directly over the

sand pack. A bentonite/cement grout will then be placed in the remaining annular space using a tremie pipe. The filter pack, bentonite seal and grout will be installed through the augers to prevent the collapse soil materials around the well. The riser pipe will be capped with a vented cap to allow equilibrium of the water inside the well with atmospheric pressure. A protective steel casing with a locking cap will be cemented in place around each well immediately upon completion. The protective casing will be painted a fluorescent color, with well identification clearly marked; the locks will be brass and will be keyed-alike. Surface-water intrusion will be prevented by constructing a sloping pad of cement around the well casing, and extending below the zone of frost heave. All well construction details will be recorded on a G&M well construction log.

Each monitoring well will also have a permanent, easily identified reference point from which its water-level measurement will be taken. The reference points will be established by a licensed surveyor, according to an established National Geodetic Vertical Datum (NGVD).

All wells will be properly screened to assess contamination levels in the uppermost aquifer, if present. With the exception of monitoring well AL-4, the wells are estimated to be approximately 40 feet deep, with 10 foot screens; although the final depths will be determined in the field. Monitoring well AL-4 is located above the northeast corner of the landfill at an elevation corresponding with the plant buildings. G&M believes that characterization of ground-water quality in this area is essential considering potential contaminant source areas south of this location on

the landfill. Access to a drilling site that would be outside disposal areas at the elevation of the landfill is not technically feasible. Therefore, G&M proposes to locate this well above the elevation of the landfill. The monitoring well at this location is expected to be approximately 90-100 feet deep.

After installation, all the monitoring wells will be developed to improve the hydrologic connection between the well and water-bearing formation, and to ensure that ground-water samples collected will be representative of natural conditions in the aquifer. Proper well development removes fines from the well screen and surrounding formation, improving the flow and physical quality of the water entering the well. Direct injection of air to develop the wells will be prohibited. All well development equipment will be decontaminated prior to use in each well, and all water produced will be contained in barrels. Water in the drums will be properly disposed of based on the analytical results from the first round of ground-water samples.

To minimize the potential for cross contamination, the drilling equipment (split spoons, drill rods, augers, etc.) will be steam cleaned prior to drilling each borehole using Cleveland municipal water, from a single source. The water for decontamination will be stored in a tank provided by the driller, and a centralized decontamination area near the drilling operation will be utilized.

The split-spoon sampler will be washed in laboratory grade soap and rinsed with water prior to collecting each sample from the boreholes. The use of water during drilling

will be restricted to minimize the introduction of contaminants to the ground water and subsurface sediments. Any water added to the boreholes will be from the same municipal water source used to fill the decontamination water tank. For quality control purposes, one water sample will be collected from the drillers' water tank and analyzed for VOCs. To remove potential contaminants from well construction materials, the well casings and screens will be steam cleaned prior to installation.

Soil removed from the boreholes will be transferred to drums for storage on-site. Upon completion of the drilling program, the soils in the drums will be disposed of properly, based on the analytical results.

Aquifer Testing

After monitor well installation and development has been completed, G&M proposes to conduct instantaneous displacement tests (slug tests) on selected monitor wells to obtain estimates of the hydraulic conductivity of the upper aquifer in the study area. Tests will consist of displacing a known volume of water in the well with a solid object, or slug, and monitoring the water-level response. The rate at which water levels return to their initial or static level is a function of the aquifer's hydraulic conductivity.

In-Field Soil Analysis

During the drilling program, formation samples will be collected in accordance with ASTM specifications D1586, using a split-spoon sampler. Representative soil samples will be

obtained by driving the split spoon ahead of the lead auger into the undisturbed stratum. G&M proposes to collect continuous split-spoon samples during drilling of the first two borings to establish the geologic conditions beneath the site. Once the subsurface conditions have been established, samples will be collected at regular 5-foot intervals, and at major changes in lithology.

During the field program, G&M will attempt to qualitatively characterize the horizontal and vertical extent of VOCs in the soil by monitoring the vapors from the soil samples collected using an HNU photoionization detector. Upon opening each split-spoon sample, the soil inside will be surveyed with the HNU, and the reading recorded. In addition, immediately after placing each soil sample in a sample jar, the jar will be sealed, first with aluminum foil directly over the mouth of the jar, and then with the original container lid. The samples will be set aside to enable them to equilibrate before measuring the vapor content inside the container. The measurements will be obtained by inserting the intake tube of the HNU through the aluminum foil into the headspace of the samples; soil-gas vapors will be read directly from the instrument and recorded on the geologic log. The HNU will be calibrated prior to the start of the drilling program, and periodically checked throughout the investigation.

The soil sample with the highest HNU headspace reading from each boring will be analyzed for the priority pollutant compounds, using EPA approved methods. In borings where all the HNU headspace readings are zero, a composite soil sample will not be collected. Samples of each split spoon will be

retained on-site at Alcoa in the event that future analysis is required.

Subsequent to the completion of the drilling program, the site topography, will be determined and the sampling and laboratory analysis of ground water samples will be conducted for a period of six quarters. G&M will comply with reporting requirements as outlined in the project specifications.

## SUMMARY

In summary, G&M proposes to drill and install 9 monitoring wells in the vicinity of the landfill. The monitoring wells are located to provide adequate coverage of the landfill boundaries to determining ground-water flow direction and quality in the uppermost aquifer. The proposed monitoring well locations allow for adequate determination of ground-water flow and any associated fluctuations due to seasonal and/or recharge events. In addition, G&M believes that the locations provide an effective strategy for the ground-water quality investigation, despite potential variations in the ground-water flow direction. However, it must be realized that certain hydraulically upgradient locations may not ultimately provide upgradient ground-water quality data, due to their proximity to other potential upgradient contaminant source areas off-site. G&M is confident, however, that the proposed configuration will provide an adequate assessment of the ground-water quality conditions in the uppermost aquifer in the vicinity of the landfill.

Sincerely,

GERAGHTY & MILLER, INC.

Barbara J. Graves

Barbara J. Graves
Senior Scientist

Lawrence S. Graves

Lawrence S. Graves, CPG
Associate

FIGURES

GERAGHTY & MILLER, INC.
Ground-Water Consultants

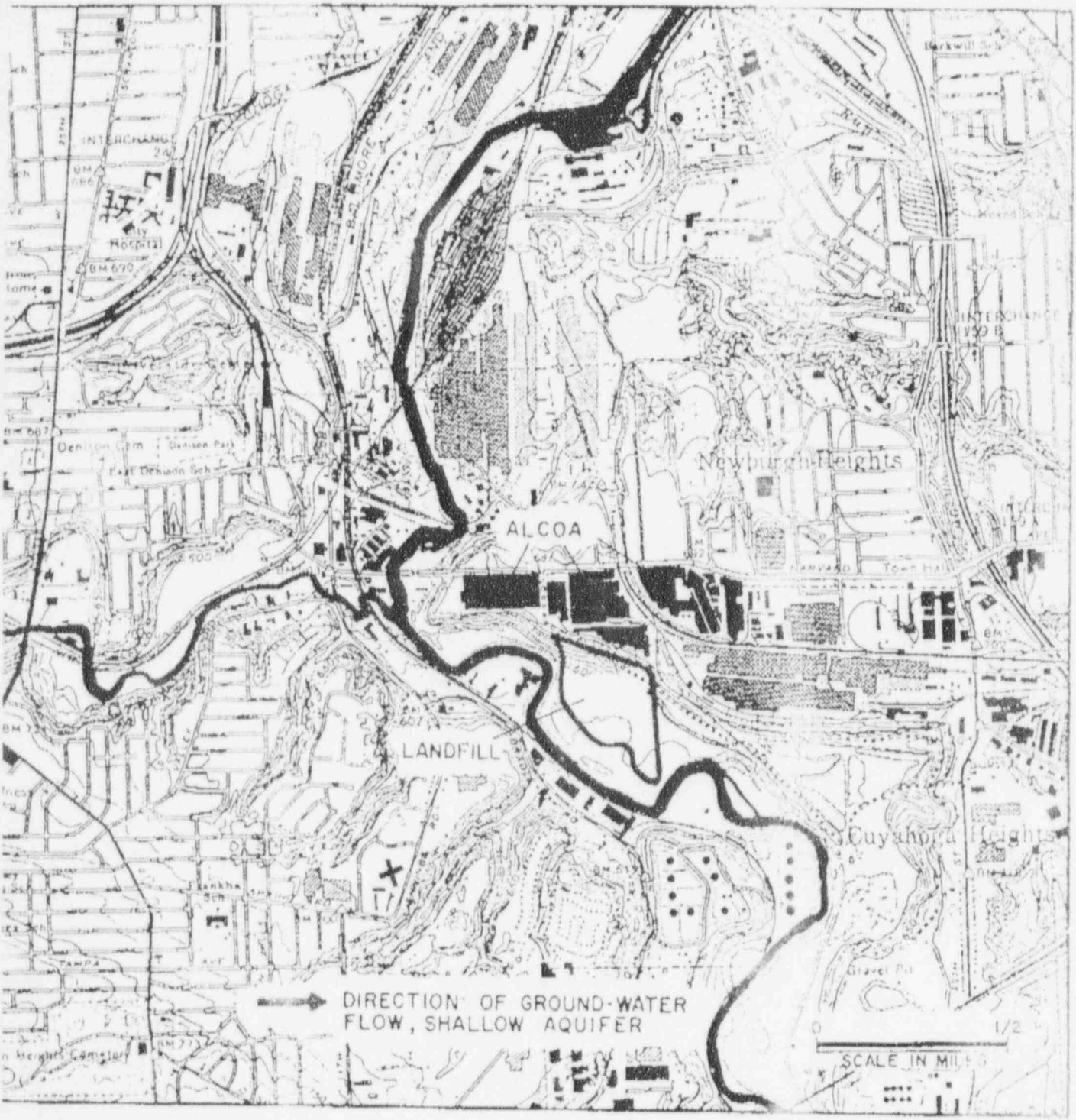
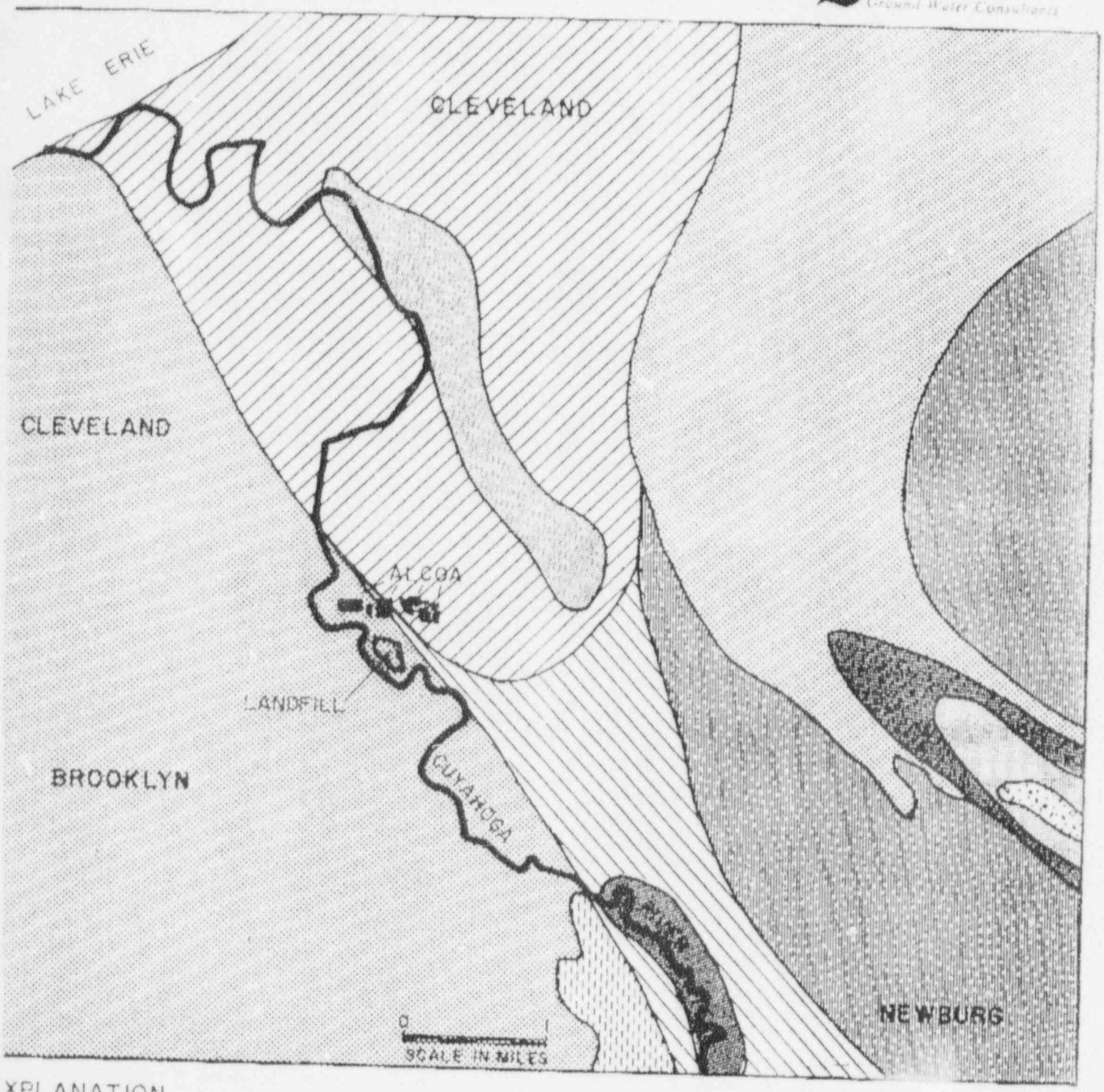



FIGURE 1 MAP SHOWING LOCATION OF LANDFILL AND DIRECTION OF GROUND-WATER FLOW IN THE SHALLOW AQUIFER ON THE EASTERN SIDE OF ALCOA, CLEVELAND, OHIO

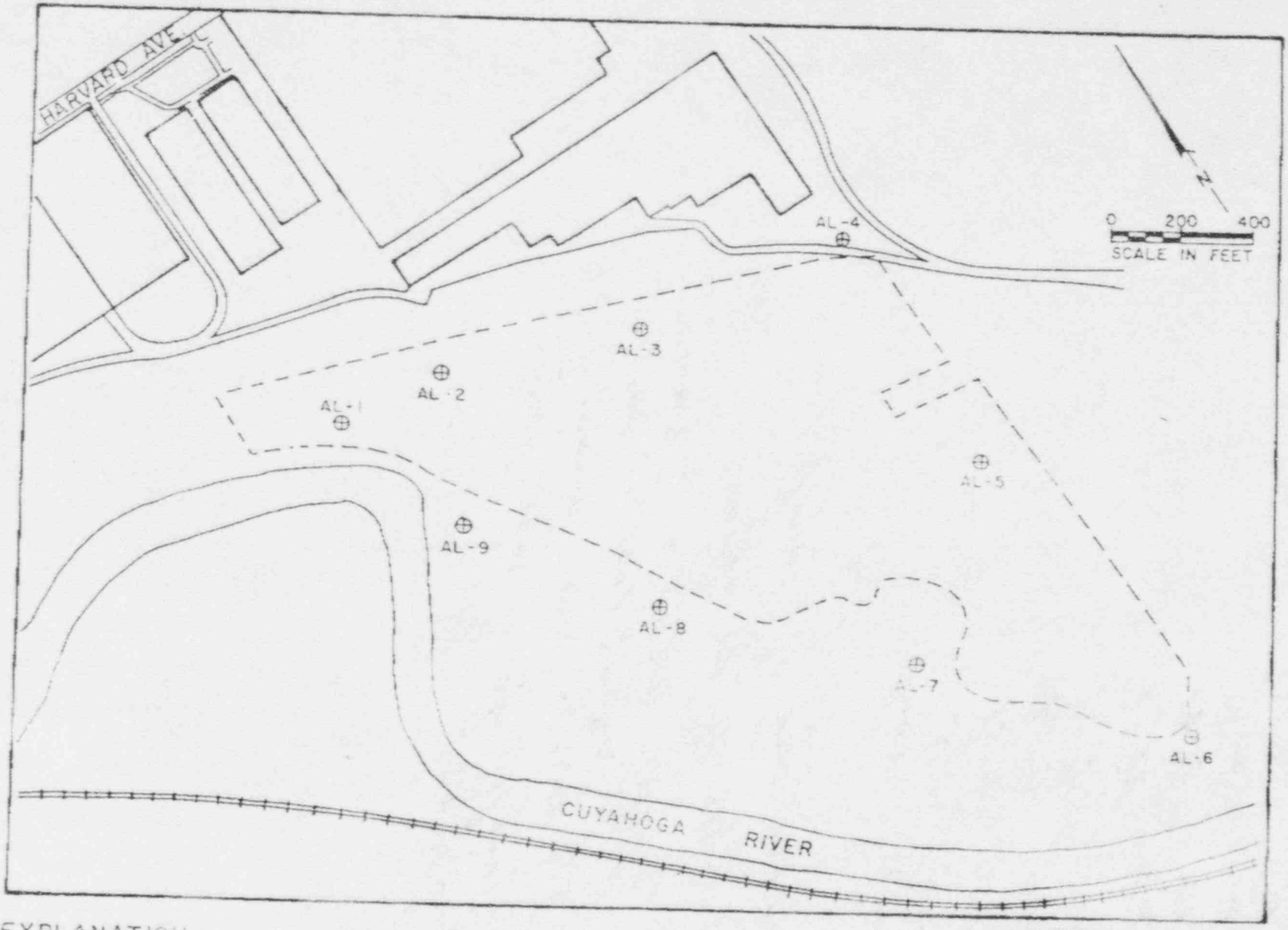



XPLANATION

- YIELDS 100 TO 300 GPM
- YIELDS 25 TO 100 GPM
- YIELDS 10 TO 25 GPM - SAND, GRAVEL
- YIELDS 10 TO 25 GPM - BEDROCK
- YIELDS 3 TO 10 GPM - SAND, GRAVEL
- YIELDS 3 TO 10 GPM - BEDROCK
- YIELDS LESS THAN 3 GPM
- YIELDS 300 OR MOVE GPM

FIGURE 2. GROUND-WATER RESOURCES IN THE VICINITY OF ALCOA, CLEVELAND, OHIO

FIGURE 3. MAP SHOWING PROPOSED MONITORING WELL LOCATIONS AT AN INDUSTRIAL-TYPE SANITARY LANDFILL AT ALCOA, CLEVELAND, OHIO




EXPLANATION

⊕ PROPOSED MONITOR WELL LOCATIONS

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| Well | 2/93 measurement |
|---|---|
| AL1 | 41.85' |
| AL2 | 44.40' |
| AL3 | 36.49' |
| AL4 | 30.24' |
| AL5 | 19.04' |
| AL6 | 12.78' |
| AL7 | 11.98' |
| AL8 | 11.82' |
| AL9 | 12.77' |

Active area of landfill
50'-150' of the active

10 acres active → 33 acres
↳ for industrial wastes
Fly ash in other areas of
landfill from coal power
plant.

# FACSIMILE TRANSMISSION HEADER

## FROM

## ALUMINUM COMPANY OF AMERICA

## CLEVELAND WORKS

## SAFETY, HEALTH, ENVIRONMENTAL DEPT.

FAX. NO. (216) 641-5333 or ACT 243-5333

TO Anthony Hoffert SE2 2:00PM 2529

LOCATION NRC

DATE 2/19/93

NO. OF PAGES (INCLUDING COVER PAGE) 23

SENDER'S NAME Dan Ryan

SENDER'S PHONE 216-641-4290

IF YOU HAVE PROBLEMS RECEIVING THIS TRANSMISSION -- PLEASE CONTACT (216) 641-4297 or ACT 243-4297.

Tony,

Attached is the research done by GRA for the Landfill monitoring wells. Please call me when you receive this.

Thx

DR